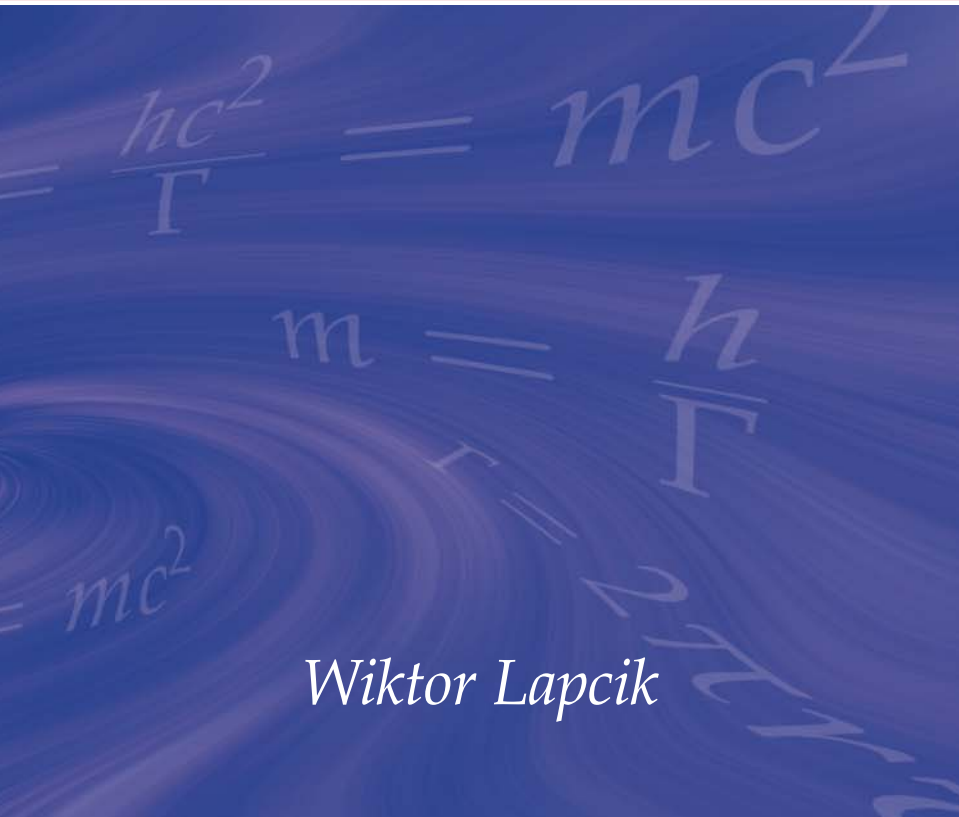


The Vortex Theory of Matter and Energy

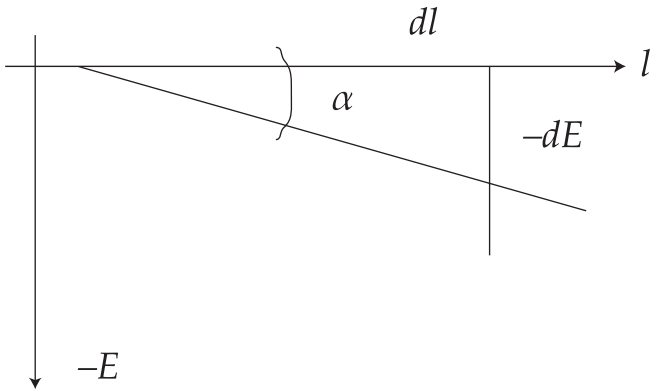


Wiktor Lapcik

**Newton's physics is back.
The Universe is not expanding...**

*The Vortex Theory of
Matter and Energy*

Newton's physics is back.
The universe is not expanding...



$$\frac{dl}{-dE} = -\tan \alpha = -\text{constant}$$

\therefore redshift

*The Vortex Theory of
Matter and Energy*

Wiktor Lapcik

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Preface

The Vortex Theory of Matter and Energy is not meant to be a summary of the existing knowledge of physics, but a trial to find new ways and methods for the progress of science. Any kind of knowledge or art, when it is past its apogee, begins to decline; we find many indications of this in physics and some of them are mentioned in this book. Let us hope that a different approach to old problems will become the spur for innovative directions and advances.

This kind of work can never satisfy everybody since it tries to show the inadequacies of present day beliefs and usages. New ideas are sometimes not sufficient to convince everybody to accept them, but to move from the unmovable we have to have the courage to try, even when there is resistance. We know what happens in politics without opposition; dictatorship. How was it with science in the Middle Ages? Geo-centrism, scholasticism and the Holy Inquisition; what about Giordano Bruno? Galileo? And what have we now? If we were to ask the adherents to existing physics theories if they were one hundred percent certain that their beliefs were correct, would they respond in the affirmative, especially when discussing such subjects like quantum physics, the expanding universe and quarks? What if we try to use other ideas, such as the Magnus effect (hydrodynamics) in atomic physics, the Compton effect

in astrophysics, or vortex equations for electrons in nuclear physics? It is simple and easy to reject something that has not been tried or accepted, but an open mind is paramount when considering these theories, so I ask for the reader's indulgence and patience because it is for the good and progress of science.

THE REALITY OF THE VACUUM

Liquids and gases moving with thermal (subsonic) velocities can be described by hydrodynamical laws, but what about the vacuum?

Many theories have been suggested in theoretical physics concerning space and time, but not about the medium that fills the space; this is the concern of *The Vortex Theory of Matter and Energy*. The laws for gases and liquids at relative velocities approaching the speed of sound are well-known. Analogically for vacuum is the velocity of light. Here then is the field for electro-magneto-hydrodynamics and this trend in physics will help us to discover new laws and technology not yet in existence.

The most fruitful domain could be the vortex theory of matter, conjoined with the flow of energy. Yet another part could be wave mechanics; this can also be studied in magneto-hydrodynamical terms. When we combine the hydrodynamics of vortex and wave mechanics, we reach our objective.

Another important aspect of such physics is its accessibility for students who are less advanced in high-level theoretical physics and mathematics. Thence, we achieve more universality in approaching theoretically highly advanced fields of study.

WHAT IS ENERGY AND MATTER?

Twentieth century scientists could not determine whether matter was made of waves or particles. The answer is neither. Matter is composed of the waves and vortices of the vacuum,

and energy is the kinetic motion of the waves and vortices that is produced when the vacuum approaches the speed of light.

The physical nature of vortices and their interactions are known from hydrodynamical studies. Vortices, on the scale of atomic nuclear components, together with their interactions and the laws governing these domains, are more difficult to observe.

While atoms move relative to the vacuum at lower velocities, like the thermal motion of gas molecules, the motion is frictionless; when such velocities approach the speed of light, the viscosity of the vacuum increases exponentially to almost a 'solid state', as it is known in physics. Such occurrences are beyond known effects and cannot at first be easily comprehended, but when we accept these theories, electromagnetohydrodynamics will help explain the new physical forces and their laws.

The most fascinating forces are those known in hydrodynamics as the lift force (the strong force in nuclear physics) and the Magnus effect. In the 1990s, Olli V. Lounasmaa of the Helsinki University of Technology showed that when we use a frictionless fluid, such as liquid helium, we get hydrodynamical vortex parameters, similar to what we have for electrons. This has been the experimental proof of the vortex theory. The theoretical precursors came from the research of Alan D. Krisch of the University of Michigan and others, even before Lounasmaa's experiments had been carried out.

Abstract

It has been found that when we accept the direction of an electromagnetic field as a flowing current of electrons in a conductor, then the electromagnetic phenomena can be explained by the laws of hydrodynamics. Further, we find that a solenoid in hydrodynamical laws has the nature of a vortex; similarly, vortices are also found in the Earth's magnetism, the sun, the Milky Way, and in electrons and protons.

Applying the laws of electro-magnetohydrodynamics in astrophysics, we find that the Universe does not expand; this brings us to the steady-state Universe. In nuclear physics, we find explanations for the structures and arrangements of atomic nuclei, and quantum theories can be explained by hydrodynamical laws, specifically, our Earth has arrived to where it is now, as a dark matter object.

CHAPTER 1

Electricity and Electromagnetism

1.1 Ohms: An Electrical Cinderella

To learn what is known is the purpose of every student. To learn what is not known is the dream of many people who have this curiosity. Some are satisfied with knowing what an electric current is in terms of volts, amps and ohms, but there are others who would like to know what electric charges are, what the electrical potential of a physical phenomenon is and how other physical phenomena can be understood in their absolute meanings. In science, like in a restaurant, some people are satisfied with a common everyday fare, while others are more fastidious and would pay more with their effort and time to get what they want.

Electrical instruments do not directly show us the quantities and qualities of entities that produce electric currents, but only the extent to which the requirement is satisfied. Such measures are sufficient for technical purposes, but are completely inade-

quate to cross the boundaries between different sciences, such as electricity, chemistry and nuclear forces. When we intend to cross these boundaries, we have to translate electrical units into terms common to all sciences, and for this purpose we use the system known as mass–length–time (MLT), using centimetres–grams–seconds (CGS), thus MLT and CGS are going to be the only qualities and quantities to be used in this book. We also cannot apply mechanical reasoning to the motion of electrons in an electrical conductor. Although we speak about electric current in terms similar to those used for a current of water, electrical resistance has little in common with its mechanical equivalents; electrical inductance, charge and capacitance are even more dissimilar to mechanical reasoning.

The knowledge of electricity has come to us through rather unusual and meandering ways; this is why it has acquired different terminologies and definitions to the mechanical sciences, and this is where the alternative physics enters. So using mass M , length L and time T , we express velocity v as

$$v = \frac{\text{length}}{\text{time}} \equiv \frac{L}{T} = \frac{\text{cm}}{\text{sec}}, \quad (1.1)$$

acceleration a as

$$a \equiv \frac{L}{T^2} \quad (1.2)$$

and force F as

$$F \equiv \frac{ML}{T^2} = \text{dynes}. \quad (1.3)$$

In this notation, electric current (the motion of electrons along a conductor) is designated simply as the velocity of electrons

$$v = \frac{\text{length}}{\text{time}} \equiv \frac{L}{T} = \text{amperes} \quad (1.4)$$

and the electromotive force (emf) is expressed as

$$F = \frac{1}{2}ma \equiv \frac{ML}{T^2} = \text{volts}. \quad (1.5)$$

All electrical units will later be translated into mechanical units, but these translations are not so straightforward. This we can see from the equation for electrical resistance R

$$R = \frac{\text{volts}}{\text{amperes}} \equiv \frac{\text{force}}{\text{velocity}} \equiv \frac{ML}{T^2} : \frac{L}{T} = \frac{M}{T}. \quad (1.6)$$

The dimension of M/T is not known in mechanics, so we can use another equation to elucidate R :

$$R = \frac{\text{specific resistance } r \cdot \text{length of the conductor } L}{\text{the cross-sectional area of the conductor } A}, \quad (1.7)$$

therefore

$$R = \frac{r \cdot L}{A} \equiv \frac{M}{T}, \quad (1.8)$$

so

$$r \equiv \frac{M}{T} \cdot \frac{L^2}{L} = \frac{ML}{T}. \quad (1.9)$$

From mechanics we know that ML/T is the dimension of momentum; mechanically it is the momentum of the flowing mass of electrons in having the velocity v . Hence, the specific resistance r of a conductor is the same as the momentum, and its electrical resistance R is the momentum divided by the length L . This means that the longer a conductor (other quantities being equal), the weaker the momentum of the flowing electrons.

1.2 Mechano-Electrical Units

When electrons are moved by a force of 1 volt with the velocity $v = 5.93 \cdot 10^7$ cm/sec, they are accelerated by this force, and at the same time, slowed by the resistance $R = 1$ ohm. If the acceleration decreases to an equal degree as the acceleration increases, then the velocity of the current becomes steady and



*Georg Simon Ohm (1789–1854):
German physicist*

we achieve a direct current. In an alternating current, electrons mechanically will have the acceleration

$$a = \frac{v_1 - 0}{t} = \frac{5.93 \cdot 10^7 \text{ cm/sec} - 0}{1 \text{ sec}}, \quad (1.10)$$

therefore

$$a = 5.93 \cdot 10^7 \text{ cm/sec}^2. \quad (1.11)$$

The number of electrons passing a cross-section of the conductor at this acceleration, $N = 6.25 \cdot 10^{18}$ electrons/sec, enables us to translate the electrical forces (volts) into mechanical forces (dynes)

$$\begin{aligned} F &= N \cdot m \cdot a \\ &= 6.25 \cdot 10^{18} \cdot 9.109 \cdot 10^{-28} \cdot 5.93 \cdot 10^7 \\ &= 0.3376 \text{ dynes}, \end{aligned} \quad (1.12)$$

where $m = 9.109 \cdot 10^{-28}$ gm, so from now on we will accept these mechanical equivalents of electricity: 1 volt of emf mechanically is equal to 0.3376 dynes and 1 ampere is equal to $5.93 \cdot 10^7$ cm/sec.

The specific resistance of a conductor has the dimensions of the diminishing momentum of electrons over the conductor's length, so a unit of electrical resistance R is ohm = gm \times cm/sec, per cm of the conductor. Therefore

$$R = \frac{\text{gm} \cdot \text{cm/sec}}{\text{cm}} \equiv \frac{M}{T}, \quad (1.13)$$

and

$$R = \frac{F}{v} = \frac{0.3376 \text{ dynes}}{5.93 \cdot 10^7 \text{ cm/sec}} = 5.693 \cdot 10^{-9} \text{ gm/sec}. \quad (1.14)$$

1.3 Electromagnetism

The knowledge of electromagnetism has developed from experiments with permanent magnets and flowing electric currents. Coming from such diverse methods of cognition, it has become too involved to be discussed here and the laws of Laplace, Biot and Savart, Maxwell and others only complicate the matter. To avoid such difficulties we will introduce the hydrodynamical theory of magnetism, electricity and nuclear forces. We begin by looking at the source of all these complications: Hans Christian Oersted's false interpretation in 1819 of the directionality of magnetic fields.

Chance discoveries are generally considered to be typical steps in the progress of science, but sometimes they are also the hindrances to such progress.¹ Oersted's discovery of electromagnetism has become one of the latter. History tells us that Oersted discovered electromagnetism during a student lecture he was conducting where there was not enough time to reflect upon the real cause of the magnetic needle stationing itself perpendicularly to the electrical conductor. He interpreted it as if the conductor stood in the middle of the magnetic force field. This notion persists despite the great progress in the knowledge of electricity and magnetism that has been achieved since then. The following now corrects Oersted's false assertions:

1. Hydrodynamically, the current of electrons flowing in a conductor drags the surrounding vacuum in the direction of its flow, parallel to the length of the conductor;
2. We can replace Oersted's magnetic needle by the means of a solenoid with its wires wound around a cylindrical space as in Figure 1.1(c). When the current in the straight conductor and in the spiral rings of the solenoid has the same direction, they attract one another and move the axis

of the solenoid perpendicular to the straight conductor or when it is bent into another shape. The hydrodynamical flows are unidirectional, so it makes a difference if we remain with the old directionality theory or accept the new one. Without a proper understanding of the directionality of magnetic fields, we could never perceive the true structure of an electron as a hydrodynamical vortex nor the structure of the Milky Way or a black hole.

1.4 Viscosity

A horizontal plane moving with a constant velocity relative to a stationary fluid and a stationary plane underneath, starts a laminar flow of the fluid. The velocity of the fluid at the top, relative to the bottom plane, is equal to the moving top plane and this velocity decreases as one moves downwards. When the planes are 1 cm apart, with the top one moving with a velocity of 1 cm/sec, the force moving the top plane is 1 dyne, the area A of the plane = 1 cm², and the value of viscosity $\eta = 1$ poise

$$F = \eta A \cdot \frac{dv}{dl}, \quad (1.15)$$

where l = the distance between the planes.

The hypotheses concerning the viscosity of the vacuum at various speeds are when:

1. the viscosity $\eta \cong 0$, the upper plane moves effortlessly through the fluid (without any persistent force being used to push it except its inertia when $v_0 > 0$), so we have a frictionless fluid;
2. the viscosity η has a moderate value, a moderate force has to be used to continue the motion;

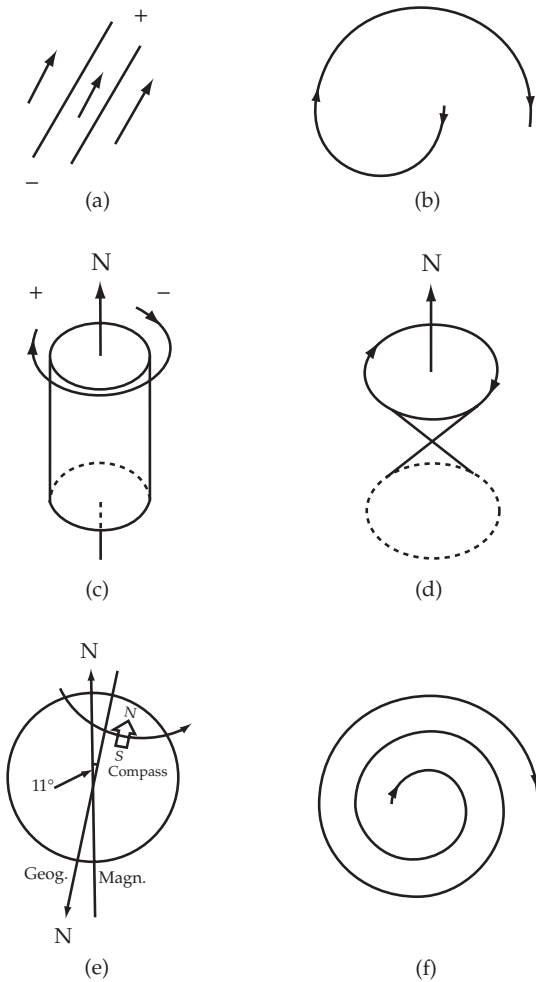


Figure 1.1

The magnetohydrodynamical flow of streamlines.

- (a) The flow in general. (b) Vortical directionality. (c) and (d) General directionality for solenoids, electrons etc. (e) The Earth's magnetism. (f) Directionality for nuclear particles and astrophysics.

3. the top plane moves through a liquid of high viscosity like oil, glycerin or melted pitch, it takes some effort to move the plane. In the latter two cases, the viscosity usually varies with the temperature: glycerin at 30°C has a viscosity $\eta = 6.29$ poise and at -42°C it has a viscosity $\eta = 6.71 \cdot 10^4$ poise. Pitch at higher temperatures can have a viscosity similar to glycerin; at 0°C its viscosity $\eta = 51 \cdot 10^{10}$ poise, corresponding to a hard solid;
4. the vacuum has a variable viscosity which varies with the velocity of a moving particle as discussed in later chapters. At the limiting velocity, when $v = c$, the velocity of light starts a turbulent flow and the creation of particles and/or waves starts in accordance with the equation $E = mc^2$ and $E = h\nu$, where $h = \text{Planck's constant}$, $\nu = \text{the frequency of the wave}$, and $E = \text{energy}$.

1.5 Inductance

Since we are entering new fields and challenging old ways, we have to make a connection between some old theories in order to describe the effects that so far have had no mechanical meaning. Thus, to get the true mechanical meaning of electromagnetic inductance, we revisit the known laws and formulas of electrodynamics and viscosity.

We assume that the flow of electrons in a conductor produces a viscous effect on the conductor's surroundings. We also assume that this effect is strong enough to drag it and to produce an electromagnetic field along the conductor. The bold acceptance of this hypothesis will show us ways to avoid the existing blind alleys in theoretical physics; this is an alternative physics and thus, we cannot return to the 'lines of force' electrical conductor concept.

When electrons move at speeds in the vicinity of 10^7 cm/sec, they encounter the viscosity of the vacuum. Using the old formula for inductance L

$$F = -L \frac{dI}{dt}, \quad (1.16)$$

where $F = \text{emf}$, $L = \text{inductance}$ and $dI = \text{the increase of the current } I \text{ in the short time span } dt$. Expressing $F = \text{volts} \equiv \text{dynes}$ and $\text{current} = \text{amperes} \equiv \text{velocity} = \text{cm/sec}$

$$\frac{dI}{dt} \equiv \frac{dv}{dt} = a, \quad (1.17)$$

where $a = \text{acceleration}$. Therefore, since $F = ma$, then

$$L = \frac{\text{force}}{\text{acceleration}} = \text{mass}. \quad (1.18)$$

This shows that the dragged environment of the conductor has an inertia similar to the effect of material mass. We check all mathematical equations in physics by dimensional analysis because this is the method used to ascertain that they have physical validity. So dimensionally,

$$\frac{ML}{T^2} : \frac{L}{T^2} = m \equiv \text{mass}. \quad (1.19)$$

In hydrodynamical equations, mass does not need to be composed of material particles. An active part of space showing inertial qualities is treated in the same manner as a space filled with a material substance.

1.6 Inductance and Viscosity

We have found that a conductor's environment, dragged by the flowing current, is in effect a drag caused by viscosity. By

comparing the equations of these two phenomena, we come to the accepted conclusion that

$$F = \eta A \frac{dv}{dl} \quad (1.20)$$

and also that

$$F = L \frac{dv}{dt}. \quad (1.21)$$

Assuming that electromagnetic inductance is of the same nature as viscosity, we find that if

$$F = \eta A \frac{dv}{dl} = L \frac{dv}{dt}, \quad (1.22)$$

then

$$\eta = \frac{L}{A} \cdot \frac{dv}{dt} \cdot \frac{dl}{dv} = \frac{L}{A} \cdot \frac{dl}{dt}. \quad (1.23)$$

Considering the propagation of the electromagnetic field being the same as the propagation of light, we accept that $dl/dt = c$ is the speed of light. By dimensional analysis we find that

$$\eta = \frac{L}{A} \cdot \frac{dl}{dt} \equiv \frac{M}{L^2} \cdot \frac{L}{T} = \frac{M}{LT} \quad (1.24)$$

and that these are the dimensions of viscosity.² We now compare the theoretical values with their technical equivalents; these we always treat as the mechanical entities. However, all the above is subject to one very important limitation. At low velocities, such as thermal velocity, the viscosity of the vacuum is zero; it is a frictionless fluid at these velocities. Viscosity increases only at very high relative velocities, somewhere about 1 electronvolt (eV), that is at approximately $5.93 \cdot 10^7$ cm/sec and it reaches its limit at $v =$ the velocity of light. Then, at $v = c$, $\eta = \infty$, the medium becomes a perfect solid.

This is only theoretical and is reached by electromagnetic wave motions. Any material particles approaching this limit

start losing their energy (and consequently their velocity) by producing electromagnetic waves and unstable vortices (short-living elementary particles). It is due to this property of vacuum space that a steady (direct) electric current cannot induce a current in the conductor next to it; it does not possess any force to induce such a current since force = mass \times acceleration. The steady flow induces only the progressive layers of the medium and this terminates at its so called 'infinity' which can be only a few centimetres away, at the infinity of its strength. However, this still can be felt by a compass needle since it is the magnetic vortex surrounding it and not the lines of force, as described in the old theories of Oersted and Faraday.

The compass needle, when considered as a permanent magnet, produces a phenomenon similar to the magnetic lines of force (molecular and crystal vortices issue from the centres of such conglomerates), but every permanent magnet as a whole acts like a solenoid when it compounds individual vortices.

When two parallel conductors carry electric currents in the same direction, there is a tendency for them to be drawn together. This is the Magnus effect of the two fluid lines flowing in the same direction, which was discovered by Heinrich Gustav Magnus in 1852. Conductors carrying currents in opposite directions tend to repel from one another.

The Biot–Savart law gives a quantitative relation between an electric current and the field intensity produced by it. The law thus permits the calculation of the forces which exist between the electric current and magnetic fields. One henry is such an inductance when the induced emf of 1 volt is produced by the inducting current charging at the rate of 1 ampere per second, therefore

$$\text{volt} = \text{henry} \cdot \frac{\text{ampere}}{\text{sec}} \quad (1.25)$$



*Michael Faraday (1791–1867):
English chemist and physicist.*

with 1 volt \equiv 0.3376 dynes and 1 ampere = $5.93 \cdot 10^7$ cm/sec, therefore

$$\text{henry} = \frac{0.3376 \text{ dynes}}{5.93 \cdot 10^7 \text{ cm/sec}^2} = 5.693 \cdot 10^{-9} \text{ gm.} \quad (1.26)$$

This is also what we found considering the quantitative aspects of 1 ohm.

1.7 Solenoids and Electromagnetic Fields

In the previous section, we considered viscosity as the cause of attraction between two conductors with an electric current flowing in the same direction. This interpretation explains the basis of electromagnetic and magnetic fields by the principle of the Magnus effect; the latter rules the motion of elementary particles and is the essence of nuclear forces. First let us consider the general definition for the quantitative aspect of electromagnetism:

*A current has unit strength when 1 cm length of a circuit, bent into the form of an arc, of radius = 1 cm, exerts a force of 1 dyne on a unit magnetic pole placed at the centre of the arc... The 'practical' unit of current ampere = 1/10 of the CGS unit.*³

This definition is correct if we run a current equal to 1 ampere at 1 volt of the electrons with the velocity $v = 5.93 \cdot 10^7$ cm/sec and instead of a unit magnetic pole, we use an identical conductor with an equal current. So here we define the strength of the electromagnetic field and a magnetic pole qualitatively and quantitatively in physical or hydrodynamical terms.

In a solenoid, there is a straight electric conductor bent into a spiral as shown in Figure 1.1(c). It is important to define the direction of the winding of the spiral, that is, whether the

winding turns left or right when observing along the axis of the spiral and that of the flow of the electric current. In elementary particle physics, this would be different when dealing with a particle or an antiparticle. In every combination, all we have to do is follow the direction of the current's flow in the straight wire conductor. The electron current flows in the circuit from the negative to the positive terminal. The electromagnetic field direction is parallel and along the length of the conductor, similar to our earlier discussion about the viscosity of the electric current.

1.8 Permanent Magnets and Magnetic Fields

The original supposition that permanent magnets exude magnetic lines of force from their poles is not very far from the definitions we have elaborated upon earlier.² It is known that ferromagnetic materials have circular magnetic fields on their surfaces—so-called magnetic bubbles⁴—and that these tube-like magnetic fields extend into space; we can compare the vortices to micro-solenoids. Such micro-solenoids are produced during the manufacturing process of magnets. When the spiral current conductor is wrapped around a ferromagnetic cylinder, it breaks the main internal electromagnetic field into micro-solenoids, the threadlike magnetic line of force. The line of force can then be considered to be like a bunch of hairs enclosed in a cylinder with their ends spreading into the space. Since all hairs have the same direction of vortical rotation, they produce a common rotational velocity around the cylindrical magnet.

If we place a similar rod made of soft iron in close parallel proximity, then it also will have a similar (although reverse) rotational velocity. It becomes a similar magnet with a reverse polarity; a permanent magnet induces magnetism in another piece of matter with a rotational velocity. So what if we put

a wire spiral around a permanent magnet? We may get the electrons flowing in such a coil and we may get the electric current to the ends of the wire. Voilà! The Perpetuum Mobile! Alas, no. There will only be a very feeble current when we put the magnet into the coil and a similar one when withdrawing it. As long as the magnet is at rest relative to the coil, there will be no electric current in the coil. Why? The answer is the reliable textbook answer: 'The magnetic force acts on moving charges only.'⁵ A magnetic field consists only of velocities in the viscous fluid (vacuum) of the next layer of space relative to the next layer to it, like in an experiment on viscosity.

From dimensional analysis we know that $\text{mass} \times \text{velocity} = \text{momentum}$. To produce a force, we have to have $\text{mass} \times \text{acceleration} = \text{force}$, and $\text{force} \times \text{distance} = \text{work}$. This pronouncement does not look to be so final when we study superconductivity phenomena. Although the physical circumstances are very strenuous, electrons do flow under the velocity of a magnetic field. So how are we to understand this?

Let us investigate the Bardeen–Cooper–Schrieffer (BCS) theory. It states that 'electrons condense from the nearly free electron gas into the paired superconducting state ... when a lattice is included, the pairing idea becomes reasonable ...'⁶ It is not easy to give a straightforward answer as to how the electron vortices combine under such circumstances. It involves the study of the very involved hydrodynamical phenomenon of vortices in a frictionless fluid and needs further theoretical studies and experimental verifications. The field is very wide and very promising in unprecedented outcomes.

1.9 Alternating Current

When we use a machine that pushes electrons in a conductor into an empty container (a capacitor), and then does the same

from the other end, we get the familiar phenomenon of the alternating current. A flow of electrons has its own peculiarities, but to some extent we can generalise in this manner: the frequency of the changing direction of the flow of the current can be called the frequency ν . Here then, the inertia of the flowing current plays a very important role; this is where we have to define inductance L in connection with the frequency ν .

The steady flow of electrons through a conductor (what we call the direct current) has the resistance

$$R = \frac{r \cdot l}{A}, \quad (1.27)$$

where r = specific resistance. Mechanically, it is the same as momentum $Z = m \cdot v \equiv ML/T$. The alternating current also finds another kind of resistance—inductive resistance R_L —to its variable flow, the viscous inertia of the flow. This in turn depends not only on the material of the conductor (like direct current), but also on the geometry and the environment of that conductor.

The inductive resistance of an electric circuit is

$$R_L = 2\pi\nu L. \quad (1.28)$$

The other relevant properties of alternating current can be found in electronics.

1.10 The Electromagnetic Field and Its Direction

When a direct current of electrons flows in a conductor, it drags the environing space with the flow in the same manner that a physical stream flowing through viscous fluid drags the fluid along its path. The stronger the current, that is, the faster its flow, the larger the volume of the surrounding space being dragged with the flow. The flow of the dragged surrounding

space is called the electromagnetic field. It is very important that we accept this mechanical meaning and no other.

1.11 The Vortices of Magnetic Fields

In a single loop of a solenoid, the electric current I has the velocity v of electrons flowing in the conductor at 1 absolute ampere and the force of 1 volt

$$I \equiv v = 5.93 \cdot 10^8 \text{ cm/sec.} \quad (1.29)$$

Taking two loops of such a conductor and separating them by 1 cm, they will interact with the force $F = 2\pi$ dynes.

Hydrodynamically, such interactions depend on the density of the medium in which this takes place. When the density of the fluid is $\rho \text{ gm/cm}^3$, the general equation becomes

$$F = \Gamma^2 \rho, \quad (1.30)$$

where $\Gamma =$ the circulation of the vortex (the main parameter). This is constant for every fluid vortex, so

$$\Gamma = 2\pi r v, \quad (1.31)$$

where $r =$ the radius of the vortex (in our use, the radius of the loop) and $v =$ the velocity of the current I . Therefore, the vorticity of each loop creating the vortex is

$$\begin{aligned} \Gamma &= 2\pi \cdot 1 \text{ cm} \cdot 5.93 \cdot 10^8 \text{ cm/sec} \\ &= 3.726 \cdot 10^9 \text{ cm}^2/\text{sec.} \end{aligned} \quad (1.32)$$

Vorticities are calculated in cm^2/sec . Since $F = \Gamma^2 \rho$, we can calculate the density of the medium ρ as

$$\rho = \frac{F}{\Gamma^2} = \frac{2\pi \text{ dynes}}{(3.726 \cdot 10^9)^2} = 4.526 \cdot 10^{-19} \text{ gm/cm}^3. \quad (1.33)$$



*Hans Christian Oersted (1777–1851):
Danish physicist and chemist.*

This is the inert hydrodynamical density and its value will be used to derive other parameters in magnetic and electrical phenomena. In magnetism, the medium density ρ is known as the permeability.

Using dimensional analysis we find that

$$F = \Gamma^2 \rho \equiv \frac{L^4}{T^2} \cdot \frac{M}{L^3} = \frac{ML}{T^2} \equiv F. \quad (1.34)$$

The experimental proof of vortex mechanics can be found in Chapter 2.2.

1.12 The Translation of Magnetic Terms into Mechanical Terms

Existing experimental knowledge of electricity and magnetism has to be translated into mechanical terms, and the use of dimensional analysis to check mathematical equations describing physical phenomena is a basic requirement of this new approach to present methods in physics.

We find the magnetic pole strength \bar{m} in Coulomb's equation

$$F = \frac{\bar{m}^2}{\mu l^2}, \quad (1.35)$$

where μ has the dimensions of density equivalent to M/L^3 and l has the dimensions of length equivalent to L , therefore

$$\bar{m}^2 = F \mu l^2 \equiv F \rho l^2 \equiv \frac{ML}{T^2} \cdot \frac{M}{L^3} \cdot L^2 = \frac{M^2}{T^2}, \quad (1.36)$$

so

$$\bar{m} \equiv \frac{M}{T}. \quad (1.37)$$

We have found similar dimensions for electrical resistance $R \equiv M/T$ in Chapter 1.1; there we concluded that the specific resistance of a conductor has the dimensions of momentum.

In a magnetic field of intensity H we find that

$$H = \frac{F}{\bar{m}} \equiv \frac{ML}{T^2} : \frac{M}{T} = \frac{L}{T} \equiv \text{velocity.} \quad (1.38)$$

So the magnetic field intensity H is the velocity of the flowing medium when it rotates around the magnetic pole of the solenoid. In the solenoid's conductor, the flow of electrons produces the internal and external flow of the medium due to the viscous drag; viscosity η we find from

$$F = \eta A \frac{dv}{dl}, \quad (1.39)$$

where A = the cross-sectional area and l = the distance from the centre of the conductor. This is described in Chapter 1.4.

Another important term in electromagnetism is 'magnetic flux density' where we find

$$B = \mu H. \quad (1.40)$$

By dimensional analysis

$$B = \mu H \equiv \rho v \equiv \frac{M}{L^3} \cdot \frac{L}{T} = \frac{M}{L^2 T} \equiv \frac{\text{viscosity}}{\text{length}}. \quad (1.41)$$

Since

$$F = \bar{m} \cdot H = \Gamma^2 \rho, \quad (1.42)$$

therefore

$$\Gamma^2 = \frac{\bar{m} \cdot H}{\rho}, \quad (1.43)$$

so

$$\Gamma = \sqrt{\frac{\bar{m} \cdot H}{\rho}} \equiv \sqrt{\frac{\bar{m} \cdot H}{\mu}}. \quad (1.44)$$

This explains the hydrodynamical circumstances for the creation of vortices, and hence, the creation of matter.

1.13 The Vortex Theory of Matter

Mathematical physics deals only with methods of representing events, for example, the connection between time and space measurements, but not why and how such events take place. The vortex theory answers such questions by the well-known laws of mechanics.

The equations of James Clerk Maxwell, Scottish mathematician and theoretical physicist, have only a mathematical form of expression. To understand the physical events taking place in space and time, we have to introduce the mechanical descriptions of these events and also explain other phenomena in the same terms; this is achieved by the introduction of the methods of dimensional analysis: mass–length–time (MLT).

In the translation of the physical formulae from mathematical into real forms, we begin with the formulae for the interaction of electric charges (see Chapter 2.4). These charges can be single electrons or the vortices of the vacuum. When each electrically-charged body has a number q of atoms with broken electron rings and exposed broken ends (poles) and they approach one another, they have q pairs of interacting poles. Originally, they are separated by a distance of 1 cm which has the quality E , called the electrostatic field; a sort of elasticity. Thence, when such bodies approach one another, the force of repulsion (or attraction) is

$$F = \frac{q^2}{El^2}. \quad (1.45)$$

Giving it the mechanical form, we assume that q is the hydrodynamical vortices interacting in the continuous quiescent medium. Such a medium has its inertial density ρ and elasticity n through which light waves are propagated with the velocity c . The medium viscosity η varies proportionally to

the velocity of vortices and waves propagated through space. For all thermal velocities, like atoms and molecules normally moving through space, the motion is frictionless and $\eta \cong 0$. The velocities of approximately 10^7 cm/sec and higher experience quite considerable viscosities as explained in Chapter 1.6. As the velocity approaches the speed of light, the medium behaves like a very hard solid (see Chapter 2.8).

CHAPTER 2

Vortices

2.1 The Kutta–Joukowski Lift Force

Although they did not have the ability to experiment with frictionless fluids, the scientists of the 18th and 19th centuries did theoretically consider such ideas. Daniel Bernoulli in 1738 announced his basic equation

$$\frac{p}{\rho} + gz + \frac{1}{2}\rho v^2 = \text{constant}, \quad (2.1)$$

where p = pressure, ρ = density, g = gravity, v = velocity and z = the height of the liquid column. However, we are dealing with a vacuum instead of a fluid, so $p = 0$, $g = 0$ and $z = 0$, so

$$\frac{1}{2}\rho v^2 = \text{constant}. \quad (2.2)$$

Checking this equation with dimensional analysis we get

$$\rho v^2 \equiv \frac{M}{L^3} \cdot \frac{L^2}{T^2} = \frac{M}{LT^2} \equiv \text{stress}. \quad (2.3)$$

Whether this has significance to our studies we do not know, as it belongs to pure hydrodynamics. For us, the most important

information gained from this research is the theory concerning the circulatory flow around an aerofoil and the Magnus effect.

These phenomena have been thoroughly studied in aerodynamics as they are the basic principles of the lift force discovered by Wilhelm Kutta and Nikolai Zhukovsky (Joukouski) in 1910. This force, known as the Kutta–Joukouski (K–J) force, is currently considered to be the universal force in physics. This force rules everywhere because it acts the same way in a vacuum as it does in air where it lifts aeroplanes off the ground.

The Magnus effect describes the attractive force of a rotating cylinder exposed to flowing fluid. We can understand this theory better if we imagine an early invention: a very impractical boat that has instead of a sail, a vertical cylinder of a few metres in diameter that quickly rotates around its vertical axis. Now imagine the wind blowing from west to east; the boat, propelled by its cylinder, would be travelling south. This is because the air and the cylinder move in the same direction on the south side, but in a contrary direction on the north side.

It is important to understand that this invention uses the same principle as that of solenoids, for example, the velocity of the current in a solenoid and a straight wire conductor are attracted to one another when flowing in the same direction, but repel when flowing in the opposite direction. Furthermore, this principle can also be applied to electrons (with ionized atoms) moving in a magnetic field tracing spirals in cloud chambers; electrons being attracted or repulsed in oscilloscopes, television tubes etc., and that the nuclear strong force is the K–J force. So it does appear that the K–J force is the universal force.

To summarise, the K–J force and the Magnus effect both describe the same effect, that of the attraction of two fluid lines when they flow in the same direction.⁷ Therefore:

1. Two wires with direct electric current are two fluid lines;
2. When one wire is twisted into a spiral and the other straight wire is placed parallel to it, they attract or repel depending on the direction of current. For example, the aeroplane wing. This is the basis of K-J force;
3. When there are the two spirals with an electric current, they either repel or attract one another. This is like two vortices interacting in the Magnus effect, for example, two hydrogen atoms (see Figure 3.1).

In aerodynamics it is the K-J force, in hydrodynamics it is the Magnus effect, but both of them come from the general law of two parallel fluid streamlines.

2.2 Vortices

As early as the 1950s, Lars Onsager of Yale University and Richard P. Feynman of the California Institute of Technology suggested the existence of vortices in a spinning bucket of liquid helium at very low temperatures,⁸ but it was only in the 1990s that Olli V. Lounasmaa of the Helsinki University of Technology and George Pickett of the University of Lancaster put this knowledge to work, the key to the future understanding of the structure of matter and of the universe.⁹

Using a frictionless fluid (helium-3), they attempted to substantiate Onsager and Feynman's theory, but a frictionless fluid is difficult to produce and it is even more difficult to carry a hydrodynamical experiment of this nature. In this case, it had to be spun in a bucket at a temperature below 2.172° kelvin (K) and even then, it still had some viscosity left; the velocity of the rotation of the bucket was very slow, and there was the possibility that the apparatus would be adversely influenced

at such temperatures. However, even with all these problems, laboratory techniques were such that in these less than ideal conditions, physics was able to gain this very fundamental knowledge.

These experiments proved useful in gaining a greater insight into vortices, but the most useful information has been in finding that Planck's constant h , a mysterious item of physics since its discovery, is physically the angular momentum of frictionless fluid vortices. This was a key discovery of last century, although it is yet to be appreciated as such. Let us examine it carefully to find out what it really means for the future of physics.

The constant h at once shows the common effect belonging to vortices and waves, namely their angular momenta: vortices in circular motion and waves in undulatory motion. As long as we properly comprehend these ideas, we will understand the nature of matter, waves and energy.

The physical law discovered by Lounasmaa and Pickett was that 'the helium atoms tend to travel around the vortex at the lowest possible speed.' (This is to prevent the viscosity effect that increases with speed.) 'Then each atom's tangential velocity is equal to Planck's constant h divided by the radius of the atom's circulation Γ , divided by the mass of the atom, divided by 2π '.⁸ Expressing this in hydrodynamical terms we get

$$v = \frac{h}{2\pi r m}, \quad (2.4)$$

where v = the tangential velocity of the vortex, h = Planck's constant, r = the vortex radius and m = the mass involved in the vortex. Therefore

$$h = 2\pi r v m. \quad (2.5)$$

In hydrodynamics, it is well-known that the term $2\pi r v = \Gamma$ is the vorticity or the circulation.¹⁰ This is the fundamental

constant for every vortex as long as it exists in time and space, and vanishes only at the destruction of the vortex. Every 'elementary' particle which is a vortex has this fundamental constant, just as every wave has its frequency.¹¹ Some elementary particles are not vortices, therefore they are not particles; photons and some particles that have a zero charge are waves and not particles.

2.3 The Parameters of the Electron Vortex

The most common studies in this emerging area of vortices have been conducted on electrons, so let us check their parameters according to the above discoveries:

$$\Gamma = \frac{h}{m} = \frac{6.6262 \cdot 10^{-27}}{9.109 \cdot 10^{-28}} = 7.274. \quad (2.6)$$

Physically, h = angular momentum of the vortex in a frictionless fluid, therefore

$$h \equiv \frac{ML^2}{T} \quad (2.7)$$

$$\Gamma = 2\pi r v \equiv L \cdot \frac{L}{T} = \frac{L^2}{T} \quad (2.8)$$

$$\Gamma = \frac{h}{M_e} \equiv \frac{ML^2}{T} \cdot \frac{1}{M} = \frac{L^2}{T} \text{ cm}^2/\text{sec}. \quad (2.9)$$

Since it is well-known in hydrodynamics that every vortex has a permanent vorticity, we can make many other deductions concerning their behaviour under various circumstances.

Hydrodynamically, they are being acted on by the Magnus effect, and it is due to their vortical structure that electrons and other elementary particles are difficult to understand in their electrical behaviour.

Having a very fast rotating polar area, they interact with each other according to electrostatic field laws, while their

cylindrically-shaped sides have slower angular velocities and interact in accordance with electromagnetic field laws.

These interactions even have different dimensions in dimensional analysis. The end-wise (polar) interactions are designated by L^2 because they involve their polar areas, while side-wise, the electromagnetic effects have a length-wise effect L . Thus, an electron flowing length-wise in an electric conductor, having its sides exposed to the side-wise interactions, has the dimensions of length L , and when acted on by an external magnetic field, moves side-wise as in the Hall effect, which was discovered by Edwin Hall in 1879.

The Hall effect and the von Klitzing effect, which was published by Klaus von Klitzing in 1980 and elaborated on later by the Physikalisch-Technische Bundesanstalt in Brunswick, Germany in 1982, both involve electrical ohmic resistance as can be seen from the equation

$$R_H = \frac{u_H}{I}, \quad (2.10)$$

where R_H = Hall resistance, u_H = Hall voltage and I = the length of the electric conductor.

In accordance with what we learnt in Chapter 1.1, ohmic resistance is

$$R = \frac{r \cdot l}{A} \equiv \frac{m \cdot v \cdot l}{A} \equiv \frac{ML \cdot L}{T \cdot L^2} = \frac{M}{T}, \quad (2.11)$$

where A = the cross-sectional area of the conductor and r = the specific resistance that hydrodynamically has the dimensions of the momentum of the flowing electrons, therefore

$$r = m \cdot v \equiv \frac{ML}{T}. \quad (2.12)$$

Hall resistance R_H is the resistance of the surroundings that the electron has to overcome while moving ahead under its

linear momentum. Therefore, the electron's internal rotational momentum is

$$h = m_e \cdot \Gamma_e. \quad (2.13)$$

In Chapters 1.7 and 1.8, the behaviour of electrons in a magnetic field is described. While the Hall effect illustrates this for electrons flowing under normal conditions,¹² the von Klitzing effect describes the behaviour and nature of pairs of electrons (similar to atomic molecules)—BCS pairs.

This superconducting stage can be achieved only at a temperature of 1.25°K in a metal–oxide–semiconductor field–effect transistor. Under such conditions, the electrons join into BCS pairs similar to atoms forming molecules, but with fundamental differences between the junctures. For example, hydrogen atoms join by the perimeter of their closed rings, but electrons forming into BCS pairs join by their vortices end-wise, forming rings. This happens only at very low temperatures when the thermal motion of the linear motion and vibrations cease to exist and only the axial vortical rotation attracts them. When such pairs are formed, they flow frictionlessly, carried by the streamline flow of the magnetic field. The electric conductor loses its normal resistance and has only the step-like Hall resistance

$$R_H = \frac{u_H}{I}. \quad (2.14)$$

The von Klitzing effect brings us closer to understanding what an electric charge is and how to consider it in dimensional analysis. In the von Klitzing effect

$$R_{H,j} = \frac{h}{j \cdot e^2}, \quad (2.15)$$

where j = the dimensionless integral number for the steps of $R_{H,j}$ and e = the electrical charge of an electron. Analysing it

dimensionally, we find that

$$e^2 = \frac{h}{j \cdot R_{H,j}} \quad (2.16)$$

$$h \equiv \frac{ML^2}{T} \quad (2.17)$$

$$R \equiv \frac{m \cdot v \cdot l}{A} \equiv \frac{M \cdot L \cdot L}{T \cdot L^2} = \frac{M}{T} \quad (2.18)$$

$$e = \sqrt{\frac{h}{R}} \equiv \sqrt{\frac{ML^2 \cdot T}{T \cdot M}} = \sqrt{L^2} = L. \quad (2.19)$$

Thus, the dimensions of an electric charge interacting with a magnetic field is the length L of the vortex (bent into a circle).

2.4 The Electrostatic Charge of the Electron

The hydrodynamical interactions of open vortex electrons that take place in an electrostatic field have a completely different nature. Here they interact with each other polar-wise.

In an electrical capacitor, the negative plate extends to the front-end of the electron and the positive plate extends to the rear-end of the proton, but they both have the same direction of rotation. Each vortex pole, rotating around its axis, encloses a certain area and so it has the dimensions of L^2 . Since the velocity of such a rotation is not far from the velocity of light, the viscosity of the vacuum transforms it into a semi-elastic rotation.

In dimensional analysis, the electrostatic field

$$E = \frac{F}{q} \equiv \frac{ML}{T^2} \cdot \frac{1}{L^2} = \frac{M}{LT^2} \equiv \text{elasticity}, \quad (2.20)$$

where q = the area of the electron pole (the charge). This can be described by Coulomb's law, where

$$F = \frac{q^2}{\epsilon l^2}. \quad (2.21)$$

Dimensionally, the dielectric constant

$$\epsilon = \frac{q^2}{Fl^2} \equiv \frac{L^4}{L^2} \cdot \frac{T^2}{ML} = \frac{LT^2}{M} = \frac{1}{\text{elasticity}}. \quad (2.22)$$

In Maxwell's equation, $1/\epsilon\mu = c^2$, μ has the dimensions of density equivalent to M/L^3 (see Chapter 2.8). Since the vorticity of electrons is constant, it must be their polar areas that have electric charges. This was established by Walter Kaufmann in 1901. Carrying his experiments to determine the charge-to-mass ratio, Kaufmann found that this ratio decreases with velocity. By the middle of the last century, this had been confirmed accurately by the use of high energy particle accelerators that showed that vacuum vortices do not increase their polar areas, but increase only in their length when more energy is added to them during their forward motion. However, in Chapter 1.4, it is concluded that with the increase of the velocity of a particle, the viscosity of the medium starts increasing rapidly when such velocity (relative to its immediate environment) approaches the velocity of light.

A particle then, to a certain extent, can increase in length and so increase in its inertial mass, but its stability decreases (depending on the experiment). By its viscous friction, the particle produces electromagnetic waves and quasi-particles and then breaks into unstable smaller vortices and other electromagnetohydrodynamical disturbances. Such is the nature of the discovered multiplicity of short-lived elementary particles.

2.5 The Energy and Mass of a Vortex

When a cylindrically-shaped vortex moves through space with the linear velocity v and the rotational velocity ω , its total energy is

$$E_T = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2, \quad (2.23)$$

where I = the moment of inertia of a cylinder.¹³ We treat these two energies separately because the linear velocity is acquired externally, while the rotational velocity gives its inherent quality: the rotational inertia acquired at the creation of the vortex.

During elementary particle creation, the velocity to achieve the turbulent flow is $v \cong c$, and so we accept its radius as being

$$r = \frac{\Gamma}{2\pi c}. \quad (2.24)$$

2.6 The Electron's Charge

By calculating the vorticity Γ of an electron, we have already found that this constant has been known as one of its parameters, but what about the electron's 'charge' in electromagnetic units (emu)?

$$q = 1.60022 \cdot 10^{-20} \text{ emu.}$$

What if we accept that this is the side area of the opened end of the electron (while moving forward from the cathode to the anode)? With an area $a = 1.6022 \cdot 10^{-20} \text{ cm}^2$, the radius of such a circular area (at an axial distance of 0.5 cm) is

$$r = \sqrt{\frac{a}{\pi}} = 7.1414 \cdot 10^{-11} \text{ cm.} \quad (2.25)$$

In such a case, the tangential velocity is

$$v = \frac{7.274}{2\pi \cdot 7.1414 \cdot 10^{-11}} = 1.62 \cdot 10^{10} \text{ cm/sec,} \quad (2.26)$$

which compares with

$$\frac{v}{c} = \frac{1.62 \cdot 10^{10}}{2.9979 \cdot 10^{10}} = 0.54. \quad (2.27)$$

2.7 The Intra-Nuclear Force

In nuclear physics, besides the strong force, which we have assumed is the K–J force, there is also a weak force. The weak force acts in the range of the distances of a proton’s diameter and there is a reason for this.¹⁴

When we consider the action of the strong force, the two vortices approach one another from infinity to the point where the streamlines of their tangential velocities start interacting with a noticeable effect. This strength of attraction increases right up to the point when the more effective streamlines reach the centre of their interactors. As soon as these streamlines pass the centre, the direction of the rear streamlines are contrary to the penetrating flows, so the vortices start repelling one another back to the position where they become stable. This also occurs with electron vortices.

Let us quote the authority on high energy physics, the Professor of Physics at Harvard University, John Huth:

*Remarkably, particle physics appears to have a viable theory called the electroweak theory, unifying the weak and the electromagnetic forces, as well as a theory of similar structure describing the strong force ...*¹⁵

In general terms, it is the Magnus effect reversed against itself by 180°. This is the reason why vortices approach one another only to a limited extent; the weak force can become quite strong when the centre of the vortices overpass too far and can even cause a disruption with a spring-like effect. Both

chemical bonds and gas-molecule bonds behave in this way, together with all other so-called covalent bonds, which are due to the interactions of electrons. Proton–neutron bonds (like in deuterons) are more internally complicated due to the internal structure of nucleons.

2.8 Maxwell's Equation

If an electron's charge is at its front-end area, its dimensions would be the same as L^2 . Let us examine the consequences of this. The charge $q \equiv \text{area} \equiv L^2$ (dimensionally). The force of the interaction of two equal charges (say, 1 cm apart) is

$$F = \frac{q^2}{\epsilon L^2} \equiv \frac{L^4}{\epsilon L^2}, \quad (2.28)$$

therefore

$$\epsilon \equiv \frac{L^4}{FL^2} \equiv \frac{L^4 T^2}{MLL^2} = \frac{LT^2}{M}. \quad (2.29)$$

Hence the dimensions of dielectric constant ϵ are

$$\epsilon \equiv \frac{LT^2}{M}. \quad (2.30)$$

The dimensions of elasticity are

$$\frac{M}{LT^2}. \quad (2.31)$$

From this we can presume that the dielectric constant ϵ has the inverse dimension of elasticity. Maxwell's equation is

$$\frac{1}{\epsilon\mu} = c^2, \quad (2.32)$$

where μ = the magnetic permeability of the vacuum, therefore

$$\mu = \frac{1}{\epsilon c^2} \equiv \frac{M}{LT^2} \cdot \frac{T^2}{L^2} = \frac{M}{L^3} \equiv \text{density } \rho. \quad (2.33)$$

We will now introduce elasticity $n = 1/\epsilon$ and $\mu \equiv \rho \equiv$ density. The equation for propagation of transverse waves, $n/\rho = c^2$, will validate the previous deductions.

2.9 Gravitation: What is G?

The basic equations relating to gravity are

$$F = \frac{G \cdot M \cdot m}{l^2} = mg, \quad (2.34)$$

where G = the gravitational constant, F = the force of attraction between a test mass $m = 1$ gm and an attractive (big) mass M (like the Earth or the sun), l = the distance between the masses and g = the gravitational acceleration. We cross out a test mass $m = 1$ gm to give

$$F = \frac{G \cdot M}{l^2} = g, \quad (2.35)$$

hence

$$GM = l^2 g. \quad (2.36)$$

According to the theory of electro-magnetohydrodynamics, gravitational forces are conveyed by the electromagnetic radiation of the shearing strain emanating from the rotating pole of every nucleon (but not of electrons). These polar vibrations are electromagnetic, string-like polar waves. Each nucleon rotates in one direction only and the polar (unidirectional) waves arise when the rotational velocity approaches the velocity of light. The polar space rotation of the vacuum then stalls until the velocity decreases sufficiently, then the velocity and strain builds up again. This is due to the transmitting nucleon on one end of the vortex. Its other end, although it has the same direction of rotation relative to itself, travels in a reverse direction relative to the other side of the surrounding space of the vacuum. These unidirectional rotations have an enormous ability to penetrate

through vacuum space due to their small polar radiating areas and their enormous masses (nuclear masses), until they reach a wave propagated by another nucleon in space. Such a polar wave from space, if it has the same directional rotation (relative to the receiving nucleon), causes an attraction between the two nucleons. If the direction of rotation is opposite, they evade one another and proceed further into the vacuum space. This is a string theory of gravitation (see Chapters 3.9 and 3.12).

2.10 The Spring and Shearing Strain

A nucleon rotating in the same direction with a velocity greater than the velocity of light, produces an elastic stalling effect that propagates unidirectional waves through the vacuum. Here then, is the elastic spring effect which helps us to explain gravitational phenomena.⁵ The force of a spring is

$$F = ke, \quad (2.37)$$

where k = the spring constant, e = elongation of the spring. The work done on the elongation of the spring is the energy

$$E = \frac{1}{2}ke^2. \quad (2.38)$$

The 'string' of the unidirectional waves through the vacuum is propagated like ordinary electromagnetic radiation and behaves in accordance with these laws. The energy of the propagated wave, $E = h\nu$, where h = Planck's constant and ν = the frequency of the radiation is

$$E = \frac{1}{2}ke^2 = h\nu, \quad (2.39)$$

therefore

$$e^2 = \frac{2h\nu}{k}, \quad (2.40)$$

so

$$e = \sqrt{\frac{2hv}{k}}. \quad (2.41)$$

In gravitation

$$F = \frac{G \cdot M \cdot m}{l^2} = mg. \quad (2.42)$$

We cross out the test mass m , and we get

$$F = \frac{G \cdot M}{l^2} = g, \quad (2.43)$$

therefore

$$GM = l^2 g, \quad (2.44)$$

so

$$F = mg. \quad (2.45)$$

In spring actions

$$F = ke = k\sqrt{\frac{2hv}{k}}, \quad (2.46)$$

therefore

$$mg = k\sqrt{\frac{2hv}{k}} = \frac{k}{\sqrt{k}}\sqrt{2hv}. \quad (2.47)$$

So here we have explained gravitation using the laws of ordinary physical effects.

CHAPTER 3

Nucleonic Structures

3.1 Nucleons and Atoms

Nucleonic structures, such as electrons, cannot be explained in terms of simple vortex mechanics because we are dealing with the complexity of a physical phenomenon taking place when atomic nuclei are being created.

The unusual properties displayed by frictionless fluids like helium-3 at very low temperatures have been noted by Finnish researchers, but a vacuum at the velocity of light is even more complicated. As shown by Alan D. Krisch of the University of Michigan in his onion model (see Chapter 3.5), we find in the structure of a proton that there is a vortex inside another vortex, and inside of it, another very dense, high-velocity vortex. Between the walls of these vortices, there are neutrinos.

Elementary particle vortices can only be produced when fluids show sufficient viscosity. At moderate speeds, the relative velocity of neighbouring streamlines do not show any viscosity, but at critical values, vortices are produced.

At moderate speeds, a vacuum is a perfectly frictionless fluid, but at the speed of light, it becomes a perfect solid. When

the velocity is lower than the speed of light, but not far from it, vortex creation ensues. Simple vortices can be produced when stress persists unidirectionally long enough, but if it is of short duration, then a wave is produced. Everything depends on the nature of the stress.

It has also been found that electrons and muons have true simple vortex structures. As one author indicated,¹⁶ they are classified as leptons and are considered to be 'structureless'. They can be compared to a bathtub vortex with an empty space inside; within an electron, there is a vacuum and the motion of the vortex walls relative to these spaces are the same. Now, what if our external stress acts on the vortex wall strongly enough to produce another critical velocity? This is probably how another internal vortex is created, but it is for hydrodynamicists and nuclear scientists to find combination vortices inside of protons.

3.2 Vortices and Waves

Vortices, being material particles, have mechanical properties similar to waves. We describe wave creation energy by the equation $E = h\nu$, where ν = the frequency of the wave. Vortices also have frequencies described in units of time (rotations per second). The rotational velocity $\omega = v/r = 2\pi r$ connects the mechanics of vortices with that of waves.

Starting with energy (nuclear), we are going to construct an atom

$$E = mc^2 = h\nu, \quad (3.1)$$

$$\nu = \frac{E}{h} \quad (3.2)$$

and

$$r = \frac{\omega}{2\pi} = \frac{v}{2\pi r}. \quad (3.3)$$

Back to the electron's frequency, where

$$\nu_e = \frac{E}{h} = \frac{0.511 \text{ MeV}}{h} = \frac{8.1866 \cdot 10^{-7} \text{ ergs}}{h}, \quad (3.4)$$

therefore

$$\nu_e = 1.2355 \cdot 10^{20} \text{ cycles (rotations)/sec.} \quad (3.5)$$

The vortex we have just described is a common one. Next, we are going to do something more refined; what would happen if a higher energy were used for the creation of an electron?

In physics we cannot rely on guesses. We have to get our knowledge from facts. To learn how a mechanical clockwork is constructed, we take it to pieces, investigate all of its parts, look at their placement and how they interact, and then we might have an understanding of how it works.

3.3 The Vortex Structure of Nucleons

Krisch, the greatest authority on the structure of nucleons, has written extensively on the spin of elementary particles,^{17,18} a property of their vorticity. His research group, which has been working on the structure of protons at the Argonne National Laboratory since 1973, has achieved splendid results from the collision of polarised protons. The only thing missing is the interpretation of these results into vortical terms. This can be completed if we apply the studies described in Chapter 2.

What are the shapes of the internal constituents of protons? How are they situated relative to each other? What are the physical forces with which they interact? To say that it is a strong force is not enough; the question is, how does this force act physically?

The constituents of a proton are supposed to be shapeless points, although they have their spin. Their other properties are

given such unusual terminology that physics is too prosaic and too earthy to accept them. Since it is not specified as to how they behave inside a proton, they are probably presumed to have some sort of a quasi-planetary existence there. The faulty interpretation of these important experiments can cause another terrible mistake like Niels Bohr's erroneous interpretation of the electron's place in an atom. The electron was 'put into orbit' around its proton and this theory still appears in textbooks on physics and chemistry. After Oersted's interpretation of the direction of electromagnetic fields, Bohr's mistake has been the worst in the history of science. Interpreting experiments with protons containing, hypothetically, internally suspended, point-like quarks without any evidence, does not give us confidence in the theory, especially considering that the existence of quarks is yet to be proven.

3.4 Pions and Kaons

Pions and kaons, generally known as mesons, are two elementary particles that have been known since the time when photographic plates were flown in high atmospheric research balloons and when nuclear smashers did not exist. Where should we fit each of them into the structure of matter?

We are now better situated to judge such particles as electrons and muons since both of them have (we presume) a simple structure common to all leptons: plain willy-willies, but it is different with mesons. When they break down, there is debris left besides the radiated energy of delta-photons. So let us investigate mesons according to their masses.

A proton's mass = 938.256 MeV = p and a kaon's mass = 493.8 MeV = K , therefore

$$\frac{K}{p} = 0.526 \cong \frac{1}{2}. \quad (3.6)$$

A pion's mass = 139.6 MeV = π , therefore

$$\frac{\pi}{K} = 0.283 \cong \frac{1}{3}. \quad (3.7)$$

Rather significant energy variations occur during the breakdown of a proton, so this can be interpreted as the various fractions into which the proton can be broken. This interpretation also holds when we consider hyperons as being unstable combinations of nucleons and pions.

Summarising, we can see that:

1. to study the structure of a particle, we have to break it (or find it broken) and observe the properties of its components;
2. unlike leptons, nucleons (protons and neutrons) do break into fractions, which are known as mesons;
3. the structure of mesons, to a certain extent, can give us some hints as to how nucleons are constructed.

Pions are the most unstable particles and when they break we get

$$\pi^+ \rightarrow \mu^+ + \nu_\mu. \quad (3.8)$$

We saw before what happens to a muon¹⁹

$$\mu^- \rightarrow e^- + \nu_\mu + \bar{\nu}_e. \quad (3.9)$$

Hence, the conclusion is that this is the way a proton goes to its finale—as pure energy. 'From energy and space it was born, into energy and space it ends . . .'²⁰ This happens to the unlucky ones; normally protons are very stable.^{17,21-25}

3.5 Krisch's Onion Model of a Proton

In 1963, Krisch proposed the onion model of a proton. He suggested that 'the proton has a "core" surrounded by a cloud of lesser density.'¹⁷ More recent experiments performed by Krisch in 1987 indicate that the radius of the core is about 1/4 fermi or $2.5 \cdot 10^{-14}$ cm.¹⁸ So how does this compare with the vortex parameters of the proton vortex components?

Since the proton is a compound vortex made of an electron, a muon and a central core, which we shall call the kernel k , we can find the mass of the latter by subtracting the masses of the other two components (neutrinos are massless)

$$m_k = m_p - m_\mu - m_e, \quad (3.10)$$

therefore

$$m_k = 938.256 \text{ MeV} - (0.511 + 105.659) \text{ MeV}, \quad (3.11)$$

so

$$m_k = 832.086 \text{ MeV} = 1.333 \cdot 10^{-3} \text{ ergs}. \quad (3.12)$$

Since energy $E = mc^2$, then

$$m_k = \frac{E}{c^2} = \frac{1.333 \cdot 10^{-3} \text{ ergs}}{(2.9979 \cdot 10^{10})^2} = 1.48334 \cdot 10^{-24} \text{ gm}. \quad (3.13)$$

According to the law of vortices, $\Gamma = h/m$, therefore

$$\Gamma_k = \frac{6.6262 \cdot 10^{-27}}{1.48334 \cdot 10^{-24}} = 4.467 \cdot 10^{-3} \text{ cm}^2/\text{sec}, \quad (3.14)$$

so

$$r_c = \frac{\Gamma}{2\pi c} = 2.37 \cdot 10^{-14} \text{ cm}, \quad (3.15)$$

and this is what we could have expected it to be.

The 1987 Stanford Linear Accelerator Center experiments used polarised protons as missiles and protons as targets to

produce collisions.¹⁸ The most crucial point of these experiments was that the collisions were produced in the exact known manner of how polarised protons approach one another, with the known direction of their spin in every singular position of missiles and targets. The 1971 experiments were conducted where the supposed partons were presumed to be located and neither electron missiles nor deuterium atom targets, were polarised. So experiments to find the three 'quarks' or 'partons' were not possible; these could be the walls of the proton and neutron's component vortices—that of the electron, muon and kernel.

3.6 The Problem of Matter and Antimatter

An electron e^- (a particle) and a positron e^+ (its antiparticle), are typical matter and antimatter. To understand this problem, we have to imagine the electron and the positron as two solenoids wound around a cylinder with a direct current flowing through the wire; the spirals wind in a reverse direction when they both are compared.^{21,24} The next point to notice is that each of them flies through space perpendicular to the planes of the spiral rings, parallel to the central axis. Through the spiral wires flows the direct electric current. Looking along their axes, one current will be twisting to the left like the streamlines in an electron vortex, and in the other spiral, the current turns to the right like the streamlines of a positron vortex. The solenoids appear to fly away from the observer. The important thing to notice is the front end of each solenoid (vortex) that we call the electric charge of the vortex (see Chapter 2.5); the electron's circle (charge) rotates to the left, the positron's to the right.

The axiom is that matter differs from antimatter in the direction of its vortex circulation Γ relative to the axially-

directed motion of the vortex; particle and antiparticle vortices rotate in opposite directions. In electrons, the direction of the rotation of the vortices is to the left, positrons to the right. The front area A of each vortex is called its electric charge and is measured in cm^2 , thus

$$\Gamma = 2\pi r v = 2\pi r^2 \cdot \omega = 2A \cdot \omega. \quad (3.16)$$

The $2A$ term is present because both ends of the vortex area are being considered (see Chapter 2.5).

3.7 The Annihilation of Electrons and Positrons

Between vortices, like between cars, there can be two kinds of collision: a head-on (front-to-front) or a front-to-back collision. In the case of particle–antiparticle collisions, both kinds of collisions are frontal; all that is left is the energy radiated away in the form of waves (alpha-photons), which is equal to the total creation energy of an electron and a positron.

In the case of electron–positron interactions, a head-on collision (the orthopositronium) is mild and lasts as long as $1.4 \cdot 10^{-6}$ seconds, leaving the ‘wrecks’ locked together. The front-to-back collision (the parapositronium) lasts only $1.25 \cdot 10^{-10}$ seconds. The reason for this is that in a head-on collision, the two vortices have the same direction of rotation and produce a longer lasting wreck (the quasi-particle), but in a front-to-back collision, they simply unwind one another and what we know as matter ceases to exist.^{20,24}

3.8 Muons

We have already met with a muon and concluded that it is a heavy electron that received more energy than an ordinary electron at its creation, but this has made it different in many ways.

While electrons and positrons annihilate themselves on contact, a muon and an electron join together forming a particle similar to an electron and a proton that produces the neutral and stable hydrogen atom. The muonium atom μ^+e lasts only $2.2 \cdot 10^{-6}$ seconds. It happens this way because the muon itself is not a stable particle,¹¹ therefore

$$\mu^+ + e^- \rightarrow e^+ + 2 \text{ neutrinos} + 52 \text{ MeV.} \quad (3.17)$$

The energies vary in this process.

3.9 Neutrinos are Particles

Atoms emit light waves when they change from one state to another. In a similar way, Wolfgang Pauli suggested that whenever an electron is emitted from a nucleus, a light particle is always given off. Enrico Fermi christened the Pauli particles 'neutrinos' or 'little neutrons'. Their existence was demonstrated experimentally in 1932 by Nobel prize winner for physics, James Chadwick.

In atomic and nuclear physics, angular momentum is measured in units of Planck's constant divided by 2π

$$\mu = \frac{h}{2\pi}. \quad (3.18)$$

According to the vortex theory, the circulation $\Gamma = 2\pi r v$ and $h = \Gamma m$, therefore

$$\mu = \frac{h}{2\pi} = \frac{\Gamma m}{2\pi} = \frac{2\pi r v m}{2\pi} = r v m. \quad (3.19)$$

It was realised that the neutrino must also carry away the linear momentum, but it took a few years before this prediction was verified experimentally. The existence of the neutrino was finally proven by Frederick Reines and Clyde Cowan at the

Savannah River nuclear reactor facility in South Carolina, USA, in 1954.

The fundamental reaction of the Fermi theory is

$$n \rightarrow p + e^{-} + \nu, \quad (3.20)$$

where ν = the neutrino. Reines and Cowan observed the inverse reaction as

$$\nu + p \rightarrow n + e^{+}, \quad (3.21)$$

where e^{+} = the positron.²⁶

3.10 Solar Neutrinos

In 1920, Arthur Stanley Eddington suggested that nuclear fusion powered the sun. In 1960, Raymond Davis Junior carried out experiments on neutrinos using liquid tetrachloroethylene, the dry cleaning fluid. The neutrinos transformed atoms of chlorine into atoms of argon.

Neutrinos arriving from the sun were always significantly less than the predicted total, in some cases as low as one-third, in other cases as high as three-fifths, depending on the energies of the neutrinos studied.

The standard model of particle physics holds that there are three distinct massless flavours of neutrinos:

1. electron–neutrinos;
2. muon–neutrinos;
3. tau–neutrinos.

According to this model, fusion reactions in the centre of the sun can only produce electron–neutrinos and tau–neutrinos. Davis designed experiments exclusively for these flavours, at solar neutrino energies. Only electron–neutrinos can convert

chlorine atoms to argon and this was the observed deficiency of the neutrons.²⁷

3.11 The Sudbury Neutrino Observatory

The Sudbury Neutrino Observatory (SNO), located 2 km underground in Ontario, Canada, uses 1,000 tonnes of heavy water ${}^2_2\text{H}_2\text{O}$ to detect neutrinos produced by the sun. Initially, they detected that a neutron in a deuteron produces two separate neutrino reactions:

1. Neutrino absorption, where an electron–neutrino is absorbed by a neutron and an electron is created;
2. Deuteron break-up, where a deuterium nucleus is broken and the neutron liberated. Electron–neutrinos of any flavour can break-up deuterons.

Later, a third reaction detected that the scattering of electrons by neutrinos can also be used to count neutrinos other than electron–neutrinos, but it is much less sensitive to muon and tau–neutrinos than the deuteron break-up reaction. SNO, using the heavy water ${}^2_2\text{H}_2$, can now count all three flavours of neutrino equally.

In 2002, SNO resolved the neutrino problem by determining that many of the electron–neutrinos produced inside the sun change to other flavours of neutrinos before reaching the Earth, causing them to be undetected by past experiments. The SNO results confirmed that neutrinos, long thought to be massless, are not so and this proves that neutrinos are not waves, but vortices. Waves turn only to 180° and then turn back. Vortices turn more than 180° through 360° and rotate continuously. The incomprehensible quality of the neutrino mass is caused by its lack of structural stability. Produced

by leptons and not hadrons, neutrinos do not have enough strength to preserve their structures permanently. Thus, we can characterise neutrinos as structurally deficient particles or underdeveloped creations.

An electron as a vortex has an internal energy of only 0.511 MeV; a neutron has 939.5 MeV. With such low internal energy, an electron cannot produce a vortex in a vacuum any better than a neutrino.²⁸

In 1998, Super-Kamiokande (or Super-K), a neutrino observatory in Gifu, Japan, found that muon-neutrinos produced in the Earth's upper atmosphere by cosmic rays were disappearing with a probability that depended on the distance they travelled.²⁹ This proves the unstable existence of such particles and that they are mere vortical disturbances of a vacuum rather than material particles. It is their quantities and their variability that show their wide existence.

Waves meeting material particles lose their energy by decreasing frequencies, $E = h\nu$, hence redshift. Pseudo-vortices (neutrinos), while grazing in space dust, lose their vortices and disappear, and this is how matter is lost. KamLAND, a giant detector in the heart of Mount Ikenoyama in Japan, has demonstrated neutrino metamorphoses in flight.

3.12 Neutrons

In 1954, Reines and Cowan discovered the neutrino reaction as²⁶

$$\nu + p \rightarrow n + e^+. \quad (3.22)$$

This reaction puts in doubt the theory that when in an atomic nucleus, there is an excess of protons, then a proton catches an external electron from another proton and changes into a neutron. This notion must have come from the neutron's

reaction taking place externally, that is, outside of an atomic nucleus. This reaction is



The first objection to this theory is that the strong force that operates inside of a nucleus is active only to the range of an atomic nucleus diameter, that is, up to 10^{-13} cm. The electron's distance from the nuclei is measured in angstrom units of about 10^{-8} cm; there is a very wide difference in the range of quantities.

The second objection is that, in these cases, we deal with the opposite sign of rotation indicated by the designation of the electrical charge of positive and negative. The reactions take place at different ends of the nucleon. Here we can see the deficiencies in the experimental physics; is it a shortage of technologically-suitable apparatus or a shortage of right ideas? Probably the problem rests more with a lack of understanding of the variations of the energy content in the nucleus while such processes take place.

A neutron's mass = 939.55 MeV¹⁹ and a proton's mass = 938.256 MeV. The mass difference is 1.294 MeV. The mass of a neutrino is unknown, and in different experiments, these values differ. From what we tried to discern from the vortex theory, the energy of a neutrino depends on the balance between the internal energy of a nucleon and what is being added to it from its exterior.

3.13 Temperatures and Heat Capacities of Atomic Nuclei

We have found that a neutron has an extra 1.294 MeV of energy. This does not mean that it had to rob another neighbouring

proton to get the extra energy. In material media, like in gases or solids, there is an energy state that is known as temperature. In gases, it is the velocity of flying atoms or the velocity of the vibration that molecules make in solids, but what is it inside of an atomic nuclei where the strong force operates? It is the velocity of the vortices' streamlines around their centres

$$v = \frac{\Gamma}{2\pi r}. \quad (3.24)$$

General vortex equations connecting the energy of waves and particles are

$$E = hv = \Gamma mv \quad (3.25)$$

and

$$\omega = \frac{2\pi}{T} = 2\pi v, \quad (3.26)$$

where $\omega = 2\pi v$. This is explained in terms of rotational velocity, but also the energy of a vortex particle. It tells us that the meaning of temperature is not limited to the state of ordinary matter, but also to the nucleonic contents of atomic nuclei.³⁰ From general physics we know that

$$Q = \check{c} \cdot m \cdot \Delta\theta, \quad (3.27)$$

where Q = the quantity of heat energy (ergs), m = the mass of the entity concerned, \check{c} = the (dimensionless) constant = the heat capacity and $\Delta\theta$ = the increase in temperature, therefore

$$Q = \epsilon = \check{c} \cdot m \cdot \Delta\theta \quad (3.28)$$

so

$$Q \equiv \frac{ML^2}{T^2M} = \frac{L^2}{T^2} \equiv \text{velocity squared}. \quad (3.29)$$

The axiom is that temperature, in dimensional analysis, has the dimensions of velocity squared. This shows that to have a higher temperature, the entity must have a higher velocity, but

if we bring the two vortices together, the interacting vortices' radii become shorter and the interacting streamlines, velocities become higher (since $\Gamma = \text{constant}$).

As temperature varies with the square of the velocities, the nuclear temperature increases. This means that the atomic nuclei that have higher heat capacities (rather than energy capacities) must have their nucleons joined in tighter unions (such nucleons may have shorter radii in their joining bonds), but how do we find the heat capacities of atomic nuclei? Once again, we look at a general definition:

*The heat capacity of any system is the quantity of energy required to raise the temperature of the system by one degree.*³¹

The definition shows that

$$\Delta\varepsilon = \check{c} \cdot m \cdot \Delta\theta, \quad (3.30)$$

where $\Delta\varepsilon =$ mass defect in MeV, $\check{c} =$ the heat capacity per nucleon = the constant, $m =$ the mass of the nucleon and $\Delta\theta =$ the temperature increase in MeV. Hence

$$1 \text{ eV} = \frac{1.6 \cdot 10^{-12}}{1.38 \cdot 10^{-16}} \text{ }^\circ\text{K} = 1.160485 \cdot 10^4 \text{ }^\circ\text{K}, \quad (3.31)$$

therefore

$$\text{K} = 1.38 \cdot 10^{-16} \text{ erg } ^\circ\text{K}, \quad (3.32)$$

so

$$1 \text{ MeV} = 1.160485 \cdot 10^{10} \text{ }^\circ\text{K}. \quad (3.33)$$

However, in this equation we have two unknowns: \check{c} and $\Delta\theta$. We can solve for these unknown by using more isotopes of the same element, thereby obtaining more equations.

3.14 How Elements are Made and Remodelled

On 5th April 1991, the space shuttle Atlantis carried the 16-ton Compton Gamma-Ray Observatory into space. The Imaging Compton Telescope generates images and collects the spectra of sources that emit medium energy gamma-rays. The Energetic Gamma-Ray Experimental Telescope (EGRET) gathers the highest energy gamma-rays.

EGRET has since detected 26 gamma-ray emitting galactic nuclei. Like 36279, almost all these objects are classified as blazars. These gamma-ray emitting blazars reside at distances ranging from 400 million to nine billion light-years away... The current best explanation of why blazars are such strong gamma-ray sources is that the gamma-rays originate in jets that point toward the Earth. In the jets, low energy photons, such as light or ultraviolet rays, generate in the disc around the black hole, would often bounce off rapidly moving electrons. Through this process, the photons could gain enough energy to become gamma-rays and would align with the particle in the beam.

Because the resulting radiation would concentrate along the narrow beam, the blazar would appear especially brilliant if the beam happened to point Earthward. For years, researchers have speculated that jets might strongly affect nuclei; the EGRET results seem to confirm the theory...³²

This long quotation proves the vortex theory of the nature and structure of galaxies. The galactic vortex contains at its centre a black hole with an inlet at one end and an outlet at the other; we have already seen such vortex structures in electrons and muons. The latter travel through space with their inlet

ends in front and the 'blazars' behind. A black hole devours interstellar dust, stars and planets, and ejects them as blazar jets while nuclear particles do the same with a vacuum.

Now, let us consider the following article about the 'factories' of the elements.

*All heavier elements, including the carbon in our bodies and the silicon and iron that make up much of the Earth, have been created through nuclear fusion reactions in the interiors of stars. Supernovae provide the primary mechanism by which these elements recycle into interstellar space, where they are incorporated into the next generation of stars, and presumably, planets. Stable stars do not create elements such as gold; these atoms form only in the extreme temperatures and densities that prevail in supernova detonation.*³³

So we arrive at the threshold of finding out what is going on in the 'elemental factory' and the atomic nucleus itself. Elements such as manganese, iron, cobalt, and nickel show that, at this point in the sequences of the creation of matter, there is some sort of mysterious mechanism \checkmark involved.

Tables 3.1.1–3.1.6, located at the end of the chapter, compares isotopes that differ by the number of neutrons they contain between alpha-particles in successive alpha-shells. The columns of the table show particular elements, the rows show isotopes of similar structure, the unshaded cells denote stable isotopes and the shaded cells denote unstable isotopes. So referring to Table 3.1.2, we see that manganese, iron, cobalt and nickel are located in the middle of the table. If we look more closely at nickel by using number two in the neutron n series to pinpoint the isotope nickel-58, we can see that there are only unstable isotopes following which terminate before krypton, as shown on Table 3.1.3.

In Chapter 3.13, we studied the temperature and heat content of atomic nuclei where we saw that the equivalent energy capacity of atomic nuclei can be considered the curve of binding energy per nucleon; the curve reaches its highest point at these elements and then starts to decline.³⁴ These processes have been studied in Supernova 1987A and the decays of cobalt-56 and cobalt-57 were correlated with the proceedings of the explosion. Aluminium-26 has a mass of approximately half of the participants mentioned before. So is element fission involved in the production of aluminium and silicon?

3.15 The Vortex Quantum Theory

For a given temperature of emission, black body radiation has a definite spectrum. The radiation emitted from any specific wavelength will possess a certain amount of energy, but rises to a maximum for each temperature. Existing theories could not reconcile the energy distribution with the wave theory of radiation, but then Planck boldly proposed the quantum theory in a paper published in 1900. He showed that experimental observations on black body radiation could be explained by supposing that energy is emitted or absorbed by a vibrating body, not continuously, but in multiples of units called 'quanta'. Furthermore, the size of a quantum of energy was proportional to the frequency of the radiation (velocity divided by wavelength) and was therefore equal to $h\nu = E$.³⁵

Take an electron, for example. Due to its vortical nature, it rotates, so it becomes the centre of rotation. As its layers of vacuum rotate, it makes the next layer of the surrounding vacuum also rotate and at such a high speed that it drags the vacuum very strongly. Further away, the drag is weaker and as such, the longer radius has the weaker drive. The slower drive produces the lower viscosity layers relative to the close distance

and the process is cumulative. The result is that the rotational motion makes only a thinly enclosed vortex, although the polar rotation is composed of different layers (as to its radius and velocity) that rotate longer distances^{17,18} (see Chapter 3.29).

While the centre of the rotational axis theoretically rotates at a very high speed relative to the motionless enviroing vacuum, to a certain extent it is affected by dragging its environment, this being the external interaction of the electron with the vacuum. Whether we consider the sideways or polar-wise environment, there can be a similar electron. If they approach each other, due to each having an inertial motion, their behaviour will be formulated by the direction of their rotation; they will either attract or repel each other. If they rotate while approaching in the reverse direction, one from left to right while the other from right to left, their approaching side will flow in the same direction, then they will not have to push the environment vacuum as the other pushes in the same direction. At the other end of the diameter, they have to force the flow of the motionless vacuum, thus each of the vortices is being pushed from the outer side to the inner side and attraction is produced. If the vortices rotate in the same direction, then each produces the opposite flowing medium. They do not have to push so strongly on the other side and they repel each other; this is the Magnus effect.

3.16 The Origin of Matter and Waves

When two layers of fluid move, one relative to the other, then an eddy is formed. If the appropriate mechanical and dynamical condition arises, then waves and vortices are formed. In the case of a vacuum, this takes place when the relative velocity of the layers approaches the speed of light c and the energy and duration suits particular events. Hence, the kinetics of the

two layers of fluid decide the results. We can call each event a 'quant'. When the eddy turns completely, then a vortex is formed and its existence depends on the energy involved in each creation, for example, $\Gamma = 2\pi v$ and $E = mc^2 = hc^2/\Gamma$.

When the momentum rises rapidly and lasts only a very short time, then the eddy does not turn completely and a quant is created when the relative forward motion stops. In the case of vortices, the reverse motion eddy will turn a full 360° and further. Thus, the wave's eddy turns to only 90° forward, 90° backward (under the created momentum) and finally 90° forward; the quantum is also 360° , but it is a wave.⁷

3.17 The Viscosity and Vorticity of a Vacuum

A feature of fluid is its viscosity and this feature applies to a vacuum as well. It depends on the relative velocity of the motion of the adjacent area. For a vacuum, the terminal velocity v is equal to the velocity of light c , but at velocities lower than c , viscosities are quite high. At the force of 1 eV, the electron travels at the speed of $5.93 \cdot 10^7$ cm/sec with the velocity of light being $2.998 \cdot 10^{10}$ cm/sec. If one part of a vacuum, plane or vortex moves very fast relative to itself, it produces the resistive force F that will be proportional to the velocity of the relative motion. So in accordance with Newton's law

$$F = \eta A \frac{dv}{dx}, \quad (3.34)$$

where η = viscosity at the given velocity v of the motion and A = the contact area of the moving entities. Smooth motion chiefly occurs when one part of the area in the interior of the fluid has been subjected to pressure for a time, while the adjacent parts have not. A vortex is produced at the point where the motion began and the vortex filaments are formed.



*Isaac Newton (1643–1727):
English physicist, mathematician, astronomer and alchemist.*

3.18 Nuclei and Protons

In general terms, the whole interior of the nucleus is composed of only two kinds of nucleons: protons and neutrons. Their composition are also very simple and they interchange from one to another (and back) when energy circumstances allow.

A proton is a linear vortex with two poles that extend indefinitely into space, one being an electron and the other being a positron. The whole vortex rotates in one direction; if observed facing the electron, the rotation is from left to right, and if facing the positron, it is from right to left. The rotational velocity is so high that the central axis of the vortex rotates like a string and each end transcends the space until it reaches the end of the string from another material particle. If both have a similar direction of rotation, they attract their respective protons, but if they have an opposite direction of rotation, then they avoid one another and proceed further into space. This is the string theory of gravitation.¹⁷

3.19 More About Neutrons

We mentioned earlier that neutrons are similar to protons. It has been observed that under certain circumstances they can even interchange. How? We found that a proton has a linear vortex at one end and an electron and positron at the other. What if the neutron was bent into a horseshoe and its ends joined together? We know how electrons and positrons mutually attract; it is the same with their central gravitational string. Thus, if we join the ends, we obtain a vortex ring.

Since the active poles have been neutralised by the junction, a circular object has been created without poles, hence, it is neutral electrostatically and gravitationally. It is correct that a

neutron has a mass that is about the same as a proton, but it is only an inertial mass.

3.20 The Strong Force

A neutron is not a permanent particle; it lasts for approximately 13 minutes. Not being upheld by gravitational- and electrostatic-like forces and being buffeted by external disturbances, its ring breaks down, shooting down the electron and positron to become a normal proton with an electron at one pole, a positron at the other and its gravitational string at its axis. However, its electron extends rotationally into space with its positron doing the same. Since they feel the electrostatic attraction, they bend the proton and join ends to become the hydrogen atom. What happens when a single proton meets a single neutron? They cannot resist the attraction and they marry. This is due to the strong force, the Magnus effect. We can see that when two vortexes rotating in the opposite direction meet sideways, they repel each other. It is only if they move in the same direction that they, in accordance with the Magnus effect, attract one another. This is how the deuteron ${}^2_1\text{H}$ comes into existence.

3.21 Atoms and Their Inertial Masses

We concluded earlier that while a proton has an inertial mass as well as a gravitational mass, the neutron has only an inertial mass. Which mass is involved when a proton's speed is increased in an accelerating machine? This mass, we read in textbooks, is an inertial mass since in such environments, gravitational force should not be considered. So when we find such masses (the mass of a proton and a neutron), both are inertial masses. It is only at the supermarket when we buy 1 kg

of potatoes that they have a gravitational mass, since they are compared with another gravitational mass—the weight.

3.22 Nuclear Quanta

The vortex theory of nuclear quanta (based on the vortex theory of matter as described in Chapter 2.3) shows that $m = h/\Gamma$, where $h =$ Planck's constant. This has the meaning (in this book) of the angular momentum of a vortical or wave quantum, where $\Gamma = 2\pi r v =$ the vertical circulation, $r =$ the vortex radius and $v =$ angular velocity. An open vortex, as described before, has the polar area motion and the sideways rotational motion that can attract (or repel, depending on the direction of rotation) another similar vortex. A vortex's circulatory line can penetrate an intersecting vortex's line only as far as the centre because on the other side, the streamlines have reverse directions so repelling takes place.

3.23 Atomic Quanta

Atomic physics starts with a single hydrogen atom ${}^1_1\text{H}_1$. Structurally, it is a single proton which has its electron and proton bent sideways and they are joined by unidirectionally joining the polar streamlines. On joining, the energy I_1 evolves to the value of 13.598 eV; therefore to break the junction, we have to apply an external energy of the same quantity. This could be done by using a quant of energy of the same dimension, either by bombarding with another material particle or a wave that is radiation.

In Chapter 2.3, we considered the making of ${}^2_1\text{H}$ by adding a neutron to a proton by joining the two vortices together sideways. This time we have two atomic hydrogen atoms in neutralised circular forms, joined together like two rings

sideways. Now we arrive at the point where complications start: two-ring atoms of hydrogen, being vortices, do not last free for long. They join in twos forming hydrogen molecules $\frac{1}{2}\text{H}_2$, but how do they join, being mechanically ring vortices, each rotating about their circular axes? They can join proton to proton due to the Magnus effect attraction. They can also join by their electron–electron or electron–proton sides or there can be a flat join, ring over ring.

These are not new problems. As long ago as 1934, there were so many experimental results on these themes that a full volume was written.³⁶

3.24 Discernments in Physics

The acceptance of a physical law as a mathematical formula is the great fault of present day physics. The danger is that a physical phenomenon can be incorrectly perceived and described in an unsuitable mathematical equation with profoundly faulty consequences; an example is the current explanation of the direction of electromagnetic fields in electromagnetic hydrodynamics. The mathematical elaborations which followed this explanation led to the theory of relativity and the enormous technical terminology that is accepted today, all of which have a faulty, physical basic assumption. What about the other laws of physics? Are they really basic laws? Take such simple laws as the lift force, electromagnetic forces and even gravitation. Are they basic laws or are they just the outcome of more basic physical phenomenon? What can be asserted is that they are all derived from the Magnus effect, but we can consider the subject even deeper than that.

Using the laws of hydrodynamics, we can examine the situation where motion consists of slipping layers of viscous fluid (the so-called laminar or streamline flow) flowing in a

straight line in the same direction; the flows attract one another, but when they move in the opposite direction, they repel. The effects are the momentum of portions of the fluid. Flowing in the same direction, the momentum of the streamlines approach one another due to the lower viscosity between them than on their outer sides and the motional momentum is unidirectional. What about streamlines bent into rings, that is, vortices facing one another? When their circular velocity has the same direction, they approach, but when their circular velocity is in the opposite direction, they repel.

In permanent magnets, there are electron vortices that extend into the source ('magnetic bubbles') and whether they attract or repel depends only on their directionality.

In gravitational strings, the protonic rotation produces polar vortices. When strings rotating in the same direction meet in space, their poles attract one another, but when they meet those rotating in the opposite direction, they avoid each other until they meet a string rotating with the same polar direction.⁷

3.25 How Novae and Supernovae Explode

If we place a large rotating cylinder in water or air and place a similar rotating cylinder parallel to it, we notice that the cylinders will attract one another if their relative rotation is reversed, but they repel each other when the rotation has the same direction; this is the Magnus effect. However, we have to consider the fluid between the rotating cylinders. Cylinders rotating in the reverse direction push the fluid between them in the same direction and the closer they come to one another, the faster the flow of fluid flowing in the same direction; the smaller the resistance against their rotation, the greater the pressure between them will decrease with the approaching distance. On the opposite side though, the viscosity of the fluid will decrease

the speed of rotation and this will push the cylinders closer together, therefore the Magnus effect brings cylinders toward one another. If the cylinders rotate in the same direction, they will push the fluid between them in the reverse direction and produce a repelling force against one another, but there is also another side of this effect. Suppose that there is only one rotating cylinder in the fluid, but parallel to the rotation of the cylinder there is a flow of fluid. This flow will have the same direction of rotation like the cylinder; on the other side, the direction will be opposite. This results in the attraction of the cylinder towards the side where it will have the same relative direction as the flow of the fluid and repulsion on the other side. This is the Kutta–Joukowski force (the lift force).

There are cases where the vortices of a fluid, once started, rotate in the fluid indefinitely. In water, they do not last long since the viscosity of water is quite high, but air viscosity is very much lower and this explains the Earth's disaster-producing tornadoes. What about vacuum? It has a much lower viscosity and so it brings about much bigger disasters; novae and supernovae. The mechanics of such things are a bit different in various cases, so let us start from the beginning.

By using cylinders rotating in water, we saw how they interacted with each other and the fluid they were in. Now we will look at more exotic creations, such as electrons and galaxies.

To begin, we will consider electrons in atomic hydrogen. We saw in the previous chapter that what we call an electron and a positron extend from the poles of the proton and eventually bend, stick together and make a vortex ring. The mass (inertial) and speed of rotation of the proton is immensely higher than that of an electron; they have proportionally very different vorticities Γ , velocities and length of radii. The radius of the electron in a hydrogen atom is of the atomic size and the proton of the nuclear size; the dimensions differ by the thousands,

but since their poles are all joined electrically, the vortex ring of the hydrogen atom is fairly neutral externally, but only up to a point. We saw in Chapter 2.3 that they interact to form ${}^1_1\text{H}^2$. This happens when two ring vortices approach one another sideways, with their electron sides rotating in opposite directions. They attract one another and form ${}^1_1\text{H}^2$. If they approach so that their electron sides are rotating (relative to their protons) in the same direction, they will repel one another.

We come back to the two hydrogen atoms and their vortical construction. We saw that when the polar electron ends of the proton bend and join to form a closed vortex ring, they have an enormous atomic size when we compare it with the size of proton. Now, the interaction of the sideways approaching vortical streamlines have the same direction of rotation relative to one another and so they come closer and closer until the streamlines of the rotating vortices interpenetrate. The interpenetration goes only to the centre of both vortices and no further because on the other side, the centres of the vortical streamlines flow in the opposite direction; they just come to their centres and stop and we get ${}^1_1\text{H}^2$. However, what about galaxies? Like our Milky Way, galaxies are vortices and when they approach, two galaxies sideways, we get a disaster. A supernova!

The dimensions and properties of the vortices of an atom of ${}^1_1\text{H}^2$ and that of a galaxy are vastly different, but they are both vortices. Atomic vortices have a very strong structure and a very high rotational velocity in a vacuum. This cannot be said about galaxies; they are very clumsy. Take the linear speed of stars and dark matter, for example. They travel at hundreds of km/sec (hydrogen atoms move at $18.39 \cdot 10^4$ cm/sec), but their rotational speeds are much higher as they are tied to the much higher masses of protons and their structures are very strong. However, galaxies have their dimensions measured by using light years and they are composed of items such as stars and

dark matter, that is, cold material (about -273°C) with various directions of motion.

3.26 Explosions

Now we return to how two vortices approach one another right up to the point when their streamline flows come closer and then they interpenetrate. However, we now come to a significant point: the centre of the galaxies can form double galaxies like the atom molecule of ${}^1_1\text{H}^2$. There are astronomical indications that such galaxies do exist; there are also clusters of stars and galaxies, but this is when their approach is quiet and peaceful. This is not always the case. What about galaxies and super galaxies flying at very high speeds? What about when one such galaxy of heavy mass and speed interpenetrates the other near its centre? The relative speed of the vortex streamlines will be the opposite, relative to one another, with all their stars and other matter banging into one another. Is this a supernova? The stars, like our sun, are also vortices. Can they collide? There are both double stars and star clusters, there are also novae which are not always 'big bangs'.

3.27 Electrons as Vortices

All fundamental particles of matter are vortices and they spin like vortices. Having mechanically-active rotating poles, they interact with one another and other hydrodynamical motions. An electron, as a free individual vortex in a vacuum, can be compared to a tornado moving through the desert, but there are differences. When an electron is attached to a proton, it forms a vortex ring which we call the hydrogen atom, but by the application of strong radiation or interaction with other atoms, the electron can be prevented from forming a ring.

Instead, it will form either a free vortex in space or become attached sideways to another atom. In the latter case, the vortex is open with its polar active rotational area free to interact statically with a positive ion or anode electrode; this is the polar interaction due to the polar motion to its attractor. A free vortex can also move sideways in the manner of a tornado over the surface of the Earth. So now the vortex has three kinds of motion: polarwise, sideways or rotationally around its axis.

All these types of motion are well-known from hydrodynamics; we know that when a tornado moves over the Earth's surface, its sideways axial motion is equal to the velocity of its vortical rotation. If we apply this knowledge to electrons, we can find their vorticity. This has been found from experiments on the superfluid turbulence of helium.⁸

Helium atoms travel around the vortex at a low speed, then each atom's tangential velocity is equal to Planck's constant h divided by a mass of the atom divided by 2π , as shown in the following equation

$$v = \frac{h}{rm2\pi'} \quad (3.35)$$

where $h = 6.626 \cdot 10^{-27}$ and $m = 9.1095 \cdot 10^{-28}$, therefore

$$2\pi rv = \Gamma = \frac{h}{m} = \frac{6.626 \cdot 10^{-27}}{9.10956 \cdot 10^{-28}} = 7.274. \quad (3.36)$$

The vorticity of a particle $\Gamma = h/m$, this being the foundation of the vortex theory. The vorticity of electrons $\Gamma = 7.274$ at the present is known as 'the quantum of circulation' h/m .

3.28 The Radius of a Vortex

While accepting that $\Gamma = h/m = 2\pi rv$, we have assumed that the velocity at the creation of the vortex is the velocity of light,

since energy $E = mc^2$. Therefore

$$\Gamma = \frac{h}{m} = 2\pi r v = 7.274. \quad (3.37)$$

So at this point we can calculate the value of r at the velocity c using the following equation

$$r = \frac{\Gamma}{2\pi c} = \frac{7.274}{2\pi \cdot 2.9979 \cdot 10^{10}} = 3.8617 \cdot 10^{-11} \text{ cm}. \quad (3.38)$$

We have calculated the radius of the electron when it was created, and having its rotation velocity $v = c$, then what about its radius when the electron is a part of a hydrogen atom at the temperature, of say, 0°C ?

As we saw on the hydrodynamical model of a tornado, the velocity of the rotation of the vortex is equal to its axial linear motion on the surface. The hydrogen atom has its electron joined twice polarly to the hydrogen ion ${}^1_1\text{H}_1^+$. The linear motion of ${}^1_1\text{H}_2$, the hydrogen molecule through space, can be seen in the following equation

$$v = 1.839 \cdot 10^5 \text{ cm/sec}. \quad (3.39)$$

Without going into further detail, we can assume that this is the velocity of the rotation of the hydrogen atom's electron at this axial speed. We know from hydrodynamics that $\Gamma = \text{constant} = 7.274 = 2\pi r v$, therefore

$$\begin{aligned} r &= \frac{\Gamma}{2\pi v} \\ &= \frac{7.274}{2\pi \cdot 1.839 \cdot 10^5} \\ &= 6.295 \cdot 10^{-6} \text{ cm} \\ &= 629.5 \text{ angstroms}. \end{aligned} \quad (3.40)$$

This is sufficient until the other details are worked out.

3.29 Electrons in Technology

Static electricity is caused by the electron vortex poles extending from electrified bodies into the surrounding space. This is achieved by the mutual rubbing of suitable materials. The outer electrons from the electron–proton vortex rings are broken mechanically. As shown in Figure 3.1, due to specific atomic structures, some materials catch single free electrons, while others lose them, exposing the proton–electron vortex poles (the positive charges). The attraction of the positive and negative ends of the vortices is due to the Magnus effect and depends on the direction of rotation of the approaching vortical poles, as shown in Figure 3.1(b) and (c). In an electrolysing vessel, the negative plate (or cathode) extends to the front pole of the electron’s vortex and the positive plate (or anode) extends to the rear end of the positive ions. Thus, taking the direction of the linear motion of the electrons in the conductor, the negative pole rotates to the left and the positive ionic poles to the right. Since the rotating areas of the electron vortex poles of positive and negative between themselves have the same direction of rotation, then in accordance with the Magnus effect, they mutually attract one another.

The electrostatic field E in dimensional analysis is

$$E = \frac{F}{2} \equiv \frac{ML}{T^2} \quad (3.41)$$

and

$$\frac{F}{l^2} \equiv \frac{M}{LT} = \text{elasticity}. \quad (3.42)$$

The interaction of the charges we can explain with the laws of elasticity of springs. The spring in this case is the elasticity of the vacuum between the poles of the vortices. With an increase in velocity, the viscosity of the vacuum increases. At

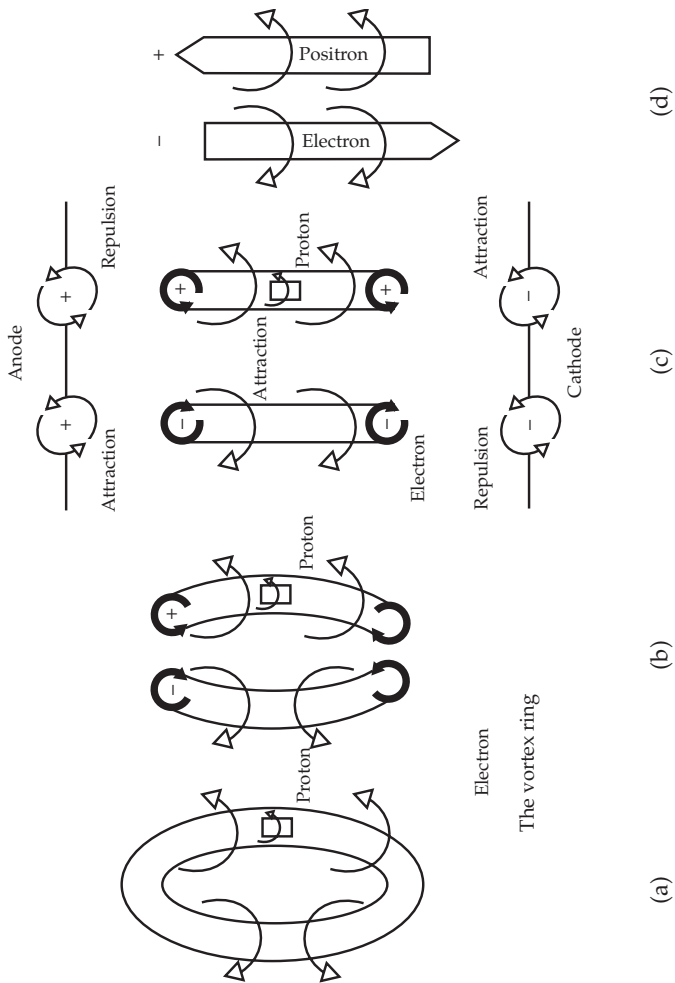


Figure 3.1
 The ionization of the hydrogen atom.
 (a) The hydrogen atom as a vortex ring. (b) The ionised hydrogen atom. (c) The ionised hydrogen atom interacting with an electrostatic field. (d) Free electrons interacting in space.

the velocity of light, when $v = c$, the vacuum behaves like a solid and this is how light waves are propagated. At 1 eV of energy, the electron moves at $v = 5.93 \cdot 10^{10}$ cm/sec, while the velocity of light waves $2.997 \cdot 10^{10}$ cm/sec.

3.30 What is a Positron?

Inside a semiconductor crystal, electrons and positrons float and their interactions produce radiation. For electrons to make a transition from being a valence electron to being a conduction electron, energy must be added.³⁷

An electron, in the conduction state in a semiconductor, is a mobile particle free to wander through the crystal, but it differs from a free electron in a vacuum. When placed in germanium, its mass is about a tenth as great. Since $m = h/\Gamma$ and h is constant, this means that $\Gamma = 2\pi r v$ becomes larger.

In plasma, the velocity of its motion is smaller than the velocity of light, so it can be assumed that r must be larger in a vacuum. Hence, electrons in plasma have a smaller mass. As described in Chapter 3.29, the vortex moving through space in a sideways direction, has a linear velocity equal to the velocity of its vortical rotation. When an electron is excited to the conduction state, it leaves behind a vacancy in a valence state—a hole. The hole has a positive charge and like the excited electron, it can migrate through the crystal. The hole moves by the reshuffling of electrons in a valence state; each time an electron from an adjacent atom fills the hole, a new hole is created in that atom. In almost all its properties, the hole behaves like a positively-charged electron.

When electrons and holes are created in pairs, their number in a crystal is exactly the same. It is the collective attraction between the electrons and the holes that binds the medium together. The electron-hole medium was first observed in 1966

by J. Richard Haynes of Bell Telephone Laboratories in the USA. This fluid-like medium exists only inside a solid semiconductor and it cannot be extracted from that environment.

Vortices extend in the direction of their flow. When they approach front-on, they give off radiation. The same could be happening inside electric wire conductors, only we cannot see it. If it were not so, then how could an electric current start when we press the switch?

In a semiconductor, crystal electrons and positrons behave like a liquid. This exists only in solid semiconductors. A positron–electron–electron pair can be created by supplying an electron with energy equivalent to twice its mass, that is, $2mc^2$, which is equivalent to 1.02 MeV. When the pair is annihilated, it emits the same energy as a photon. The laboratory source is the nuclide sodium-22 emitting positrons of maximum energy of 0.54 MeV.²⁴

A positronium atom is the combination of a positron and electron, and has been observed in certain nebulae. Its binding energy is 6.77 eV, half that of the electron in a hydrogen atom.

The spins of vortices are parallel for the orthopositronium; it is formed three times as frequently as the parapositronium, which is very unstable. Their existence is calculated in nanoseconds: 1 nanosecond = 1 nsec = 10^{-9} sec.

Positronium atoms lose their energy before annihilation in a manner that is not yet understood. Positrons that do not form positroniums will react with the medium. To visualise the entities which exist on the limits of matter, we have to make models. Taking a pen with its writing end pointing up, on the side of it draw an arrow from left to right. This will depict the rotation of the positron. Next, turn the writing end down into the writing position and observe that the arrow now points from right to left; this is the direction of the rotation of the electron as shown in Figure 3.1(d). In Figure 3.1(b), the

electron has been removed from the hydrogen positive ion and the arrow indicates the direction of their vortical rotation. We can compare the hydrogen ion to the positron in Figure 3.1(d). The ionization of the hydrogen atom looks like the ionization of positronium, but it is not so.

To ionize ${}^1_1\text{H}^1$, we have to use 13.598 eV, while to divide the positronium, we need only 6.799 eV; this is exactly half of the previously quoted energy. Look again at Figure 3.1(b) and (d) and try to locate them so that they will adhere to one another, joining only by one end, not by two. This can be accomplished only if we put both pens, as shown in Figure 3.1(d), one on top of the other and both with their writing ends down.

Referring to Chapter 3.30, we can see that it is so. There are methods to determine the work that must be added to a system to remove an electron thermally. This thermionic work function is an effective potential jump through which the electron passes as it leaves the surface, as shown in Figure 3.1(c). The thermionic work function for a clean, outgassed platinum surface has been very carefully determined by the two methods discovered by L. A. Du Bridge and found to be 6.27 volts, which confirms the above.

3.31 Quarks Do Not Exist

Elementary particles are the building blocks of matter, but we should not invent something that does not exist. The material particles are only those that can be investigated experimentally. Quarks cannot be probed in this way. The most basic problem is the failure to detect a free quark.^{38,39} The essential point in this matter is not to mix the matter and the forces influencing the effects, and this is what happened in the case of quarks.

When we consider protons, we know that sometimes they repel one another and at other times they attract. They cannot

repel in the atomic nuclei since these are stable, but sometimes they repel and do it strongly, hence the unstable elements.

Nuclear particles are subject to the force which could not be accepted if they are not considered as having the nature of vortices ruled by the universal force, the Magnus effect. The application of this force in atomic and nuclear physics has been widely elaborated on in earlier chapters.

In nuclear physics, the Magnus effect is known as the strong force, but the weak force acts on the same principle; the difference is only in the distance between the centre of action—the length of the vortex radii.

All particles that are subject to the strong force are called hadrons, from the Greek *hadros*, meaning robust or heavily built. In 1962, Murray Gell-Mann of California University and Youval Ne'eman of Tel-Aviv University proposed a scheme for classifying the hadrons in symmetrical patterns, without considering that they were dealing with vortices and not billiard balls. This reminds us how Oersted in 1819 discovered that a magnetic needle is deflected at right angles to a wire carrying an electric current. This is still considered as the direction of the magnetic field, but electromagnetic-hydrodynamics asserts that it is parallel to the length of the conductor.

The introduced classification of quarks is quite involved. The quarks' 'flavours' distinguish them into four basic kinds and introduces such terms as 'colour' and 'charm', but the relative positioning of the hadrons and their other physical properties link their vorticities.

3.32 More About Quarks

Nobody has been successful in producing unambiguous evidence of the existence of quarks (free quarks that have not been 'locked' into hadrons) as this cannot be done. What is involved

in hadrons is the Magnus effect which works on either side like between protons and neutrons in helium atoms—alpha-particles. The alpha-particle ${}^4_2\text{He}_1$ is so strongly bound, not only sideways by all hadrons together, but also polar-wise by electrons; it is simply the strongest 'fortress' in nuclear physics. It will take physicists some time to explain all its mysteries.

Being so strongly built, alpha-particles semi-independently fill up the nuclear alpha-rings like in inert gases, such as neon and argon. The only problem that remains is how it is that in nuclei like magnesium and aluminium, the alpha-particles become broken or protons or combined protons and neutrons just enter the ring from space like 'intruders'. This is another problem to solve.

Table 3.1.5
The comparison of isotopes (thulium to radon).

Z n	69 Tm	70 Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
17										173								
18										174								
19										175								
20										176								
21										177								
22										178								
23										179								
24										180								
25										181								
26		166								182								
27		167		171						183								
28	166	168	170	172		176				184								
29	167	169	171	173		177				185								
30	168	170	172	174	176	178	180	182		186	188	190						
31	169	171	173	175	177	179	181	183		187	189	191				199		
32	170	172	174	176	178	180	182	184		188		192			198	200		
33	171	173	175	177	179	181	183	185	187	189	191	193	195	197	199	201	203	
34	172	174	176	178	180	182	184	186	188	190	192	194	196	198	200	202	204	206
35		175	177	179	181	183	185	187	189	191	193	195	197	199	201	203	205	207
36	174	176	178	180	182	184	186	188	190	192	194	196	198	200	202	204	206	208
37		177	179	181	183	185	187	189	191	193	195	197	199	201	203	205	207	209
38					184	186	188	190	192	194	196	198	200	202	204	206	208	210
39					185	187	189	191	193	195	197	199	201	203	205	207	209	211
40					186	188	190	192	194	196	198	200	202	204	206	208	210	212
41							191	193	195	197	199	201	203	205	207	209	211	
42								194	196	198	200	202	204	206	208	210	212	214
43									197	199	201	203	205	207	209	211	213	215
44									198			204	206	208	210	212	214	216
45												205	207	209	211	213	215	217
46													208	210	212	214	216	218
47													209	211	213	215	217	219
48													210	212	214	216	218	220
50																217	219	221
51														214		218		222

Table 3.1.6
The comparison of isotopes (francium to rutherfordium).

Z \ n	87 Fr	88 Ra	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	104 Rf
34	208																	
35	209																	
36	210																	
37	211	213																
38	212	214																
39	213	215																
40	214	216																
41	215	217																
42																		
43	217	219																
44	218	220	222	224	226	228	230	232										
45	219	221	223	225	227	229	231	233										
46	220	222	224	226	228	230	232	234		238		242						
47	221	223	225	227	229	231	233	235	237	239						251		
48	222	224	226	228	230	232	234	236	238	240		244	246	248		252		
50	223	225	227	229	231	233	235	237	239	241	243	245	247	249		253	256	
51	224	226	228	230	232	234	236	238	240	242	244	246	248	250		254	257	
52	225	227	229	231	233	235	237	239	241	243	245	247	249	251		255		260
53	226	228	230	232	234	236	238	240	242	244	246	248	250	252		256		
54	227	229	231	233	235	237	239	241	243	245		249	251	253	255	257		
55	228	230		234	236	238	240	242	244	246		250	252	254	256			
56		231		235	237	239	241	243	245	247	249	251	253	255	257			
57	230					240		244	246	248	250	252	254	256				
58								245	247	249		253	255	257				
59								246		250		254	256					

CHAPTER 4

The Structures of Atomic Nuclei

4.1 The Atomic Nucleus

To create a model of an atomic nucleus we have to use models of their components whose physical properties have been found in ways other than to make them visible. At present, imaginary models of atomic nuclei that are assumed to be similar to the solar system fail in their efforts because:

1. they do not give any explanation as to the physical beginning of the nuclear components;
2. there is no reasonable physical way to explain the process of interaction between these components, nor how these forces started to operate.

In both cases, a dogmatic statement saying that it is so is not sufficient for a physicist because it does not answer the questions of how and why; to answer these questions is the sole purpose of physics. Any theory which does not try to answer

them rationally is a myth. The alpha-shell model tries to answer the questions of how atomic nuclei were created and also why and how nuclear components interact as they do.

4.2 Nuclear Components and Structures

An atomic nucleus is composed of a number of protons Z , plus a number of neutrons n . The total number of components is

$$A = Z + n, \quad (4.1)$$

where A = the mass number and is expressed in atomic mass units and where oxygen-16 has 16 units.

Various models exist that depict the structure of a nucleus. The best is the alpha-particle model and the nuclear shell model, but neither of these models answer the questions mentioned earlier. The alpha-particle model visualises alpha-particles interspersed with neutrons and formed into concentric double-shells as shown in Figure 4.1.2.

When the outer shell is full, we get chemically-inert element structures, like neon and argon; all other chemically-active elements have chemical valencies numerically equal to the number of protons in the outermost shell—the protons that are not components of the whole alpha-particle. The number of neutrons that are not part of the alpha-particle or delta-particle (the proton–neutron nuclide) determine the isotope we are dealing with. These isotopes, as shown in Tables 3.1.1–3.1.6 and 4.1.1–4.1.28 form the neutron n series (see Chapter 4.9).

The nuclear structure of sodium-23 can be ascertained by consulting Tables 3.1.1 and 4.1.2, and Figure 4.1.2. Table 4.1.2 shows that its structure consists of one alpha-particle at the centre with one neutron, a neon shell composed of four alpha-particles and one delta-particle in a shell of argon. While

The formation of the atomic nucleus

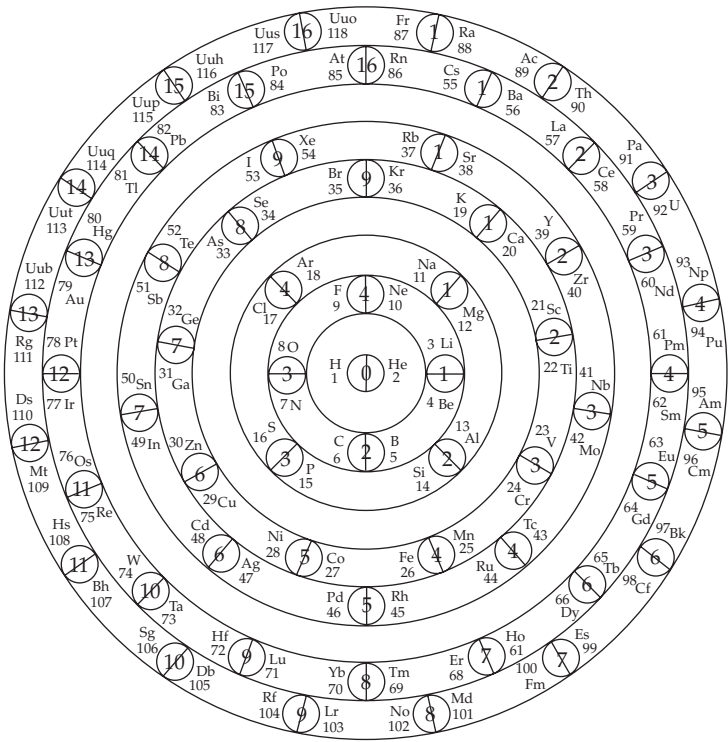


Figure 4.1.2

The vortex has stagnated and the alpha-particles form shells.

4.3 Nuclear Spin

Due to the faulty assumptions of the planetary-like model of atomic structure, conventionally-used formulas of atomic spin are very misleading. In some cases, the data is acceptable, but the calculations often involve 'orbital spin' as explained in Chapter 2.2. To understand the real meaning of orbital spin,

The formation of the atomic nucleus

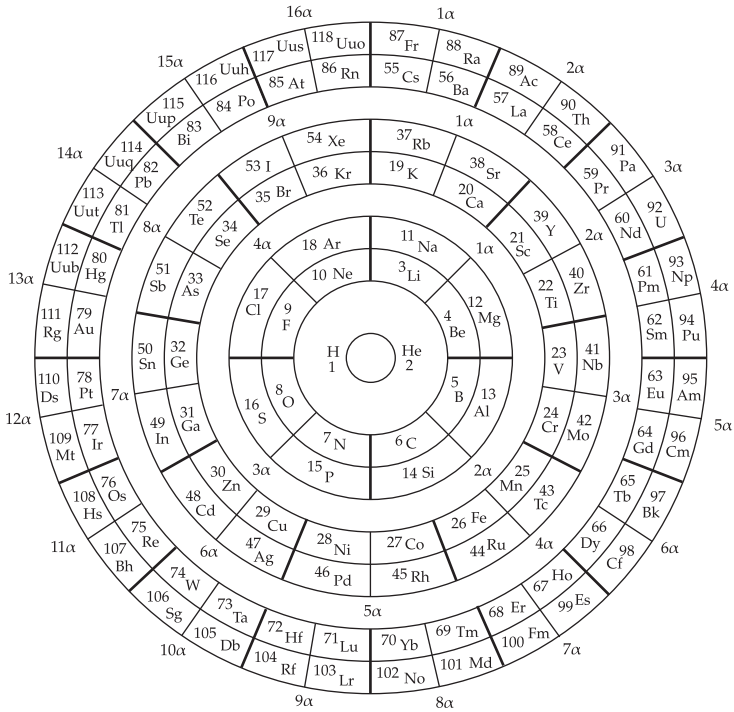


Figure 4.1.3

The formation of the outer shell by the outside bombardment of alpha-particles, protons, neutrons and deuterons to form the chemically active atom.

we can use the macro model—cloud chamber spirals of ions moving in a magnetic field.

Simple elementary particles like electrons behave in a magnetic field in a well-known manner, like in a television tube or the tube of an oscilloscope. This can be explained in Magnus effect terms. When an electron is attached to an atom, that

is, as ions in a cloud chamber, then it is not only the electron that moves through space, but also the central mass of its atom. This is the additional component of the velocity that has to be added and which is known as the orbital velocity of an electron moving around an atomic nucleus.^{8,13,14,17,18,40,41} The electron's velocity is the same as in hydrodynamical vortex mechanics and is shown in Figure 1.1(d). So after all these meanderings, we look at the matter anew and avoid borrowing from old terminology (see Chapter 3.27).

In general, we accept that all elementary particles have the vortical shape of solid cylinders. The moment of inertia I of a solid cylinder of radius r and mass m is

$$I = \frac{1}{2}mr^2. \quad (4.2)$$

When such a cylinder spins with the rotational velocity $\omega = v/r$, then it has the angular momentum

$$h = \frac{1}{2}mr^2 \cdot \omega = \frac{1}{2}mr^2 \cdot \frac{v}{r} = \frac{1}{2}mrv. \quad (4.3)$$

In the vortex theory

$$h = \Gamma \cdot m = 2\pi rv \cdot m, \quad (4.4)$$

therefore

$$\frac{h}{2\pi} = rvm, \quad (4.5)$$

where $h =$ Planck's constant.

In the old terminology, we often meet with the term $h/2\pi$ and here we see it in the terms of vortex mechanics. What we have to elaborate on now is the direction of rotation of the elementary particles.¹⁴ This is fundamental in order to understand their structure, behaviour in magnetic and electric fields, and most importantly, their interactions.^{13,18} So the

axiom is that the cylindrical permanent magnet's north-seeking pole and an electron vortex have the same direction of magnetic field rotation around their axes. The direction is the left-handed screw, and when the model is held in the left hand, the direction of rotational velocity is indicated by the fingers on the left hand. The positron and proton have the reverse direction of circulation as shown in Figure 1.1(c) and (d). If we specify that the permanent magnet's north-seeking pole has a negative direction, then the proton and the positron's field direction is marked as positive. This also relates to the sign of the particle's electric charge (see Chapter 1.7).

These are the basic directionalities of vortices (and particles). It relates to magnetic fields, electromagnetic fields and interacting vortices (see Chapters 3.5 and 3.6).

4.4 The Hydrogen Atom's Structure

An atom has a structure of the two kinds of vortices; the electron is the simplest and the lightest having the vorticity $\Gamma = 2\pi r v$ and $h = \Gamma_e m_e$. The proton in the hydrogen atom nucleus has a composed structure as described in Chapter 3.3. The problem now is how the electron and the proton are combined. Since they have an opposite direction of rotation when combined, they must form a vortex ring in which they are joined polar-wise, meaning that the positive end of the electron joins the negative end of the proton and vice versa.

4.5 Proton–Neutron Combinations and Spin

Before we finish explaining the theory of nuclear vortices, we once more come to their combinations, but now it is the combination of nucleons—the open proton vortex with the closed neutron ring.

Let us imagine the figure ten: let the digit one (1) represent the proton, and zero (0) represent the neutron. When they come into contact with one another, then they will both have vortical rotations in the opposite direction producing a mutual attraction; if the rotation is in the same direction, they will repel one another. Again, we have to remember the two-solenoid idea described earlier—one straight and the other bent into a circle.

In the structure of the helium-4 nucleus, the alpha-particle is more difficult to describe, but in this case, the vortices at each contact rotate in the opposite direction. First, there are two protons rotating in the opposite direction so they attract one another. Then, on one side of the joint and on another, there are the two neutron rings, with each of the neutrons touching both protons with one limb of the circle at the same time. If we draw this combination in a cross-section, we shall find these four circles rotating according to vortex rules.

There remains now only the helium-3 nucleus. We take two open proton vortices rotating in the same direction and insert between them one limb of the neutron ring getting the correct direction of rotation. Such combinations happen only in very exceptional circumstances, so helium-3 is a very rare isotope.

In vortex terminology, we call this circular motion of vortices 'rotation', while in atomic physics this is called 'spin'.

Checking the spin of the above isotopes we see that ${}^2_1\text{H}$ has spin = 1; therefore when two vortices rotate in the opposite direction their spin = 1. Also, since the spin of two vortices having the opposite rotation = 1, then each vortex has spin = 1/2.

The nucleus of ${}^3_2\text{He}$ has spin = 1/2; that is, two protons rotating in the same direction have spin = 1 and the neutron rotating in the opposite direction (the limb) has spin = -1/2, therefore ${}^3_2\text{He}$ spin = 1/2; the same for ${}^3_1\text{H}$ spin = 1/2. In this way we can determine the direction of the rotation of other nucleons in an atomic nucleus and find the rotation of the

required nuclides and their mutual placements. However, this is not a simple matter and it will not be as easy as it seems to proceed further.

4.6 The Alpha-Shell Nuclear Model

This model does not make any dogmatic assertions, but only logical deductions from the properties of the components involved as shown in Figures 4.1.1–4.1.3. Neon gas has a nucleus that is made up of one central alpha-particle surrounded by four alpha-particles to form the neon shell. Geometrically, it is well-known that six equal coins can be placed around a central coin when each one touches its neighbours, so when we find that only four particles surround the central one, we see that there are spaces left between each component; this is where interspacing neutrons enter (when available) to serve as additional strengthening in the shell. The proof of this we shall find in the structure of such elements as mercury and lead. The question is why the isotopes become radioactive when they reach a certain maximum number of components.

4.7 The Unfulfilled Alchemists' Dreams

Since the fusion of the heavy parts of nuclei have not been successful, even in controlled laboratory conditions, we cannot expect that such reactions can take place in the turbulent environment of stars' interiors—stars similar to our sun. The fusion reactions undertaken in laboratories are normally limited to the addition of small nuclides. It is the fission reaction that predominates in nuclear research and industries; this is because, in general, it is easier to break something than to join it.

The efforts to produce new extra-heavy elements like nobelium (atomic number 102) by the bombardment of curi-

um-244 with carbon-12 and carbon-13 was an effort comparable with climbing Mount Everest; it is praiseworthy to find the physical condition of such events, but not as a product itself. The difficulties encountered in such reactions is obvious from the magnitude of the energies involved. Colliding heavy masses produce the disintegration of both colliding parts. Also, it is difficult to imagine that atomic nuclei, being so selective in their interaction with the bombarding particles, would not have some particular kind of internal structure.

The nuclides evolved during the disintegration of nuclei and can be recognised as being arranged in some internal order before the decay event. Such order can be found from the knowledge of the particular chemical element.

We now come to the question: can it be that the nuclei of chemically-inert elements are composed of alpha-particles arranged in some sort of order? There are plenty of indications that they are and we shall be considering such arrangements.

4.8 The Mathematical Series for Inert Gases

It has been known for years that if we consider the atomic numbers of the inert elements, then we can fit these numbers Z into the following series:⁴²

Element	Z	The series
He	2	$= 2 \cdot (1^2)$
Ne	10	$= 2 \cdot (1^2 + 2^2)$
Ar	18	$= 2 \cdot (1^2 + 2^2 + 2^2)$
Kr	36	$= 2 \cdot (1^2 + 2^2 + 2^2 + 3^2)$
Xe	54	$= 2 \cdot (1^2 + 2^2 + 2^2 + 3^2 + 3^2)$
Rn	86	$= 2 \cdot (1^2 + 2^2 + 2^2 + 3^2 + 3^2 + 4^2)$
?	118	$= 2 \cdot (1^2 + 2^2 + 2^2 + 3^2 + 3^2 + 4^2 + 4^2)$

The axioms are that:

1. in the series, each term in brackets represents the number of alpha-particles in successive nuclear shells of inert elements;
2. if some of the alpha-particles in the outer shell are missing, then the required number is split into delta particles to occupy all the existing locations in the shell;
3. the earlier (hypothetical) stage of the alpha-shell model, as shown in Figure 4.1.1, could be the primordial spiral vortex of the alpha-particles that settles down into shells at each successive stage of existence.

The above axioms try to uncover Nature's code of how matter was created, although so far we do not have any proof that it was so.

Spiral and elliptical nebulae also cannot be observed at their creation and transformation, but it is known that generally, spiral nebulae more often contain young blue stars—the creators of matter—while elliptical nebulae have more old red stars and their interstellar space is swept clean of dust and gases.

In Chapter 3.14 we have the experimental results which eventually will help us to obtain a better picture of the universe.

4.9 The Post-Natal Activities of Atomic Nuclei

How are atomic nuclei created in stellar interiors? We can only make some guesses derived from the hydrodynamical activities of double-vortex trails.¹⁰ When we deal with atoms, it is long after the turmoil of their birth and subsequent structural rearrangements. Only a part of those that now exist are stable isotopes, while others break down sooner or later. What we are interested in is how all isotopes are constructed and how these

structures influence their properties. These problems are very important for us, both theoretically and practically.

Unstable nuclei have very limited ways of breaking down and these are being studied extensively. The kind of radioactivities being performed are:

1. the ejection of alpha-particles, protons and/or neutrons
2. the ejection of positrons or electrons
3. the radiation of energy by gamma-rays
4. fission of nuclei into large fractions, accompanied by the above radiations.

While the radiated nuclides provide us with knowledge of the structural parts of atomic nuclei, the ejected electrons—the β^+ and β^- radiations—show the energy states of the nuclei.

The structure of an atomic nucleus can be found from structurally 'ideal' nuclei, such as xenon-136, neon-20 and argon-36. A catalogue of all nuclear structural particulars is shown in Tables 4.1.1–4.1.28. It is not a complete catalogue and it can be extended in any direction as this knowledge is widening. It portrays the internal structures of all isotopes that are currently known or whose existence is considered to be theoretically possible, with shading to indicate their radioactivity.

Referring to Table 4.1.1, the top row shows the chemical element and its atomic (proton) number, indicated by Z . Each element has two squares: one shows the isotope's mass number, indicated by A , and the other shows the particular shell of the isotope, indicated by 1–7. The shells and their corresponding numbers are shown below:

Column	1	2	3	4	5	6	7
Shell	He	Ne	Ar	Kr	Xe	Rn	118

On the left side of the table, the neutron series number, indicated by n , shows the number of extra neutrons in the isotopes (as per Tables 3.1.1–3.1.6). Each isotope has its own square divided into three rows:

- n row: showing the number of free neutrons (interspersals) in the particular shell
- δ row: showing the number of proton–neutron pairs which indicates how the chemical valencies can be found
- α row: showing the number of whole alpha-particles in each shell.

In each square, when we add the number of alpha-particles multiplied by four plus the number of deuteron-particles multiplied by two plus the number of neutrons, this equals the mass number of isotope A ; this serves as a check of our calculations. Therefore, $A = 4 \cdot \alpha + 2 \cdot \delta + n$, where n is the number of free neutrons in each shell. The total number of the neutrons not involved in other nuclides marks the number of the neutron series, that is, the total number of such neutrons for the particular isotope.

Using Table 4.1.12, we will examine isotope xenon-136. Looking at Shell 1 (helium) we notice that it has one alpha-particle and two neutrons; Shell 2 (neon) has four alpha-particles and four neutrons; Shell 3 (argon) contains another four alpha-particles and four neutrons; Shell 4 (krypton) has nine alpha-particles and nine neutrons, and the same amount in its outer shell (xenon). The delta row is empty because xenon contains whole alpha-particles and no delta-particles; this is why it is chemically inert. It is one of the ideal isotopes (and one of the last in the heavy elements) because it contains an exact number of appropriate nuclides according to nuclear

laws. All its shells are filled with a full number of alpha-particles, separated and affixed by interspacing neutrons. In contrast, xenon-137 and xenon-135 are unstable isotopes; the former is unstable because it has more neutrons than places available in its outer shell, while the latter is due to the loss of one of its neutrons.

4.10 Alpha-Particle and Neutron Shells

During the period of high turbulence that follows the creation of elements, the outer shells of each isotope suffer more than the inner ones; their alpha-particles and neutrons are more likely to have 'evaporated' from their outer shells before their inner shells are affected. Xenon-136 can lose many of its neutrons in this way and the outcomes of this are isotopes xenon-134, xenon-132, xenon-131 and so on up to xenon-124. The latter is the lightest stable isotope of xenon.⁴³

There is also another problem that relates to the filling of the shells. In some isotopes, there is one neutron at the central alpha-particle marked as 'helium shell 1'. For example, referring to Table 4.1.8, it can be seen that krypton's first (lightest) isotope, krypton-78, only occurs when there are two neutrons and four neutrons in the centre of the neon shell. What are other stable combinations? Such questions can only be answered by good computers, directed by even better operators.

4.11 Broken Alpha-Particles in Outer Nuclear Shells

So far we have studied inert elements' structures; the full shells of alpha-particles. In practice, these elements play a very insignificant role since chemistry is mainly concerned with the rest of the existing elements.

The argon isotope is an ideal model as it has four alpha-particles in its outer shell. However, when it loses two alpha-particles, it becomes sulphur (a more useful substance than argon), and when it loses three alpha-particles, it becomes magnesium (a very reactive metal). So what is happening here?

Hypothetically, we assume that in such cases, the unreactive alpha-particles break into reactive entities called delta-particles. Each delta-particle in the outer shell of an atomic nucleus gives one chemical valency through its electron vortex that is attached by its bond ends to its proton in the nucleus, forming a structure similar to hydrogen-2—deuterium. Thus, while the proton vortex is attached sideways to the neighbouring nuclides in the shell, it is polarly attached by both ends to its electron. The electron, reaching into the outer spaces and beyond the nucleus, creates the atomic space of the element.

In a magnesium atom, the last remaining alpha-particle in the outer shell splits into two delta-particles, which extend their two electrons (of the argon shell) towards two protons; these two electrons give the reactivity (chemical and electro-chemical) to this element.

4.12 The Problems of Broken Shells

While the arrangements and the qualities of full shell elements are relatively simple to understand, the incomplete shell elements that constitute most of the existing elements are very complicated. This is due to the qualities imparted to them by the stability (and instability) of the isotopes and the fractional irregularities of the outer broken shells. To come to some sort of understanding of these problems, we have to treat each one of them on a one-at-a-time basis before we can start explaining the existence of chemical phenomena in light of the atomic nuclear structures.

What we notice right at the beginning is that the remaining alpha-particles in the shell form a chain of delta-particles. Magnesium has its qualities due to the two delta-particles with their electrons in the atomic space. When only one alpha-particle is missing, like in the case of sulphur, the remaining three alpha-particles split into six delta-particles and give it six, four or two chemical valencies; these are determined by the geometry and the energy levels of the interacting elements. Chlorine has seven, five, three or one valency; the last one is due to the cleft in the electron vortices surrounding the nucleus, where one electron can be accepted to fill the ring.

That the validity of the nuclear structure has an influencing effect on the chemical behaviour of an element is certain, only external causes can often be misleading as the following quotation will show:

[In Lanthanides] the tripositive state owes its general stability to a somewhat fortuitous combination of ionization and hydration energies rather than to any particular electronic configuration...⁴⁴

4.13 What is Wrong with Technetium?

Why is technetium so radioactive while its neighbours, molybdenum and ruthenium, are stable? It is a mystery; the mystery of the seventh element (as we may call it). Starting from the beginning of the shell, from rubidium, technetium is the seventh in the shell. In the next shell we have a similar case; promethium (counting from caesium) and neptunium, the seventh from francium. Manganese is situated similarly; it is the seventh from potassium and it is stable. This may have something to do with the splitting of alpha-particles in the shell, that is, when three and a half alpha-particles are left in the shell.

In the krypton shell there is room for nine alpha-particles and when seven deuteron-particles must replace them, some sort of a physical effect that we do not understand may be taking place. This is not a valid excuse; the physicist's duty and privilege is to find this out.

4.14 Energy, Mass and Gravitons

That energy and mass are interchangeable is the old truism and it does not need any magical interpretation. A neutron, finding itself in an extranuclear environment where its vortical streamline velocities are higher than the velocity of light, produces two electrons (e^+ and e^-) in the twisting motion against the vacuum at rest. The neutron has the inertial rotational mass of a closed rotating vortex ring, much like a match has the chemical energy to start combustion. Textbooks express the interchange of mass and energy as

$$E = c^2(m - m_0) \quad (4.6)$$

or in calculus notation as

$$dm = \frac{dE}{c^2}. \quad (4.7)$$

We can speculate for the present that electrons have only inertial mass and do not have any gravitational mass because they do not have neutrinos in their structure. It is the same as saying that infrared light will not produce interference with ultraviolet light because of the big difference in their wavelengths. Thence, neutrinos may only have gravitational mass (that we have no means to check at present) and no inertial mass. Gravitons, apparently, have a polar wave nature and are not vortical like electrons; polar waves cannot be described as being vortical waves although they are produced by vortices. This may sound rather complicated, but Nature has her own finesses.

An accelerated vortex can propagate two kinds of waves: lateral waves that are similar to visible light waves and polar waves that are propagated from their poles in axial directions.

An electron has too small a mass (0.511 MeV) and too large a radius ($3.8617 \cdot 10^{-11}$ cm) to produce polar waves when accelerated, although it may be able to do so when attached to a proton. It is different with a kernel (see Chapter 3.5) that has a mass of 832 MeV and a radius of $3.8617 \cdot 10^{-14}$ cm. The latter may have the property to produce gravitons, but laboratories do not have the facilities to polarise all nucleons in a piece of matter, which would be the prerequisite to produce gravitons.*

It is generally accepted that gravitational mass is equal to inertial mass (kinetic mass). This is because both these phenomena depend on the same factor: the viscosity of the vacuum space surrounding the material vortices moving relative to this space with a high velocity.

4.15 Mass Defect: The Nuclear Binding Energy

For all non-radioactive isotopes, the mass of an atom is less than the mass of its constituent parts.⁴⁵ We calculate mass in grams (gm), in atomic mass units (amu), or in millions of electron volts (MeV), therefore

$$1 \text{ amu} = 931.2 \text{ MeV} = 1.66 \cdot 10^{-24} \text{ gm.} \quad (4.8)$$

When Z = the number of protons, n = the number of neutrons and A = the mass number of the isotope, then the mass defect MD is the same as the binding energy E_B

$$MD = E_B = Z \cdot m_p + n \cdot m_n - m_A, \quad (4.9)$$

where m_A = the mass of the isotope.

*The author spent a whole year on it with a negative result.

To calculate the MD of neon-21 (${}^{21}_{10}\text{Ne}$), we write

$$\begin{array}{r}
 10 \cdot 1.008145 \text{ amu} = \qquad 10.081450 \text{ amu} \\
 11 \cdot 1.008987 \text{ amu} = \qquad 11.098857 \text{ amu} \\
 \hline
 \therefore 10p + 11n = \qquad 21.180307 \text{ amu} \\
 -m_A \text{ of } ({}^{21}_{10}\text{Ne}) = \qquad -21.000504 \text{ amu} \\
 \hline
 \therefore MD \equiv E_B = -\Delta m = \qquad 0.179803 \text{ amu} \\
 \qquad \qquad \qquad 931.2 \text{ MeV} \\
 \hline
 \qquad \qquad \qquad 167.43255 \text{ MeV}
 \end{array}$$

In the same way that we calculate the E_B of neon-20 and other nuclei, we find that each isotope that has similar chemical properties, similar atomic weights and similar internal binding energies has the same nuclear structure. What follows from this is that having all these parameters, we can identify the structure of a particular isotope. This is not just to satisfy our curiosity; if we can ascertain how such structures evolve, then we can read Nature's code wherein are enciphered all her secrets. We have already noticed a certain arbitrariness in deciding ways to find these structures (see Chapter 4.5).

Before we start, I wish to warn the reader that the values for isotopic masses sometimes vary from one table to another. This means that to achieve reliable results, the best tables available at the time of calculation must be used. For this reason, the subsequent calculations made here are to be treated only as examples.

We begin with the simple structure of neon and then proceed to the more complicated nuclei. So

$$E_B \left({}^{21}_{10}\text{Ne} - {}^{20}_{10}\text{Ne} \right) = 166.269 - 159.497 = 6.772 \text{ MeV}. \quad (4.10)$$

According to the previous chapter, we accept that the structure of the magnesium nucleus is very similar to neon, with the addition of two proton–neutron pairs that we call 2δ ; in

simple terms, there are two delta-particles stuck on the shell of neon. The difference in MD between neon-21 and neon-20 should be similar to the differences between magnesium-25 and magnesium-24, hence

$$E_B \text{ of } ^{25}\text{Mg} - ^{24}\text{Mg} = 7.349 \text{ MeV} \quad (4.11)$$

and

$$E_B \text{ of } ^{21}\text{Ne} - ^{20}\text{Ne} = 6.772 \text{ MeV}. \quad (4.12)$$

This shows that we are on the right track, but are we? We compare in the same way

$$E_B \text{ of } ^{23}\text{Na} - ^{22}\text{Na} = 185.318 - 172.883 = 12.435 \text{ MeV}. \quad (4.13)$$

The result is about twice as large as we expected and sodium-22 is radioactive. Why? Remember the internal temperatures and energy capacities of the atomic nuclei? (see Chapter 3.13) Then why are some isotopes stable and others radioactive?

It was suggested that xenon-136 was the isotope constructed true to specification; others were not, hence the evaporation of the outer shell's neutrons. Still, we were not exactly successful (see Chapter 4.9). Let us try some other options: lead-207 and lead-208. They may be called perfect as to the number of neutrons separating the alpha-particles; the alpha-particles are in order and there are eight of them (although we have not heard about eight-valent lead). Still, maybe there is not enough access to a simple atom of lead by eight hydrogens. Lead-207 has at the centre of its nucleus one neutron; lead-208 has two. Can we be sure of that? Before we find a reason to believe any assumption, we must first confirm that it is correct. A single-fronted attack will not lead us to quick success. We must try many other points: gamma velocities, temperatures, energy contents, placement in the shell, and many others. Try this on our earlier example of sodium-22 and sodium-23; also, try magnesium-23

to 28 in the same manner. What we need to do is to try and try again on the different structures listed in Tables 4.1.1–4.1.28. Nature’s code has to be broken and her secret discovered.

4.16 The Bond Strengths Between Nuclides

In the previous section, we were comparing the E_B of structurally similar isotopes to elucidate further on these structures. Now, we take a step further; we shall try to find the strengths of the bond between the nuclides in the nucleus. This again requires many computations to find the laws ruling inside atomic nuclei; almost nothing is known at the present time. General outlines have been prepared in Tables 4.1.1–4.1.28 and all we have to do is to find the details. Figure 4.2 is an example as to what can be calculated. It shows how the state of the nuclear binding energies (mass defect) progressively increase with the atomic mass number, forming a straight line.

A bond between two nucleons is marked by a dot (\cdot) like a chemical bond in a molecule and is measured in the units of E_B in MeV as before. The most common bond is between the alpha-particle α and the delta-particle δ as in lithium-6

$${}^6\text{Li} = \alpha \cdot \delta. \quad (4.14)$$

Hence, the E_B bond of $\alpha \cdot \delta$ is

$$E_B({}^6\text{Li} - {}^4\text{He} - {}^2\text{H}) = 1.477 \text{ MeV}. \quad (4.15)$$

From now on, this value, as a known quantity, will become our standard.

In boron-10, we have three delta-particles attached to one alpha-particle; this we shall write as

$$\alpha \cdot \left(\frac{3\delta}{3} = [{}^{10}\text{B} - (3 \cdot \delta + \alpha) : 3] \right) = 9.932 \text{ MeV}. \quad (4.16)$$

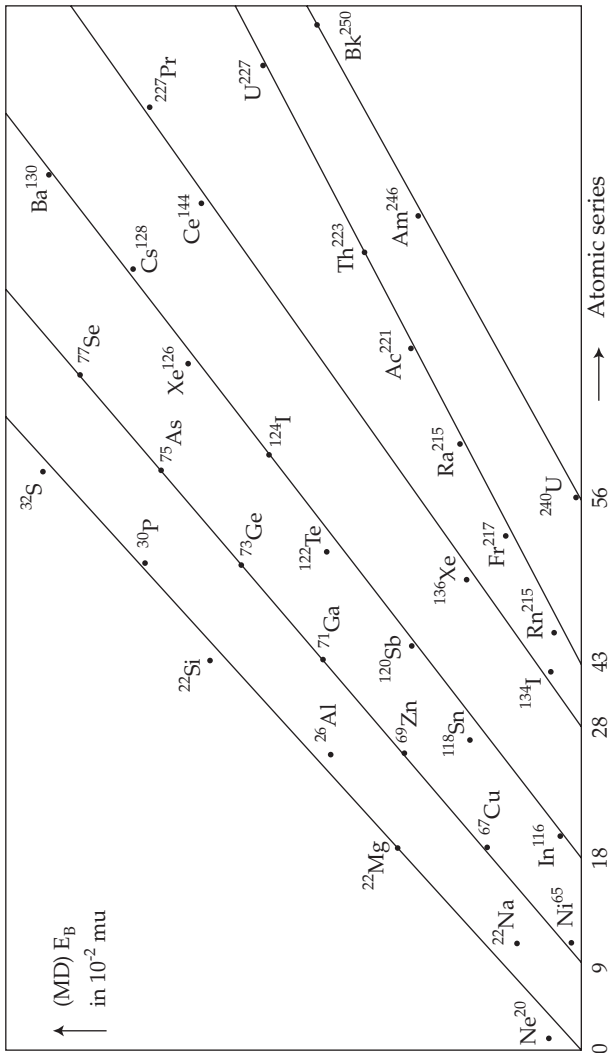


Figure 4.2

The bond strength between nuclei; an example of what can be calculated by plotting the mass defect against the atomic number.

A breakdown of this equation shows that when in the square brackets, the delta-particle δ represents the MD of ${}^2_1\text{H}_1$ and the alpha-particle α represents the MD of ${}^4_2\text{He}$; the $\alpha \cdot (3\delta/3)$ represents the bonding (\cdot) between the alpha particle α and each of the delta-particles δ in boron; and ${}^{10}\text{B}$ denotes its MD .

From now on, we are going to deal with the E_B (the mass defect), and every nuclear symbol for an isotope, as well as the alpha-particles and delta-particles, will henceforth mean their MD in MeV. The following shows the nuclear bonds:

Nuclear bond	MeV
$\alpha \cdot \delta = {}^6\text{Li} - {}^4\text{He} - {}^2\text{H}$	1.477
$\alpha \cdot \left(\frac{3\delta}{3} = [{}^{10}\text{B} - \{3 \cdot \delta + \alpha\}]\right) : 3$	9.932
$\alpha \cdot \left(\frac{4\delta}{4} = [{}^{12}\text{C} - \{4 \cdot \delta + \alpha\}]\right) : 4$	13.738
$\alpha \cdot n = {}^{21}\text{Ne} - {}^{20}\text{Ne}$	6.772
$\alpha \cdot 2n = {}^{22}\text{Ne} - {}^{20}\text{Ne}$	16.99
$\delta \cdot ({}^{21}\text{Ne} = {}^{23}\text{Na} - {}^{21}\text{Ne} - \delta)$	16.949
$\delta \cdot ({}^{20}\text{Ne} = [{}^{24}\text{Mg} - \{20\text{Ne} + 2\delta\}]) : 2$	16.59
$\delta \cdot ({}^{21}\text{Ne} = [{}^{25}\text{Mg} - \{21\text{Ne} + 2\delta\}]) : 2$	16.879
$\delta \cdot ({}^{22}\text{Ne} = [{}^{26}\text{Mg} - \{22\text{Ne} + 2\delta\}]) : 2$	17.336
$\delta \cdot ({}^{21}\text{Ne} = [{}^{27}\text{Al} - \{21\text{Ne} + 3\delta\}]) : 2$	16.97
$\delta \cdot ({}^{20}\text{Ne} = [{}^{28}\text{Si} - \{20\text{Ne} + 4\delta\}]) : 4$	16.76
$\delta \cdot ({}^{21}\text{Ne} = [{}^{29}\text{Si} - \{21\text{Ne} + 4\delta\}]) : 4$	17.191
$\delta \cdot ({}^{22}\text{Ne} = [{}^{30}\text{Si} - \{22\text{Ne} + 4\delta\}]) : 4$	14.636

Checking the results does not make us completely satisfied that we are correct. Have we made the right assumptions about certain bonds? Are there not other factors to be accounted

for? To start again at the beginning: $\alpha \cdot \delta$ bond from ${}^6\text{Li} = 1.477$ MeV, while derived as $1/3$ from ${}^{10}\text{B}$ it is 9.932 MeV. From ${}^{12}\text{C}$ at $1/4$ it is 13.738 MeV. The $\delta \cdot \text{Ne}$ shell bonds are rather similar, on the order of 17 MeV; what is the secret? We are yet to find it, but there is another thing to consider: in ${}^{10}\text{B}$ and ${}^{12}\text{C}$ the delta-particles must also have the $\delta \cdot \delta$ bond.

This area will require a lot of work as we must find out all such bond combinations as shown in Tables 4.1.1–4.1.28. It will take some time; we may be the first to start on this new track, but we may not be the last.

Table 4.1.1
The internal structure of isotopes (hydrogen to oxygen).

Z \ n	1	H		2	He		3	Li		4	Be		5	B		6	C		7	N		8	O	
	A	Shell		A	Shell		A	Shell		A	Shell		A	Shell		A	Shell		A	Shell		A	Shell	
		1	2		1	2		1	2		1	2		1	2		1	2		1	2		1	2
-1	n																							
	δ	1	P		3		3															16		2
	α																						1	2
0	n																							1
	δ	2	1		4			6		1			10		3	12		4	14		5	17		2
	α				1			1					1				1			1			1	2
1	n							7		1		9		1	1		1		1		1		2	
	δ							1	1	9		2	11		3	13		4	15		5	18		2
	α							1		1		1		1			1		1		1		1	2

Table 4.1.2
The internal structure of isotopes (fluorine to silicon).

Z \ n	9	F		10	Ne		11	Na			12	Mg			13	Al			14	Si			
	A	Shell		A	Shell		A	Shell			A	Shell			A	Shell			A	Shell			
		1	2		1	2		1	2	3		1	2	3		1	2	3		1	2	3	
-1	n																						
	δ						20				24			2									
	α						1	4			1	4											
0	n		1		1			1			1			1			1						
	δ	19		1	21		23		1		25		2	27		3	28				1	4	4
	α		1	3		1	4		1	4		1	4		1	4					1	4	
1	n				2						2										1		4
	δ										26		2								29		4
	α				1	4					1	4									1	4	
2	n																				2		4
	δ																				30		4
	α																				1	4	

Table 4.1.3
The internal structure of isotopes (phosphorus to potassium).

Z \ n	15 P			16 S			17 Cl			18 Ar			19 K				
	A	Shell			A	Shell			A	Shell			A	Shell			
		1	2	3		1	2	3		1	2	3		1	2	3	4
0	n																
	δ				32		6				36						
	α					1	4					1	4	4			
1	n		1			1			1						1		
	δ	31		5	33		6	35		7				39			1
	α		1	4		1	4		1	4					1	4	4
2	n					2						2					
	δ				34		6				38						
	α					1	4					1	4	4			
3	n								1	2							
	δ							37		7							
	α								1	4							
4	n					2	2					2	2				
	δ				36		6				40						
	α					1	4					1	4	4			
5	n																
	δ																
	α																
6	n					2	4										
	δ				38		6										
	α					1	4										

Table 4.1.4
The internal structure of isotopes (calcium to vanadium).

Z \ n	20 Ca				21	Sc				22	Ti				23	V				
	A	Shell				A	Shell				A	Shell				A	Shell			
		1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
0	n																			
	δ	40			2															
	α	1	4	4																
1	n																			
	δ																			
	α																			
2	n		2								2									
	δ	42			2					46				4						
	α	1	4	4							1	4	4							
3	n		1	2		1	2				1	2								
	δ	43			2	45			3	47				4						
	α	1	4	4		1	4	4			1	4	4							
4	n		2	2							2	2								
	δ	44			2					48				4						
	α	1	4	4							1	4	4							
5	n										1	4			1	4				
	δ									49				4	51			5		
	α										1	4	4		1	4	4			
6	n		2	4							2	4								
	δ	46			2					50				4						
	α	1	4	4							1	4	4							
7	n																			
	δ																			
	α																			
8	n		2	4	2															
	δ	48			2															
	α	1	4	4																

Table 4.1.5
The internal structure of isotopes (chromium to cobalt).

Z \ n	24 Cr				25 Mn				26 Fe				27 Co							
	A	Shell				A	Shell				A	Shell				A	Shell			
		1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
2	n	2								2										
	δ	50			6					54			8							
	α	1	4	4							1	4	4							
3	n																			
	δ																			
	α																			
4	n	2	2							2	2									
	δ	52			6					56			8							
	α	1	4	4							1	4	4							
5	n	1	4			1	4			1	4				1	4			3	
	δ	53			6	55			7	57			8	59					3	
	α	1	4	4		1	4	4		1	4	4		1	4	4	3			
6	n	2	4							2	4									
	δ	54			6					58			8							
	α	1	4	4						1	4	4								

Table 4.1.6
The internal structure of isotopes (nickel to gallium).

Z \ n	28 Ni				29 Cu				30 Zn				31 Ga							
	A	Shell				A	Shell				A	Shell				A	Shell			
		1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
2	n	2																		
	δ	58			4															
	α	1	4	4	3															
3	n																			
	δ																			
	α																			
4	n	2	2							2	2									
	δ	60			4					64			2							
	α	1	4	4	3					1	4	4	5							
5	n	1	4			1	4													
	δ	61			4	63			1											
	α	1	4	4	3	1	4	4	5											
6	n	2	4							2	4									
	δ	62			4					66			2							
	α	1	4	4	3					1	4	4	5							
7	n					1	4	2		1	4	2			1	4	2			
	δ					65		1		67		2		69			3			
	α					1	4	4	5	1	4	4	5	1	4	4	5			
8	n									2	4	2								
	δ									68			2							
	α									1	4	4	5							
9	n														1	4	4			
	δ													71			3			
	α													1	4	4	5			
10	n									2	4	4								
	δ									70			2							
	α									1	4	4	5							

Table 4.1.7
The internal structure of isotopes (germanium to bromine).

Z \ n	32 Ge				33 As				34 Se				35 Br							
	A	Shell				A	Shell				A	Shell				A	Shell			
		1	2	3	4		1	2	3	4		1	2	3	4		1	2	3	4
6	n	2	4							2	4									
	δ	70								74			6							
	α	1	4	4	5						1	4	4	5						
7	n																			
	δ																			
	α																			
8	n	2	4	2						2	4	2								
	δ	72			4					76			6							
	α	1	4	4	5						1	4	4	5						
9	n	1	4	4		1	4	4		1	4	4			1	4	4		7	
	δ	73			4	75			5	77			6	79						
	α	1	4	4	5	1	4	4	5	1	4	4	5	1	4	4	5			
10	n	2	4	4						2	4	4								
	δ	74			4					78			6							
	α	1	4	4	5						1	4	4	5						
11	n													81	1	4	4	2		
	δ														1	4	4	7		
	α														1	4	4	5		
12	n	2	4	4	2					2	4	4	2							
	δ	76			4					80			6							
	α	1	4	4	5						1	4	4	5						
13	n																			
	δ																			
	α																			
14	n														2	4	4	4		
	δ									82			6							
	α										1	4	4	5						

Table 4.1.8
The internal structure of isotopes (krypton to yttrium).

Z n	36	Kr				37	Rb					38	Sr					39	Y				
	A	Shell				A	Shell					A	Shell					A	Shell				
		1	2	3	4		1	2	3	4	5		1	2	3	4	5		1	2	3	4	5
6	n	2	4																				
	δ	78																					
	α	1	4	4	9																		
7	n																						
	δ																						
	α																						
8	n	2	4	2							84	2	4	2									
	δ	80													2								
	α	1	4	4	9							1	4	4	9								
9	n																						
	δ																						
	α																						
10	n	2	4	4							86	2	4	4									
	δ	82													2								
	α	1	4	4	9							1	4	4	9								
11	n	1	4	4	2		1	4	4	2		1	4	4	2		89	1	4	4	2		
	δ	83				85				1	87				2						3		
	α	1	4	4	9	1	4	4	9			1	4	4	9			1	4	4	9		
12	n	2	4	4	2						88	2	4	4	2								
	δ	84													2								
	α	1	4	4	9							1	4	4	9								
13	n																						
	δ																						
	α																						
14	n	2	4	4	4																		
	δ	86																					
	α	1	4	4	9																		

Table 4.1.9
The internal structure of isotopes (zirconium to technetium).

Z \ n	40					41					42					43					44						
	A	Shell					A	Shell					A	Shell					A	Shell							
		1	2	3	4	5		1	2	3	4	5		1	2	3	4	5		1	2	3	4	5			
8	n																										
	δ											92	2	4	2												
	α												1	4	4	9	6										
9	n																										
	δ																										
	α																										
10	n		2	4	4								2	4	4												
	δ	90				4						94				6											
	α		1	4	4	9							1	4	4	9											
11	n		1	4	4	2		1	4	4	2		1	4	4	2						1	4	4	2		
	δ	91				4	93				5	95				6	97								7		
	α		1	4	4	9		1	4	4	9		1	4	4	9		1	4	4	9						
12	n		2	4	4	2							2	4	4	2						98	2	4	4	2	
	δ	92				4						96				6	98								7		
	α		1	4	4	9							1	4	4	9		1	4	4	9						
13	n												1	4	4	4						99	1	4	4	4	
	δ											97				6	99								7		
	α												1	4	4	9		1	4	4	9						
14	n		2	4	4	2							2	4	4	4											
	δ	94				4						98				6											
	α		1	4	4	9							1	4	4	9											
15	n																										
	δ																										
	α																										
16	n		2	4	4	6							2	4	4	6											
	δ	96				4						100				6											
	α		1	4	4	9							1	4	4	9											

Table 4.1.13
The internal structure of isotopes (barium to cerium).

Z \ n	56 Ba						57	La						58	Ce								
	A	Shell						A	Shell						A	Shell							
		1	2	3	4	5			6	1	2	3	4			5	6	1	2	3	4	5	6
18	<i>n</i>	2	4	4	8																		
	δ	130												136									
	α	1	4	4	9	9	2																
19	<i>n</i>																						
	δ																						
	α																						
20	<i>n</i>	2	4	4	8	2								2	4	4	8	2					
	δ	132					2							136					4				
	α	1	4	4	9	9								1	4	4	9	9					
21	<i>n</i>																						
	δ																						
	α																						
22	<i>n</i>	2	4	4	8	4								2	4	4	8	4					
	δ	134					2							138					4				
	α	1	4	4	9	9								1	4	4	9	9					
23	<i>n</i>	1	4	4	8	6																	
	δ	135					2																
	α	1	4	4	9	9																	
24	<i>n</i>	2	4	4	8	6								2	4	4	8	6					
	δ	136					2							140					4				
	α	1	4	4	9	9								1	4	4	9	9					
25	<i>n</i>	1	4	4	8	8		1	4	4	8	8											
	δ	137					2	139				3											
	α	1	4	4	9	9		1	4	4	9	9											
26	<i>n</i>	2	4	4	8	8								2	4	4	8	8					
	δ	138					2							142					4				
	α	1	4	4	9	9								1	4	4	9	9					

Table 4.1.14
The internal structure of isotopes (praseodymium to promethium).

Z \ n	59	Pr						60	Nd						61	Pm					
	A	Shell						A	Shell						A	Shell					
		1	2	3	4	5	6		1	2	3	4	5	6		1	2	3	4	5	6
20	n																				
	δ																				
	α																				
21	n													143	1	4	4	8	4		
	δ														1	4	4	9	9		
	α														1	4	4	9	9		
22	n							142	2	4	4	8	4	144	2	4	4	8	4		
	δ								1	4	4	9	9		1	4	4	9	9		
	α								1	4	4	8	6		1	4	4	8	6		
23	n	141	1	4	4	8	6	143	1	4	4	8	6	145	1	4	4	8	6		
	δ					3			1	4	4	8	6		1	4	4	8	6		
	α								1	4	4	9	9		1	4	4	9	9		
24	n													146	2	4	4	8	6		
	δ														1	4	4	9	9		
	α														1	4	4	9	9		
25	n							145	1	4	4	8	8	147	1	4	4	8	8		
	δ								1	4	4	9	9		1	4	4	9	9		
	α								1	4	4	9	9		1	4	4	9	9		
26	n							146	2	4	4	8	8								
	δ								1	4	4	9	9								
	α								1	4	4	9	9								
27	n																				
	δ																				
	α																				
28	n							148	2	4	4	8	8	2							
	δ								1	4	4	9	9	4							
	α								1	4	4	9	9	1							

Table 4.1.15
The internal structure of isotopes (samarium to gadolinium).

Z \ n	62 Sm						63	64 Eu						65	66 Gd						
	A	Shell						A	Shell						A	Shell					
		1	2	3	4	5	6		1	2	3	4	5	6		1	2	3	4	5	6
20	n	2	4	4	8	2															
	δ	144					6														
	α	1	4	4	9	9	1														
21	n																				
	δ																				
	α																				
22	n																				
	δ																				
	α																				
23	n																				
	δ																				
	α																				
24	n	2	4	4	8	6		2	4	4	8	6			2	4	4	8	6		
	δ	148					6	150					7	152							8
	α	1	4	4	9	9	1	1	4	4	9	9	1	1	1	4	4	9	9	1	1
25	n	1	4	4	8	6		1	4	4	8	8									
	δ	149					6	151					7								
	α	1	4	4	9	9	1	1	4	4	9	9	1	1							
26	n	2	4	4	8	8									2	4	4	8	8		
	δ	150					6							154							8
	α	1	4	4	9	9	1							1	4	4	9	9	1	1	
27	n							1	4	4	8	8	2		1	4	4	8	8	2	
	δ							153					7	155							8
	α							1	4	4	9	9	1	1	1	4	4	9	9	1	1
28	n	2	4	4	8	8	2								2	4	4	8	8	2	
	δ	152					6							156							8
	α	1	4	4	9	9	1							1	4	4	9	9	1	1	
29	n														1	4	4	8	8	4	
	δ													157							8
	α													1	4	4	9	9	1	1	
30	n	2	4	4	8	8	4								2	4	4	8	8	4	
	δ	154					6							158							8
	α	1	4	4	9	9	1							1	4	4	9	9	1	1	
31	n																				
	δ																				
	α																				
32	n														2	4	4	8	8	6	
	δ													160							8
	α													1	4	4	9	9	1	1	

Table 4.1.16
The internal structure of isotopes (terbium to holmium).

Z n	65 Tb						66 Dy						67 Ho								
	A	Shell					A	Shell					A	Shell							
		1	2	3	4	5		6	1	2	3	4		5	6	1	2	3	4	5	6
24	n							156	2	4	4	8	6								
	δ												4								
	α								1	4	4	9	9	4							
25	n																				
	δ																				
	α																				
26	n							158	2	4	4	8	8								
	δ												4								
	α								1	4	4	9	9	4							
27	n																				
	δ																				
	α																				
28	n							160	2	4	4	8	8	2							
	δ												4								
	α								1	4	4	9	9	4							
29	n		1	4	4	8	8	4	161	1	4	4	8	8	4						
	δ	159					3						4								
	α		1	4	4	9	9	4		1	4	4	9	9	4						
30	n							162	2	4	4	8	8	4	165	1	4	4	8	8	6
	δ												4							5	
	α								1	4	4	9	9	4		1	4	4	9	9	4
31	n							163	1	4	4	8	8	6							
	δ												4								
	α								1	4	4	9	9	4							
32	n							164	2	4	4	8	8	6							
	δ												4								
	α								1	4	4	9	9	4							

Table 4.1.18
The internal structure of isotopes (lutetium to tantalum).

Z \ n	71 Lu						72	73 Hf						74	75 Ta								
	A	Shell						A	Shell						A	Shell							
		1	2	3	4	5			6	1	2	3	4			5	6	1	2	3	4	5	6
28	n																						
	δ																						
	α																						
29	n																						
	δ																						
	α																						
30	n							2	4	4	8	8	4										
	δ							174					4										
	α							1	4	4	9	9	7										
31	n																						
	δ																						
	α																						
32	n							2	4	4	8	8	6										
	δ							176					4										
	α							1	4	4	9	9	7										
33	n		1	4	4	8	8	8	1	4	4	8	8	8									
	δ	175					3	177					4										
	α	1	4	4	9	9	7	1	4	4	9	9	7										
34	n							2	4	4	8	8	8										
	δ							178					4										
	α							1	4	4	9	9	7										
35	n							1	4	4	8	8	10	1	4	4	8	8	10				
	δ							179					4	181					5				
	α							1	4	4	9	9	7	1	4	4	9	9	7				
36	n							2	4	4	8	8	10										
	δ							180					4										
	α							1	4	4	9	9	7										

Table 4.1.19
The internal structure of isotopes (tungsten to osmium).

Z \ n	74	W					75	Re					76	Os										
	A	Shell					A	Shell					A	Shell										
		1	2	3	4	5		6	1	2	3	4		5	6	1	2	3	4	5	6			
32	n	2	4	4	8	8	6							2	4	4	8	8	6					
	δ	180					6							184					8					
	α	1	4	4	9	9	7							1	4	4	9	9	7					
33	n																							
	δ																							
	α																							
34	n		2	4	4	8	8	8							2	4	4	8	8	8				
	δ	182					6							186					8					
	α	1	4	4	9	9	7							1	4	4	9	9	7					
35	n								1	4	4	8	8	10					1	4	4	8	8	10
	δ	183						185					7	187						8				
	α								1	4	4	9	9	7					1	4	4	9	9	7
36	n		1	4	4	8	8	10							2	4	4	8	8	10				
	δ	184					6							188						8				
	α	1	4	4	9	9	7							1	4	4	9	9	7					
37	n								1	4	4	8	8	12					1	4	4	8	8	12
	δ							187					7	189						8				
	α								1	4	4	9	9	7					1	4	4	9	9	7
38	n		2	4	4	8	8	12							2	4	4	8	8	12				
	δ	186					6							190						8				
	α	1	4	4	9	9	7							1	4	4	9	9	7					
38	n																							
	δ																							
	α																							
38	n														2	4	4	8	8	14				
	δ													192						8				
	α													1	4	4	9	9	7					

Table 4.1.20
The internal structure of isotopes (iridium to gold).

Z n	77	Ir					78	Pt					79	Au						
	A	Shell					A	Shell					A	Shell						
		1	2	3	4	5		6	1	2	3	4		5	6	1	2	3	4	5
32	n																			
	δ																			
	α																			
33	n																			
	δ																			
	α																			
34	n																			
	δ																			
	α																			
35	n																			
	δ																			
	α																			
36	n							2	4	4	8	8	10							
	δ						192						4							
	α							1	4	4	9	9	10							
37	n		1	4	4	8	8	12												
	δ	191						3												
	α		1	4	4	9	9	10												
38	n																			
	δ							194												
	α												4							
								1	4	4	9	9	10							
39	n		1	4	4	8	8	14						1	4	4	8	8	14	
	δ	193						3	195					4	197					
	α		1	4	4	9	9	10							1	4	4	9	9	10
40	n																			
	δ							196												
	α												4							
								1	4	4	9	9	10							
41	n																			
	δ																			
	α																			
42	n													2	4	4	8	8	16	
	δ							198												
	α												4							
								1	4	4	9	9	10							

Table 4.1.21
The internal structure of isotopes (mercury to lead).

Z	80	Hg						81	Tl						82	Pb					
	A	Shell						A	Shell						A	Shell					
n		1	2	3	4	5	6		1	2	3	4	5	6		1	2	3	4	5	6
36	n	2	4	4	8	8	10														
	δ	196																			
	α	1	4	4	9	9	10														
37	n																				
	δ																				
	α																				
38	n	2	4	4	8	8	12														
	δ	198																			
	α	1	4	4	9	9	10														
39	n	1	4	4	8	8	14														
	δ	199																			
	α	1	4	4	9	9	10														
40	n	2	4	4	8	8	14								204	2	4	4	8	8	14
	δ	200																		8	
	α	1	4	4	9	9	10									1	4	4	9	9	10
41	n	1	4	4	8	8	16	203	1	4	4	8	8	16							
	δ	201						203					7								
	α	1	4	4	9	9	10		1	4	4	9	9	10							
42	n	2	4	4	8	8	16								206	2	4	4	8	8	16
	δ	202																		8	
	α	1	4	4	9	9	10									1	4	4	9	9	10
43	n							205	1	4	4	9	9	16	207	1	4	4	9	9	16
	δ												7							8	
	α								1	4	4	9	9	10		1	4	4	9	9	10
44	n	2	4	4	9	9	16								208	2	4	4	9	9	16
	δ	204																		8	
	α	1	4	4	9	9	10									1	4	4	9	9	10

Table 4.1.22
The internal structure of isotopes (bismuth to astatine).

Z n	83 Bi						84 Po							85 At														
	A	Shell						A	Shell							A	Shell											
		1	2	3	4	5	6		1	2	3	4	5	6	7		1	2	3	4	5	6	7					
38	n															208	2	4	4	8	8	12						
	δ																					3						
	α															1	4	4	9	9	14							
39	n														209													
	δ																											
	α															1	4	4	9	9	14							
40	n							208	2	4	4	8	8	14	210													
	δ												4															
	α								1	4	4	9	9	13		1	4	4	9	9	14							
41	n							209	1	4	4	8	8	16	211													
	δ												4															
	α								1	4	4	9	9	13		1	4	4	9	9	14							
42	n							210	2	4	4	8	8	16	212													
	δ												4															
	α								1	4	4	9	9	13		1	4	4	9	9	14							
43	n	1	4	4	9	9	16																					
	δ	209					9																					
	α	1	4	4	9	9	10																					

Table 4.1.23
The internal structure of isotopes (radon to radium).

Z n	86 Rn							87 Fr							88 Ra										
	A	Shell						A	Shell						A	Shell									
		1	2	3	4	5	6		7	1	2	3	4	5		6	7	1	2	3	4	5	6	7	
38 n																									
δ								212								1									
α								1	4	4	9	9	16												
39 n																									
δ																									
α																									
40 n																									
δ								214								1									
α								1	4	4	9	9	16												
41 n																									
δ																									
α																									
42 n		2	4	4	8	8	16																		
δ	214																								
α	1	4	4	9	9	16																			
43 n																									
δ																									
α																									
44 n																									
δ																									
α																									
45 n																									
δ								219								2									
α								1	4	4	9	9	16			1									
46 n																									
δ																		222							
α																		1	4	4	9	9	16		2
47 n																									
δ								221								4		223							
α								1	4	4	9	9	16			1		1	4	4	9	9	16		4
48 n																									
δ								222								4		224							
α								1	4	4	9	9	16			1		1	4	4	9	9	16		4
49 n																									
δ																		225							
α																		1	4	4	9	9	16		6
50 n		2	4	4	9	9	16	6																	
δ	222																	226							
α	1	4	4	9	9	16												1	4	4	9	9	16		6
51 n																									
δ																									
α																									
52 n		2	4	4	9	9	16	8																	
δ	224																	228							
α	1	4	4	9	9	16												1	4	4	9	9	16		8

Table 4.1.24
The internal structure of isotopes (actinium to protactinium).

Z \ n	89 Ac							90	91 Th							91	Pa								
	A	Shell							A	Shell							A	Shell							
		1	2	3	4	5	6			7	1	2	3	4	5			6	7	1	2	3	4	5	6
46	<i>n</i>																								
	<i>δ</i>																								
	<i>α</i>																								
47	<i>n</i>													229	1	4	4	9	9	16	4				
	<i>δ</i>																				3				
	<i>α</i>														1	4	4	9	9	16	1				
48	<i>n</i>		2	4	4	9	9	16	4		2	4	4	9	9	16	4		2	4	4	9	9	16	4
	<i>δ</i>	226						3	228						4	230								3	
	<i>α</i>		1	4	4	9	9	16		1	4	4	9	9	16		1	4	4	9	9	16	1		
49	<i>n</i>		1	4	4	9	9	16	6		1	4	4	9	9	16	6		1	4	4	9	9	16	6
	<i>δ</i>	227						3	229						4	231								3	
	<i>α</i>		1	4	4	9	9	16		1	4	4	9	9	16		1	4	4	9	9	16	1		
50	<i>n</i>		2	4	4	9	9	16	6		2	4	4	9	9	16	6		2	4	4	9	9	16	6
	<i>δ</i>	228						3	230						4	232								3	
	<i>α</i>		1	4	4	9	9	16		1	4	4	9	9	16		1	4	4	9	9	16	1		
51	<i>n</i>																						8		
	<i>δ</i>														233								3		
	<i>α</i>															1	4	4	9	9	16	1			
52	<i>n</i>								232	2	4	4	9	9	16	8									
	<i>δ</i>														4										
	<i>α</i>									1	4	4	9	9	16										

Table 4.1.26
The internal structure of isotopes (americium to berkelium).

Z n	95	Am						96	Cm						97	Bk									
	A	Shell						A	Shell						A	Shell									
		1	2	3	4	5	6		7	1	2	3	4	5		6	7	1	2	3	4	5	6	7	
48	n																								
	δ																								
	α																								
49	n																								
	δ																								
	α																								
50	n																								
	δ																								
	α																								
51	n		1	4	4	9	9	16	8		1	4	4	9	9	16	8								
	δ	241						7	243							4									
	α		1	4	4	9	9	16	1		1	4	4	9	9	16	3								
52	n										2	4	4	9	9	16	8								
	δ									244							4								
	α										1	4	4	9	9	16	3								
53	n		1	4	4	9	9	16	10		1	4	4	9	9	16	10		1	4	4	9	9	16	10
	δ	243						7	245							4	247							5	
	α		1	4	4	9	9	16	1		1	4	4	9	9	16	3		1	4	4	9	9	16	3
54	n										2	4	4	9	9	16	10								
	δ									246							4								
	α										1	4	4	9	9	16	3								
55	n										1	4	4	9	9	16	12								
	δ									247							4								
	α										1	4	4	9	9	16	3								
56	n																								
	δ																								
	α																								
57	n																								
	δ																								
	α																								
58	n										2	4	4	9	9	16	14								
	δ									250							4								
	α										1	4	4	9	9	16	3								

Table 4.1.27
The internal structure of isotopes (californium to fermium).

Z \ n	98	Cf						99	Es						100	Fm						
	A	Shell						A	Shell						A	Shell						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	
53	<i>n</i>	1	4	4	9	9	16	10	1	4	4	9	9	16	10	1	4	4	9	9	16	10
	δ	249					6	251						3	253							4
	α	1	4	4	9	9	16	3	1	4	4	9	9	16	5	1	4	4	9	9	16	5
54	<i>n</i>	2	4	4	9	9	16	10	2	4	4	9	9	16	10							
	δ	250					6	252						3								
	α	1	4	4	9	9	16	3	1	4	4	9	9	16	5							
55	<i>n</i>	1	4	4	9	9	16	12	1	4	4	9	9	16	12							
	δ	251					6	253						3								
	α	1	4	4	9	9	16	3	1	4	4	9	9	16	5							
56	<i>n</i>	2	4	4	9	9	16	12														
	δ	252					6															
	α	1	4	4	9	9	16	3														
57	<i>n</i>														257	1	4	4	9	9	16	14
	δ																					4
	α															1	4	4	9	9	16	5
58	<i>n</i>	2	4	4	9	9	16	14														
	δ	254					6															
	α	1	4	4	9	9	16	3														
58	<i>n</i>	1	4	4	9	9	16	16														
	δ	255																				
	α	1	4	4	9	9	16	3														

Table 4.1.28
The internal structure of isotopes (mendelevium to lawrencium).

Z \ n	101 Md							102 No							103 Lr								
	A	Shell						A	Shell						A	Shell							
		1	2	3	4	5	6		7	1	2	3	4	5		6	7	1	2	3	4	5	6
48	n							252	2	4	4	9	9	16	4								
	δ													6									
	α								1	4	4	9	9	16	5								
49	n							253	1	4	4	9	9	16	6								
	δ													6									
	α								1	4	4	9	9	16	5								
50	n							254	2	4	4	9	9	16	6	256	2	4	4	9	9	16	6
	δ													6								3	
	α								1	4	4	9	9	16	5		1	4	4	9	9	16	7
51	n																						
	δ																						
	α																						
52	n																						
	δ																						
	α																						
53	n																						
	δ																						
	α																						
54	n		2	4	4	9	9	16	10														
	δ	256							5														
	α		1	4	4	9	9	16	5														

CHAPTER 5

Astrophysics

5.1 Doppler's Redshift or Compton's?

A core assumption of cosmology ever since redshift was first observed in electromagnetic radiation from distant galaxies, is that the universe is expanding. The basis for this assumption is that redshift is a consequence of the Doppler effect, wherein the apparent frequency of a wave varies as the emitting source approaches or moves away from the observer. Therefore, the colour of a self-luminous body like a star would displace towards the blue end of the spectrum when moving towards us, and to the red end when receding from us.

In 1842, Christian Doppler formulated a principle in relation to longitudinal sound waves. The classic scenario is the rising pitch of a train whistle as the train approaches and its lowering pitch as it passes and moves away. Doppler speculated that the principle might apply to all wave phenomena, including transverse waves characteristic of electromagnetic radiation.

Until Vesto Melvin Slipher of the Lowell Observatory presented the first photographs showing the existence of redshift in nebulae spectra at an Astronomical Society meeting in 1914,

there was no evidence to link Doppler's effect to electromagnetic wave phenomena. Slipher's assumption that redshift was an indication of the Doppler effect was taken up by Edwin Powell Hubble who elaborated the discovery by observing that the velocities of the supposedly receding stellar systems were proportional to their distances. His first paper on the velocity-distance relationship, published in 1929, presented the linear relationship between velocity and distance in a single statement now known as Hubble's law: $v = Hd$. The constant H is referred to as the Hubble constant. To Hubble, the existence of redshift implied that the universe was expanding; what he always described as 'apparent' velocities seem to increase as one looks further outward from any point within the universe. This observation, as is well-known, is the basis for the Big Bang theory of cosmology.

At first sight, the Doppler effect has proved such a satisfying explanation for redshift that there seems little reason to contest it. Although first observed as a property of longitudinal or pressure waves passing through material media, it was supposed that, like other wave properties, it would also apply to transverse waves moving through a vacuum. That assumption has not been without its difficulties.

One of the abiding problems is in measuring distances to remote galaxies. The Hubble constant has not always lived up to its name and scientists have had to work with a range of values, as measured in megaparsecs (Mpc), the distance that light travels in 3.26 million years, to measure the speed of distant galaxies. Allan R. Sandage and Gustav Tammann, for example, accepted the lower value of 50 km/s/Mpc, whereas the late Gérard de Vaucouleurs preferred 100 km/s/Mpc. Furthermore, by using the Doppler effect as the basis of calculations, it has been estimated that some galaxies are receding at the somewhat improbable speed of 90% of the speed of light.

Another major problem is that the universe appears to be homogeneous in terms of its density. Although the distribution of closer galaxies shows clustering, more extended surveys reveal considerable uniformity over sufficiently large-length scales. Fluctuations in the average density of matter diminish as the scale of the structure being investigated increases; this should not be the case in a universe originating from a single big bang and expanding from a single point in time and space. If there were another reason for the redshift other than that suggested by Doppler, the Big Bang hypothesis would be sorely tested.

Another explanation for redshift that should not be discounted is the weakening of light waves across interstellar distances. Investigations by satellite space laboratories on the dispersion of starlight in interplanetary space show that waves travelling considerable intergalactic distances lose energy. In the process, their frequencies ν decrease and their wavelengths λ lengthen. Physicists describe this using the equation, $\lambda\nu = c$, where c = the speed of light. The equation $E = h\nu$ describes exactly how much energy a light wave can lose, where h = Planck's constant. From these equations, we see that

$$\lambda = \frac{c}{\nu} = \frac{ch}{E} \quad (5.1)$$

and

$$\nu = \frac{E}{h}. \quad (5.2)$$

We see, therefore, that combining these well-known equations shows us exactly how much the reduction in the energy of a wave can increase its wavelength. If distant galaxies were not actually moving away from us, but the energy of light waves originating from them attenuated during their journey, a redshift might result. So what would cause the reduction in energy needed to produce a spectral redshift?

A possible cause could be the observation made by Arthur Holly Compton in 1923, now known as the Compton effect. Compton discovered that by scattering X-rays through a metallic foil, their wavelengths became longer. He found that this could be described by the following equation

$$\lambda_1 - \lambda_0 = \frac{h}{m_e c} (1 - \cos \theta), \quad (5.3)$$

where m_e = the electron mass, θ = the scattering angle, λ_1 = the wavelength of the X-ray after scattering and λ_0 = is the wavelength of the X-ray before scattering. The value of the angle θ by which the wave is scattered is critical. The larger the angle θ , the more energy the X-ray loses and the longer its wavelength.

Compton's experiment was conducted using X-rays and metal foil, but the phenomenon relating to gamma-ray bursts might indicate an astrophysical parallel. The wavelength of gamma-rays is considerably shorter than the size of atoms and cannot be reflected or focused. Even grazing incidence optics used for X-rays cannot be used for gamma-rays. When NASA's Orbital Solar Observatory first undertook an analysis of gamma-ray bursts in March 1967, they had to use special detectors to observe these rays. NASA's research found that gamma-ray bursts were of two types: the brightest rays of highest frequency arrived directly from their source; rays of lower frequency arrived shortly after, as if they had been scattered in a manner reminiscent of the Compton experiment.

For Compton's effect to work, there has to be some material or medium in interstellar space capable of causing the same effect as metal foil; of absorbing and scattering electromagnetic waves. One possibility is the existence of frozen particles known as interstellar grains, which are dispersed thinly throughout space. Their effect, taken over the enormous

distances travelled by interstellar light, might be to gradually weaken it to the extent of producing a spectral redshift.

The nature of the interaction of these particles with light depends on the size of the particle and on the wavelength of the light. Light passing through a suspension of chalk dust is dimmed, but its colour is not changed. However, particles comparable in size to a given wavelength, scatter that wavelength more effectively. This process was investigated thoroughly with the data from the International Ultraviolet Explorer satellite by Grzegorz Chlewicki of the University of Leiden. If light is scattered through too wide an angle, it never reaches an observer on Earth, but waves scattered by small angles could be the ones we recognise as being subject to a spectral redshift.

Assuming that Compton-like scattering was the cause of redshift would allow us to reconsider the means for measuring distances to the remote galaxies. As suggested, the use of the Hubble constant for this purpose has proved to be far from satisfactory. It is known that waves passing through shorter distances of space have a less pronounced redshift. When we arrange the already known distance to various stars in a consecutively increasing order as abscissae and the decrease in light frequencies as shown in Figure 5.1, the wave's energy can be defined as

$$E = hv, \quad (5.4)$$

then

$$-dE = h(-dv), \quad (5.5)$$

where dv = the frequency by which the wave decreases and dl = the distance travelled by the wave. As the wave passes from the star to the Earth, its energy decreases as follows:

$$\frac{-dE}{dl} = \frac{h(-dv)}{dl}. \quad (5.6)$$

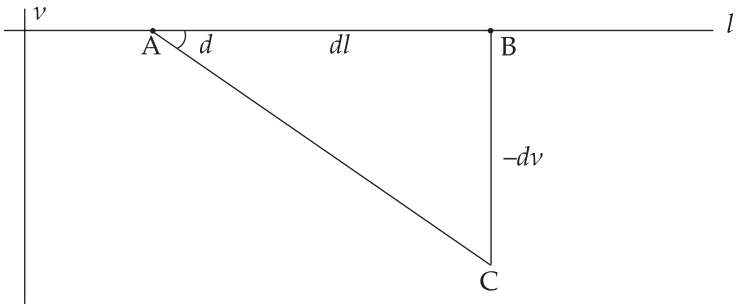


Figure 5.1

Space dust and the coming radiation, where ν = the frequency, l = the distance, A = Earth and B = the star.

Therefore

$$\frac{-dv}{dl} = -\tan \alpha = \text{constant}, \quad (5.7)$$

so that

$$\frac{-dE}{dl} = h(-\tan \alpha). \quad (5.8)$$

To find the distance dl to a star radiating light at frequency ν_s , which we observe as the frequency ν_e , we calculate

$$dl = \frac{d\nu}{\tan \alpha'}, \quad (5.9)$$

remembering that

$$\nu = \frac{c}{\lambda}. \quad (5.10)$$

All that remains is to calculate the universal constant: the tangent of the angle α .

If it were found that the universe is not expanding, we would have to revisit the basis of the Big Bang theory which poses the anthropocentric principles of a beginning and possible end to the universe.

The term 'Big Bang' was introduced by Fred Hoyle in a BBC broadcast in 1950 in order to contrast the theory with his own steady-state hypothesis. Although now widely discounted, his steady-state hypothesis still offers considerable explanatory power that the current theory does not provide. The steady-state hypothesis poses a universe without beginning or end, space and time that are infinite, matter that is continuously being created, and intrinsic properties of the universe that do not change with time. The main attraction of this hypothesis is that it can address the issue of the homogeneous density of the universe. In this regard, it may be worth revisiting the assumptions we have made following Doppler's early observations on the changing pitch of the whistle of passing trains.^{14,46-48}

5.2 The New Physics

Paul Davies, in his book *God and the New Physics*,⁴⁹ poses what he calls deep questions: 'How did the universe begin?' 'What is life?' 'What is mind?' These are the questions that we cannot answer, not because we do not know and we cannot find the physical realities involved, but because these questions imply the antecedent question: 'What existed before the universe came into existence?' The answer of 'nothing' does not give any physical meaning to it. The empty container in our environment always contains air, hence it is not empty. We can pump out the air and then physically it is empty; was the universe a vacuum before matter and light had been (supposedly) created? Then comes the next question: 'What is matter?'

According to the vortex theory, it is the mechanical structure of nuclear elementary particles. Physically, these particles are the vortices of vacuum. They have the internal energy

$$E_i = \frac{1}{2} I \omega^2 \quad (5.11)$$

and the external energy E_x due to their motion relative to the space vacuum

$$E_x = \frac{1}{2}mv^2, \quad (5.12)$$

where I = rotational momentum, ω = rotational velocity and v = linear velocity of a particle—the vortex (see Chapters 2.3 and 3.3).

So here we almost arrive at the creationist's point of view: how did the motion of the vacuum create vortices? This question remains unanswered and this is how far physics can go. When we arrive at the question: 'What is life?', we enter the area of collision with religious dogmas. Physically, it is only the evolution of atomic and molecular conglomerates formed by the mechanical interaction of component vortices; such interactions are powered by a type of electromagnetic force (see Chapter 1.12). The further evolutionary steps to life are the larger molecules and viruses, followed by bacteria, motile bacteria, botany and zoology.

What is mind? It is the apogee of the evolutionary transformation, shunning the dangers and striving for the advantages; this is how the biocomputer has come into existence. Biologically, from euglena to prairie dog to the mind of a professor of mathematics are great steps.

René Descartes, the French philosopher, mathematician, scientist and writer, directed his mind to grasp the imaginary side of the world. He filled his world with vortices of an unknown entity that we now call vacuum, and through the vacuum the planets moved around the sun driven by the unknown forces that we call gravitation and intergalactic electromagnetism; our solar system vortex being rotated and moved between the two hydrodynamic streamlines.⁵⁰

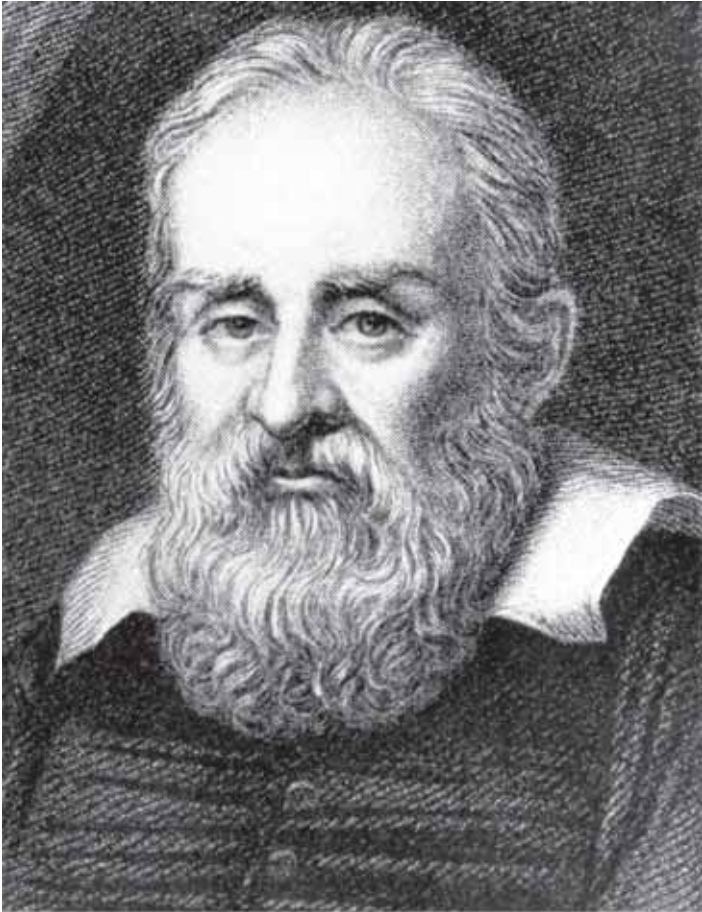
Descartes's 'mechanics of the heavens' theory can be rediscovered now in terms of the vortex theories. He condemned

Galileo's theory of falling bodies in empty space as being without foundation; this was before Newton's discovery of gravitation. Thus, we see how two great minds were working and fighting one another. Descartes concluded that 'Cogito, ergo sum' (I think, therefore I am); he determined his own existence and was not concerned with the existence of his body, nor with the impressions of his senses, but simply with the existence of his mind. Then, what is the body? Just vortices?

5.3 The Cosmos

The Cosmos is the almost empty space where occasionally astronomers find specks of matter and light that they call galaxies. Our galaxy—the Milky Way—is just like any other speck of light, but it is not a common one; it is a highly evolved mechanism. How does it work and exist? It is an electromagnetic vortex combined with gravitational attractive forces that continue to support the original kinetic creation. The combination of these forces have created and powered the existing mechanism of galaxies. The streams of ionized gases moving through space behave like electrons flowing in electric conductors; they produce electromagnetic fields while the gravitational forces of the material particles provide attractive forces as the centripetal forces of the vortices (see Chapter 1.3).

A galaxy can be compared to a two-dimensional electromagnet. This can be made by turning an electric conductor into an Archimedean spiral with an electric current running through it. Similarly, our sun is a vortex of ionized gases between the two streamlines of such a coil which powers it. So now we know where we are in the Cosmos, but still, what about the more mundane picture of it? After having your bath and while emptying the water from the tub, observe the drain; the water turns around and around creating what is known as a



*Galileo Galilei (1564–1642):
Italian physicist, mathematician, astronomer and philosopher.*

whirlpool. Such are the vortices described by mathematicians, and such is our galaxy.

Galaxies are not the only kind of vortices in the Cosmos; the others are electrons (see Chapter 2.3). Nuclear scientists observe such creations in cloud chambers. Nuclear particles are perfect elementary vortices created out of vacuum by very energetic particle motion, such as protons from disintegrating radioactive elements; they produce electrons like very fast projectiles moving through fluid.

In 1845, the Irish astronomer, Lord Ross, was the first to observe the structure of spiral galaxies. Now it has been estimated that one-third of the galaxies in the universe are spiral galaxies. Most of the others are elliptical galaxies; these are the older ones that have their whirlpool streamlines folded on themselves at later evolutionary stages. The structure and consistency of every galaxy depends only on the environment where it evolved by gravitational and magnetic attractions and the existence there of magnetic streamline flows.

When we call the Cosmos 'the extent of the whole unlimited space', and the universe 'the part of the Cosmos that has been observed by astronomers',⁵¹⁻⁵³ then quasars lie near such limits, about two billion light years from the Earth; this is the position of the object 3C273. Many more quasars have been found up until now and their brightness varies to a great extent. This is how we know that the distances involved must be enormous. The observed images suggest that colliding galaxies supply the fuel for quasar energy production. What are the forces that produce such enormous cataclysms in the Cosmos? We must call these forces by their existing names: gravitational force and electromagnetic force. Both have the nature of the Magnus effect, meaning that when two vortices approach one another with their streamlines moving in the same direction, they attract one another, but when their streamlines move in the oppo-

site direction, they repel one another. This can be visualised by using two solenoids or two Archimedean spiral electromagnets approaching one another sideways or polarwise. The latter case illustrates the gravitational fields of the protonic poles. Here the enforcers are the polar ends of the protons, radiating their pulsating (unidirectional) gravitational strings which have only one direction of rotational pulses shining into the Cosmos.

When such rotational pulses shine into the Cosmos and meet pulses from the opposite direction, then only the attractive gravitational strings interact by mutual attraction; the contrary rotating strings avoid meeting one another. The result is that only attractive forces of gravitation exist. There are no anti-gravity forces between matter in space.

5.4 Spiral Galaxies

According to the vortex theory, a spiral galaxy has the structure of a vortex with all its hydrodynamical parameters; the Milky Way can be accepted as a typical model of such a vortical structure. The breadth of this vortex (the diameter of the structure) is 10 times the thickness of it and is the length of the vortex along its axis of rotation.⁵⁴ Within the plane of the vortex, there is a dense concentration of bright young stars, dust and giant gaseous clouds. From its axis of rotation, there are about four spiral arms and our sun is located between these arms at about 25,000 light years (from Earth).

The parameters of the vortex (see Chapter 2.3) describe its properties. The vorticity is seen in the following equation

$$\Gamma = 2\pi r v, \quad (5.13)$$

where r = the radius of the vortex and v = the rotational velocity of a point on the radius.⁵⁵



*Nicolaus Copernicus (1473–1543):
Polish astronomer.*

Vortices are powered in two ways:

1. The forced vortex is energised from outside like a vortex located between two streamline arms of different lengths of the radii in the powering vortex. This is how our sun is powered;
2. The free vortex in the frictionless medium, which rotates only due to its original kinetic energy. When such a vortex enters (or is created in) a medium where there is slight friction due to the medium, then its external velocity slows down while those near the centre remain fast. This is the case with the Milky Way, which slows down due to the external materials being attracted to it.

It is known that all the spiral galaxies have their discs flattened and each has its brightness falling rapidly with the distance from the centre of rotation. Some are dusty and some are clean; this depends on their age and environment after birth.

The dusty matter contained in the galactic disc is about 90% hydrogen and 9% helium. The 1% of the remaining matter contains heavier elements, solids etc, rich in carbon and silicates; these are the remains of burned-out stars.

These space ashes have complex peculiarities. They interact with each other and with the magnetic fields, but they also interact with radiation from the stars—hence the lore of the expanding universe! This dust can absorb and scatter light and produce the Compton effect in the transmitted light. Unfortunately, astronomers considered it to be the Doppler effect and this was accepted to be the result of the receding stars of the expanding universe (see Chapter 5.1).

These dust particles, while annoying astronomers, are very active parts of the galaxy and perform essential services in supporting the existence of this enormous hydrodynamic vor-

tex. Each particle has a kinetic motion with more freedom than an air molecule in our atmosphere. They also have more compelling forces modulating their interactive behaviour. Electromagnetic radiation and streamlines direct them along bent dust lines and spirals where they interact with the stars, planet-like bodies and other floating debris. Sometimes they are whirled into vortices of longer or shorter duration that can eventually form new stars.

Whether they are larger or smaller bodies, each of these particles is reactive to the gravitational forces within its environment and from the centre of the galaxy. These forces move them towards the central rotational axis of the galaxy and hold them back from forming a straight line. Most of them are studded with ionised atoms and molecules, and the electromagnetic forces of the rotating galaxy carries them along.

These same forces cause galactic dust to have the same features as the large scale components of the galaxies. Huge bubbles, tendrils, sheets and clouds have been observed by astronomers. The quantity of gas and dust increases in the closer approaches to the rotational axis; it is densest at 12,000 light years (from Earth), forming molecular rings; the centre of the vortex is nearly empty, which apparently is the mysterious black hole.

When compared to a bath's drain, the vortex must be the conduit of the falling through of the stars and other matter when encountered on its way through space.

5.5 The Theses: The Parameters of Stellar Bodies

1. There are two kinds of inertia: a) linear inertia that we call mass, and b) vortical inertia Γ that we call circulation. They are both connected with matter (see Chapter 2.2);

2. Electromagnetic undulations are limited by their periodic stalls and reversals. This occurs when the accelerated velocity approaches the velocity of light;
3. Linear electromagnetic undulations are transverse light waves; light waves can also be produced by polar radiators. The most important polar, unidirectional radiation is produced by the poles of protons that are gravitational strings;
4. Electromagnetic waves can only be produced by material bodies.

5.6 The Electromagnetic Field of the Galaxy

The galaxy's electromagnetic field is created by ionised matter moving in a straight line. It is the gravitational field that bends the straight line of the original kinetic motion of the ionised matter into a flow that arches into the streamlines of the cosmic vortex. These are the elementary forces of celestial mechanics. The kinetic force of an ionised body produces the electromagnetic force of the vortex, while the gravitational force keeps it on a circular path. As long as these forces are balanced, we have regular hydrodynamic vortices. When such forces are unbalanced and the material is not ionised, the body is not in the hydrodynamical vortex, but in the dark matter existing in space.

5.7 The Sun

The sun has many mysteries which scientists cannot explain. For instance, how does the sun generate its magnetic field? What are the magnetic entities called sunspots? Why does the sun's magnetic field intensity vary approximately every 11 years?⁵⁶ The mass of the sun $m = 2 \cdot 10^{33}$ gm. Each second

$8.8 \cdot 10^{25}$ calories of heat escapes from the sun, that is, $3.68 \cdot 10^{33}$ ergs/sec; where does it take energy to replenish itself?

Sunspots tend to occur in pairs, not at random positions, but oriented east–west. Because the sun’s rotation carries the spots from east to west, the western spot is known as the ‘preceding spot’ and the eastern spot as the ‘following spot’. George Ellery Hale discovered that if one has north magnetic polarity, the other has south magnetic polarity, but the hydrodynamical theory of sunspots was initiated by Vilhelm Bjerknes in 1926.⁵⁷ He suggested that the primary vortices below the visible surface circle of the sun are the potential source of sunspots (see Chapter 5.5).

The sun’s temperature of 15 million°K decreases to 6,000°K in the photosphere and then rises to 10,000°K in the chromosphere, beginning the interaction of the galactic and sun’s vortical streamlines;⁵⁸ pure electromagnetic heating, like in a microwave oven. It is hottest where the electromagnetic field is strongest, in the chromosphere and corona, and as the corona extends into the solar system, we may conclude that it is not nuclear reactions that supply the sun’s heat, but an electromagnetically-produced current from the galaxy that powers the stars and their internal ‘nuclear power stations’.

Discrepancies have been found in the quantities of neutrinos produced in the nuclear reactions of the sun; it is only about one-third of what it is supposed to be. Stars are mostly created, held and powered by their galactic vortices; however, this varies. It depends on their mode of creation, age and later fortunes. Like all other space vortices, they have magnetic fields. When observed equator-ward as we see our sun, it does not appear to be very strong. On the other hand, the stronger star vortices, when observed polarwise, show some extreme electromagnetic-related phenomena. Some of them are so strong that they are called ‘neutron stars’, although there is

no such material in the Cosmos that is composed of neutrons. This is known from nuclear physics.

5.8 Starbursts

Black holes occur only as a small proportion of the galaxy mass, but this is the place where matter is reproduced. In many galaxies, space material is devoured by vortical intakes generating a phenomenon called an active galactic nucleus (AGN). Stars form at a high rate known as starbursts and this is where gas condenses into stars at a rate equivalent to 1,000 suns a year. Some occur in small regions only, hundreds of light years across, and located near the vortical axis of the galaxy; others are much larger.

Starbursts usually take place in galaxies that are going through or have recently undergone a merging process with a neighbouring galaxy (see Chapter 3.26). A massive star often goes out with a bang; a supernova explosion scatters hot X-ray emitting debris.

The existence of AGN has been known for some time, with such structures occurring in the vicinity of super-massive black holes. Researchers like Robert Terlevich of the University of Cambridge and Jorge Melnick of the European Southern Observatory considered AGNs to be a type of starburst.³³

CHAPTER 6

Geophysics

6.1 Gravitation on the Earth

The law of gravitation is one of the most contentious laws in theoretical physics. Everything experiences the gravitational effect on our planet, and by analogy, on other planets and bodies in space.⁵⁹

Theoretical physics abounds in theories that try to find an explanation for why our feet hold so strongly to the ground. Unfortunately, all the theories have one property in common—they do not have a material approach that enables laboratory verification. Often they contradict one another, like quantum mechanics and general relativity. This means that either one of them or both are wrong. There have been many other efforts to find an all-purpose theory, but to date nothing has been found, so we will start right at the beginning with Newton's theory of gravity

$$F = \frac{G \cdot M \cdot m}{l^2} = m \cdot g. \quad (6.1)$$

In this case, the vortex theory finds the explanation by clarifying how each material interacts with each other in space (see Chapter 2.9).

6.2 Gravitational Interactions

Although gravity is ever present, our current instruments and laboratories are not adequate to test space phenomena, but we have such a laboratory on Jupiter's moon Io. Here we can witness gravitational forces producing so much heat that it melts the inside of the moon. When observing this phenomenon on Io, we pose the question: what has melted the interiors of Earth, Venus and other planets and moons? Our moon seems to be solid, but why is this? Often answers bring more questions; this is science. Space laboratories open up new horizons and enable us to learn more about our world and the universe, as have the space probes Voyager 1, Voyager 2 and others.⁶⁰

On Earth we have volcanoes and earthquakes that devastate whole towns and regions, but we have scarcely any real theories about the cause of these eruptions except vague notions about the movement between the Earth's plates. The reason is that we have little understanding of what gravitation does in the universe, but this is changing. Teams of scientists at the California Institute of Technology and the University of California at Santa Barbara have started to improve our knowledge of gravity. Stanton J. Peale and his numerous associates have been studying how gravitational mechanisms work in the complicated apparatus of the Jovian moons. They have found that an enormous amount of heat energy is emitted from the moving parts of moons and planets, so it appears that we must forget the earlier theory that a planet's internal heat results from the remnants of their fiery births. They could have had various beginnings; however,

when they were caught in stellar vortices by gravitational and electromagnetic forces, they were just old and cold bodies of dark matter (see Chapter 5.5). Thus, the descendants of all the material bodies in space did not need to come from one single explosion. Novae and supernovae are new beginnings, and such explosions happen by the million every day. It has been observed by astronomers that a few dozen extrasolar planets float in space without being associated with any star;⁶¹ this is the controversial dark matter discussed by physicists.

6.3 The Interior of the Earth

The land tides on the Earth are not as significant as the ocean tides, but they very often cause earthquakes and volcanoes when a structural abnormality occurs in the Earth's crust. Until recently, our knowledge of the heat these land tides produce and their effect upon the Earth has been limited, but with the research now being carried out on Io, we can recognise the cumulative effect that these tides have on the interior of the Earth and its molten condition. This negates the theory that the Earth's core is made of molten iron (770°C) and that it produces geomagnetism. So where did the proof for this early theory come from?

Through the study of meteorite specimens that fell through our atmosphere to Earth, it was found that they were heated to a very high temperature and that among the silicates and other minerals that made up their structure, they also contained iron. From this it was theorised that a meteorite was the remnant of a destroyed planet and therefore similar to our own. As far as we know, planets do not collide and then eventually fall to Earth. Instead, they are pieces of dark matter and do not contain ionized shining materials. So what is our Earth

made of? There is considerable controversy surrounding this question. One thing is certain: pure iron by itself could not separate from other materials to descend and produce an iron core.

Drilling at the Kola Peninsula produced the deepest well on Earth. The region had been exposed to glaciation and weathering for hundreds of millions of years and lost 5,000–15,000 m of the upper portion of its granitic layer by erosion.⁶² The 12,000 m geological section of the Kola well corresponds to an average continental layer at depths of between 8,000 and 20,000 m below the surface. These results allow us to conclude that in general, there are no mysterious materials contained in the Earth besides what we have already found on its surface.

Since the mass of the Earth is $6 \cdot 10^{27}$ gm and its volume $1.1 \cdot 10^{27}$ cm³, its mean density is approximately 5.5 gm/cm³. The surface rock density is on average 2.8 gm/cm³; the maximum is 3.3 gm/cm³ and it has been posed that the Earth's mantle consists mostly of olivine with such other minerals as chrysolite, peridot, iron, magnesium, oxygen and silica.

To understand the material and the structure of the Earth is to appreciate the total effect pressure and high temperatures have had on the density and molecular structure of its minerals. Consider, for example, the popular sport of ice-skating: why do skates lose their friction on ice? Under the pressure of the narrow metal strip, the ice melts and becomes water. The same applies to the Earth; the hard rock that we see on the surface becomes liquid at a depth of 6,371 km and some liquid substances at still higher pressures become solids, with correspondingly much greater densities. This is what happens to the earthy substances at the Earth's core; the Earth's density increases to 6 gm/cm³ and then to 9 gm/cm³, so could there be heavier unknown substances than iron? Even minerals such as olivine become dense under so high a pressure.

6.4 Directionalities

The vortex theory for cosmology is shown in Figure 1.1. The most important part of the magnetohydrodynamical flow is the direction that the streamlines assume relative to their environment and other entities¹⁴ (see Chapter 2.3 and Figure 3.1).

In electromagnetism, the flow of the electric current in a conductor is the essential factor. The flow of electrons in the conductor drags the vacuum in the environment in the same direction as the current (see Chapter 1.3 and Figure 3.1). When we add another conductor with a current, then the straight line flows according to Biot–Savart law and the curved lines flow according to the Magnus effect.^{10,63} The latter produces the Kutta–Joukowski lift force⁷ (see Chapter 2.7).

In electrical engineering we have solenoids; in topography we have compass needles. Hydrodynamical circular motions like electron vortices are finite motions in space, whereas spiral motions, such as galaxies, are infinite in space and time (excepting cataclysms or termination by viscosities) when the initial kinetic energy is spent.

A vortex can be created by rapid motion due to a ‘kick’ or a longer-lasting effect involving motion with velocities close to the speed of light. This is how neutrinos and electrons are produced.

Present day explanations about magnetic fields have led to confusion among physicists as to the structure of a magnetic compass needle. The sharp end of the needle is a kind of cone. The slanting area around the central sharp projection exudes the ends of the strings of the vortices, which in the vacuum (or air), repel each other and form a funnel-like projection in space, narrowing toward the magnetic pole of the magnet.

Sea navigators noticed the two discrepancies in compass needle behaviour: the inclination and declination. The inclined

needle directs toward the strongest spot where the magnetic vortex forms a whirl and the declined needle shows the direction of the geomagnetic axis south–north, while the geographic axis is north–south; the latter is the rotational axis of the Earth. The compass needle indicates the geographic north pole which magnetically is the south pole.

The Earth does not behave like a permanent magnet, but like a solenoid. With its ionosphere, it forms the two magnetic poles of the vortex, powered by the motion of the ions. The ions are dragged by the rotating Earth's atmosphere to produce an electromagnetic field, like solenoid wires with an electric current.

The solar system is located between two outer galactic vortex streams that keep it rotating due to the differences in their velocity; it is a typical forced vortex with an external energy supply. The constant addition of angular momentum to the sun increases its rotational energy (with a part of it being radiated into space) until the rotation become too fast—faster than the powering vortex streamlines; this takes place for 11 years, then turbulence and sunspots ensue and the atmosphere becomes studded with electromagnetic vortices. Gradually, the speed decreases over another 11 years and then the sun enters a quiet period. The cycle is then repeated.

When the sun enters its turbulent period, the Earth's ionosphere also becomes turbulent, which upsets radio communication and induced electric current in the power supply lines. The lower boundary of the ionosphere is not well defined, but it is considered to be approximately 90 km above the Earth where the density of ions falls roughly to $10^{10}/\text{m}^3$. Extensive studies have been undertaken on this subject in the United States by the National Centre for Atmospheric Research.⁶⁴

The electro-magnetohydrodynamical theories in this book describe the electrical and magnetic phenomena of the Earth

in terms that are more suitable and clear than the present terminology in physics. The basis of these theories is that the electromagnetic field is not turning around the electric conductor, but that fast flowing electrons at a speed of about 53 million cm/sec drag the vacuum that surrounds the wire.

The space plasma environment is dominated by electro-dynamical processes. Solar wind is a plasma with electron and ion number densities of the order of $5 \cdot 10^6 / \text{m}^3$. Our Milky Way, in the manner of other galaxies in the universe, is a spiral vortex of ions and other materials, turning around and producing a magnetic field. Figure 1.1(b) shows a spiral vortex as it occurs in space, but mostly they take place during nuclear disintegrations, for example, neutrinos. In electrodynamics, Figure 1.1(c) depicts a solenoid, but in the solar system it depicts geomagnetism and the solar photosphere. Figure 1.1(d) shows a free electron emerging from an atomic nucleus. It spins in the same sense as the fingers of the left hand would curl if the left thumb were pointed in the direction of the electron's motion.¹⁴

6.5 The Earth's Ionosphere and Geomagnetism

Since the English physician William Gilbert published his *De Magnete, Magneticisque Corporibus, et de Magno Magnete Tellure* in 1600, humanity has been certain that geomagnetism comes from beneath us, in the iron core of the Earth; really it is otherwise. It comes from the atmosphere which starts at about 90 km above the Earth, in the ionosphere. This electromagnetic phenomenon is well described by A. D. Richmond,⁶⁴ but even now, when manned satellites pass the ionosphere, we still consider that the inside of the Earth consists of a ferromagnetic structure that produces its magnetic field (see Chapter 1.8).

The motion of ionised gases dragged by the Earth's rotation is similar to the flow of an electric current that produces an

electromagnetic field (see Chapter 1.6), but there has to be the relative motion of the inductor relative to the surface of the Earth. Since the Earth rotates and carries its atmosphere, there is not much relative motion between them, least of all at the equator. However, the Earth is spherical and so it is only over the Equator that the surface of the Earth moves at about the same speed as the atmosphere. As we move toward the ends of the rotational axis, the radii of the rotation becomes shorter, hence the surface of the Earth near the polar regions become slower relative to the ionosphere, while the motion of the atmospheric polar ends of the vortex become faster (as in every forced vortex). The ionosphere with its currents moves with approximately the same speed; the faster relative speeds occur near the poles. If the Earth did not rotate while the ionosphere rotated around it, geomagnetism would be very strong, as shown in Figure 1.1(e).

6.6 The Enigma of Geomagnetic Reversals

The reversal of the Earth's magnetic field (as known from palaeogeology) cannot be explained in the terms of a hot liquid iron core. The Earth was undergoing surface changes during the formation and shifting of the oceans; there were times when the Earth was frozen.⁶⁵ Considering ionospheric vortical motion as described before, such reversals could be produced by the variations in such a mechanism, although this is not the only possibility, as we will learn.

The analysis by J. G. Negi and R. K. Tiwari of the National Geophysical Research Institute in India suggests that the changes tend to be correlated with certain periodic phenomena in the galaxy.⁶⁶ This was reported in *Geophysical Research Letters* where they explain their statistical methods. The physical basis can be found in Chapter 5.4.

From the sun's atmospheric vortices we can study the electro-magnetohydrodynamics of our star.⁵⁷ An important aspect to consider is how the sun is being energised and how it is matched into the combination of cosmic vortices, that is, into the Milky Way vortex, as indicated in Figure 1.1(f).

In 1893, E. Walter Maunder of The Royal Observatory, Greenwich, found in the Observatory's archives, reports detailing the reduction of sunspots and other activities involving the sun over a period of 70 years, ending in 1715.⁶⁷ In 1843, Samuel Henrich Schwabe, a German amateur astronomer, noted from his own observations that the average number of spots seen each year seemed to go in an obvious cycle of about 10 years. Maunder's observations were confirmed by the Dutch investigator Hessel De Vries in 1958 when he called attention to an anomaly in the abundance of carbon-14 in tree-rings dating from the second half of the 17th century. This appeared to correlate to the sun being abnormally inactive during this time. The De Vries effect has been found in tree-ring data from around the world, confirming the existence of Maunder's findings (Maunder Minimum); this then facilitated the study of records back to 5000 BC and it was found that the Maunder Minimum corresponds almost precisely with the coldest periods in Europe; little ice ages in the 16th century through to the early 19th century. Up until now, it has not been possible to explain these phenomena because a basic physical model did not exist, but now the vortex theory provides such a model; however, we will need a brilliant mathematician and a computer to work it out.

6.7 The Dark Matter Earth

When and how the Earth was created belongs only to religious myths; these are entirely anthropomorphic meditations and

scientific theories do not progress much further. Many people believe either the nebula theory or that the Earth was created by a creator, which in reality, is the same kind of mythology.

Recently, astronomers have discovered planets in the vicinity of other stars, but most importantly, planets that are not within the vicinity of any star, which is something they call 'dark matter'.⁶⁸ The latter is most likely the source of all planets, moons, meteors and comets.⁶¹

From studies undertaken on samples of the moon obtained by astronauts, it appears that the sun, Earth, moon and planets were never a single body as was often assumed, but only casual co-travellers joined by gravitational attraction.^{69,70} A few dozen extra solar planets have been discovered that are not affiliated with any star at all; they are called the 'free floating planets'. We know that Jupiter provides gravitationally-produced energy for its moon Io; the sun does the same for Venus, our Earth and other planets that have a heated core (see Chapter 6.3), but how did the orbital motion start?

The kinetic energy of a moving body before it is caught in the gravitational action of another, preferably heavier body, start to interact gravitationally and if the forces are strong enough, the heavier one prevents the escape of the lighter one long enough to direct it into a circular or elliptical orbit. Since the heavier body is very often a star, a new solar system is formed. However, stars are not the only space entities that produce such couplings; a heavy object like the planet Jupiter (while still free floating in space) can at certain times attract lighter ones like Io, Europa and others. So eventually when such a congregation approaches a still heavier and active vortex like a star, then a new solar system starts forming. The other dark matter objects like Saturn and Uranus are a whole new world for people like us.

Quantum Dynamics

7.1 Particles

From the vortical structure of matter described in Chapter 3 and illustrated in Figure 3.1, we can assume that in a hydrogen atom, the proton and electron are connected in a polar manner, forming a vortex ring. It has been shown that the rotational velocity of an electron vortex is the velocity of light relative to its environment. Since the resistance of the vacuum is infinite at the velocity $v = c$, there must be drag parallel to the axis of the vortex rotation; the velocities of the consecutive layers must gradually slow down away from the initial surface. At a certain distance, which we will call infinity, the drag will cease being effective and the environment will rotate. However, while the ring vortex rotates around its axis, externally (relative to its internal radius) it possesses the velocity of the vacuum through its central doughnut-like hole, which it will blow through.

This is how a particle acquires its backward motion, while a jet-like blow ensues forward. This will eventuate only if the particular hydrogen atom is in an ideal empty space.

It is known that even in interstellar space, there are material particles—space dust—like electrons, protons etc; they produce collisions of atoms and molecules. Hence we arrive at the theories of gas kinetics.

When a cylinder rotates in water, the adjacent layers of water have the same rotational velocity as the cylinder; however, the layers furthest away have slower rotations until they gradually stop. We then start moving the whole cylinder in a direction perpendicular to its rotational axis. Eventually, the velocity of the axis of the cylinder, relative to its environment, has the same velocity as its rotational velocity. We call these velocities v and the surface rotational velocity v_0 ; $v_0 > v_1$ by the slowing-down layer over the cylinder. Then when an electron vortex moves through the vacuum at the velocity v_1 , its rotational is v_0 , so that $v_0 > v_1$.

7.2 The Vorticity of a Vortex

The vorticity of the vortex is $\Gamma = 2\pi r v = \text{constant}$; this means that $2\pi r_0 v_0 = 2\pi r_1 v_1 = \Gamma = \text{constant}$ (see Chapter 2.3). Since $\Gamma = h/m = 7.274$ for electrons, we find that the radius of the electron vortex having $v_0 = c$ is

$$r_0 = \frac{\Gamma}{2\pi c} = 3.86 \cdot 10^{-11} \text{ cm.} \quad (7.1)$$

Then what is its radius when it moves at the velocity of a hydrogen atom at 0°C at $v = 18.39 \cdot 10^4 \text{ cm/sec}$?

$$r_1 = \frac{\Gamma}{2\pi v_1} = \frac{7.274}{2\pi \cdot 18.39 \cdot 10^4} = 6.295 \cdot 10^{-6} \text{ cm.} \quad (7.2)$$

This would be for a single particle, such as an electron or a hydrogen molecule; all atoms and molecules moving through space encounter and collide with other particles.

7.3 Temperature

We accept the parameters of the kinetic theory of gases where P = pressure, V = volume, M = molar weight, m = molecular weight, v = molecular velocity, R = universal gas constant, N = Avogadro's number, k = the Boltzmann constant, θ = temperature and E = energy. The kinetic energy of gas $E_k = PV = R\theta = Nk\theta$ for one molecule of the ideal gas. For one molecule of it $E/N = k\theta = 1/3mv^2$; k = the energy for one molecule of the ideal gas; the Boltzmann constant. So

$$k = 1.38 \cdot 10^{-16} \text{ ergs/degree molecule.} \quad (7.3)$$

The problem here is that we did not consider the structure of the molecule of ideal gas or how it acquired the kinetic energy to move through space at the speed of v_1 cm/sec. Also, when this additional energy dE was acquired, how was it stored? It is better if we use an electron instead of an ideal gas molecule as electrons have a vortex with known parameters which we can consider as it changes during its motion.

When an electron moves from the initial velocity $v = 0$ and acquires the speed of $5.932 \cdot 10^7$ cm/sec, its kinetic energy increases by $dE = mv dv = 1.602 \cdot 10^{-12}$ ergs. Since

$$dE = kd\theta, \quad (7.4)$$

then

$$d\theta = \frac{dE}{k} = 1.1606 \cdot 10^4 \text{ }^\circ\text{K}, \quad (7.5)$$

so

$$\frac{dE}{d\theta} = k. \quad (7.6)$$

By arranging the known equations we get

$$\frac{E}{N} = k\theta = \frac{1}{2}mv_1^2. \quad (7.7)$$

The vorticity $\Gamma = 2\pi rv$. The velocity of the progression of the vortex's axis through space = v and the vortex's rotation velocity at the distant r from the centre are numerically equal (see Chapter 7.2). Differentiating r and v , with Γ being constant, we get

$$r = \frac{\Gamma}{2\pi v} = \frac{\Gamma}{2\pi} v^{-1}, \quad (7.8)$$

$$\frac{dr}{dv} = \frac{\Gamma}{2\pi} \cdot v^{-2} \cdot (-1) = -\frac{\Gamma}{2\pi v^2}, \quad (7.9)$$

$$\frac{dr}{dv} = -\frac{2\pi vr}{2\pi v^2} = -\frac{r}{v} = -\frac{1}{\omega'}, \quad (7.10)$$

where $\omega =$ the angular velocity.

We have already seen in Chapter 7.2 that the $r_0 = r_c = 8.86 \cdot 10^{-11}$ cm and at v_1 the $r_1 = 6.295 \cdot 10^{-6}$ cm when v_1 is the velocity of a hydrogen atom moving through vacuum at $v_1 = 18.39 \cdot 10^4$ cm/sec. This is how we connect micro with macro. Naturally, we introduce generalisations, but this is necessary before we obtain more experimental data and the adaptation of existing knowledge to this new domain.

So finally we can ask: what is the Boltzmann constant k , both physically and mathematically, for quantum dynamics? Physically, it is the bridging between our reasoning in terms of litres, atmospheres, bouncing hard balls of ideal gas molecules and the mathematical abstractions dealing with the heavy metal cylinder rotating and moving through a fluid, such as water or glycerin. The latter are abstractions of a purely mathematical nature. So k is the standard quantity of energy that carries the simple molecule of the ideal gas. This we try to compare with an electron and a hydrogen atom in order to understand what matter is and how it is built.

7.4 Radiation and Nuclear Parameters

The Lemmas

1. All electromagnetic radiations are waves and all material particles are vortices.
2. Whenever a material particle contains so much energy that its motion relative to vacuum has the velocity of light, then such a particle radiates energy by producing electromagnetic waves and in effect loses the extra energy to the extent of $E = h\nu$.
3. If a particle stops radiating and its velocity relative to vacuum gets much lower, then the particle can absorb the radiation from the vacuum which will increase its energy to a similar extent of $E = h\nu$.
4. Dimensionally, in MLT and CGS

$$E \equiv \frac{ML^2}{T^2} \quad (7.11)$$

and

$$h\nu \equiv \frac{ML^2}{T \cdot T'}, \quad (7.12)$$

therefore

$$h\nu = E. \quad (7.13)$$

5. A particle of mass m and the velocity v relative to vacuum has the kinetic energy

$$E \equiv \frac{1}{2}mv^2 \equiv \frac{ML^2}{T^2}. \quad (7.14)$$

6. Force = mass \times acceleration

$$F = ma \equiv \frac{ML}{T^2}. \quad (7.15)$$

7. Force \times length

$$F \cdot L \equiv \frac{ML \cdot L}{T^2} = \text{energy}. \quad (7.16)$$

8. The Compton effect (scattering): when a radiated wave λ_0 is scattered by a particle m , its new $\lambda_1 > \lambda_0$ and the frequency $\nu_1 < \nu_0$.
9. Visible light waves are produced by the polar parts of ions—the opened vortices of atoms. They have the form of a circular front with the rotational oscillations producing the polar waves.
10. Electrons and atoms are the fundamental vortices of matter.
11. The vorticity of a vortex $\Gamma = 2\pi r v$, where r = the radius and v = the rotational velocity.
12. Planck's constant h is the angular momentum of the vortex

$$h = \omega m r^2 \equiv \frac{I}{T} \cdot ML^2 = \frac{ML^2}{T}. \quad (7.17)$$

13. For an electron

$$h = \Gamma_e m_e r, \quad (7.18)$$

$$\Gamma_e = \frac{h}{m_e} = 7.274 = \text{constant}, \quad (7.19)$$

$$\Gamma = 2\pi r v. \quad (7.20)$$

At $v = c$

$$r_e = \frac{\Gamma_e}{2\pi c} = 3.86 \cdot 10^{-11} \text{ cm}. \quad (7.21)$$

The Equation

$$\Gamma v = 2\pi r v v = 2\pi r v \cdot \frac{w}{2\pi} = r v \frac{v}{r} = v^2 = c^2, \quad (7.22)$$

therefore

$$\Gamma v = c^2 \quad (7.23)$$

and

$$\lambda v = c, \quad (7.24)$$

therefore

$$\frac{\Gamma v}{\lambda v} = \frac{c^2}{c} = c, \quad (7.25)$$

therefore

$$\Gamma = \lambda c, \quad (7.26)$$

therefore

$$\Gamma = \lambda c = \frac{c^2}{v}, \quad (7.27)$$

so

$$v = \frac{c^2}{\Gamma}. \quad (7.28)$$

So after these parametric equations we derive the *physical basis* of the famous equation brandished through the previous century

$$E = mc^2. \quad (7.29)$$

This comes from

$$E = hv = h \frac{c^2}{\Gamma} = \frac{\Gamma mc^2}{\Gamma} = mc^2, \quad (7.30)$$

since $h = \Gamma m$ as derived before.⁷

From his experiments in the late 1600s, Newton argued that light is composed of undetectable tiny particles of energy called photons and this is how quantum theory originated. However, the vortex theory assumes that vacuum vortices, such as electrons and protons, are the centres of light wave propagations. The rotational motions of vortices are centred at the poles of their rotational axes and the undulatory motion of waves propagate into the envioning vacuum space. The waves

can be transverse when produced by the sides of the vortices and polar when produced by the poles of the vortices with their axial centres; the rotational velocities approach the velocity of light. Extremely strong rotations are produced in this way. The proton's vorticity is

$$\Gamma_p = 2\pi r v = \frac{h}{m_p} = 3.96 \cdot 10^{-3}. \quad (7.31)$$

As shown above

$$\Gamma v = c^2, \quad (7.32)$$

therefore

$$v_p = \frac{c^2}{\Gamma_p} = \frac{(2.9979 \cdot 10^{10})^2}{3.96 \cdot 10^{-3}} = 2.2686 \cdot 10^{23} \text{ cm/sec} \quad (7.33)$$

and

$$\lambda = \frac{c}{v} = 1.32 \cdot 10^{-13} \text{ cm}, \quad (7.34)$$

therefore

$$h v = 8.75 \cdot 10^{-40} \text{ ergs}, \quad (7.35)$$

so

$$r_p = \frac{\Gamma_p}{2\pi c} = \frac{3.96 \cdot 10^{-3}}{1.88 \cdot 10^{11}} = 2.1055 \cdot 10^{-14} \text{ cm}. \quad (7.36)$$

The area of the proton's pole producing the polar waves is

$$A = \pi r^2 = 1.3927 \cdot 10^{-27} \text{ cm}^2. \quad (7.37)$$

When the area of rotation reaches the velocity of motion relative to vacuum $v = c$, the vacuum is not rotated and the wave departs into space. The built-up strain in the vacuum does not have a proton mass, so the unidirectional waves depart, while the proton produces an identical wavelet again in the same rotational direction. What happens is that the

proton produces the polar unidirectional wavelets in a string-like fashion. This is what is called a 'super string'.

Previously we found that $\Gamma = \lambda c$, hence the wavelet has

$$\lambda = \frac{\Gamma_p}{c} = \frac{3.96 \cdot 10^{-3}}{c} = 1.32 \cdot 10^{-13} \text{ cm} \quad (7.38)$$

and

$$\nu = \frac{c}{\lambda} = \frac{c}{1.32 \cdot 10^{-13} \text{ cm}} = 2.27 \cdot 10^{23} \text{ cycles/sec.} \quad (7.39)$$

The energy of waves $= h\nu = 1.5 \cdot 10^{-3}$ ergs and the force of the proton's rotation is $F = 7.124 \cdot 10^{10}$ dynes/cm.

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