BOOKS BY DANIEL W. FRY

The White Sands Incident

To Men of Earth

Steps to the Stars

STEPS TO THE STARS

By Daniel W. Fry

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When Understanding is added to

knowledge it is but a step

to the stars.

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ABOUT THE AUTHOR

Daniel W. Fry, though still a comparatively young man, (he was born in 1908) has been in a position to observe, in intimate detail, the development of the science of rocketry in the United States. During the second World War, he was employed by the California Institute of Technology to test, at their Eaton Canyon Project, the double base propellant missile which was being developed for the use of our Armed Forces.

He is a charter member and one of the founders of the Pacific Rocket Society, which now has members in all parts of the United States and in several foreign countries.

From 1949 to 1955, he was employed by the Aerojet General Corporation, the world's largest developer and manufacturer of rocket engines. It was during the second year of this employment, 1950, that an event occurred which demonstrated to Mr. Fry the severe limitations and the basic obsolescence of the rocket concept. The event, which he has described minutely in his first book, "The White Sands Incident," also brought to him a number of somewhat advanced and at the same time simplified concepts of the physical science.

This book is the result of some of his attempts to make these concepts available to the general public. Daniel Fry is currently employed as the Superintendent of Research at the Crescent Engineering and Research Co., a rapidly growing concern whose headquarters are in El Monte. California.

He is also the editor of a monthly publication called "Understanding," and the first president of a world wide organization of the same name.

FOREWORD

by Lloyd E. Cannon, Ph.D

"Happy is the man that findeth wisdom, and the man that getteth understanding." *Proverbs 3:13.*

These words, accredited to one of the wisest thinkers of all times, must be the criterion of today's seekers of Truth, as well. However, wisdom and understanding constitute a state of awareness which comes from an unobstructed view of an unobstructed Universe.

Remember the story of the child who was informed by his Sunday School teacher, "From dust ye came, and to dust ye shall return," (no doubt referring to Wise King Solomon's word's: "All go unto one place; all are of the dust, and all turn to dust again.")

At home the little boy happened to roll a ball under the bed, and came running to his mother, exclaiming excitedly, "Mommy, Mommy, come quick! There's somebody in the bedroom under the bed!"

Showing his Mother the rolls of dust underneath the bed, the little boy said, "See. he's either coming or going."

That pile of dust signified to the little lad just one thing, from the "bit of knowledge" he had recently acquired, to him God was in the process of creating another man, or of taking one away.

Here is a lucid example of a rare philosophical idea completely misunderstood and distorted in the mind. All of us react as this little boy did. When we get a "bit of knowledge" we think we have understanding. Or, we become so confused by conflicting viewpoints that we give up before we even start.

This brings us to Dan Fry's unique treatment of laws and theories which have been expounded, more or less by others; but not in this distinctly different manner.

Dan provokes one to think things out for himself. He seems to reach out to you, offering a key to logic simply expressed. One can grasp easily what he says of our Universe and Our Creator.

This man, who has traversed many a step to the stars, breaks down the barriers to an understanding. Through him the mysteries and complexities are deleted. The fresh and clear definitions within the pages of this book make one conscious of a science and law underlying the Universe.

You may or you may not accept what Dan Fry

writes; but as you continue reading through this book, you will certainly think about "Steps to the Stars" and a literal possibility of them.

Many things have been written as to what constitutes a good book. I think that Dan Fry's latest book is a `must' for everyone who has become `Space-Conscious'-a `must' for everyone who is absolutely certain that we are moving into a New Dispensation, when a completely new point of reference is necessary.

Dan throws a search light of understanding on scientific facts which have heretofore baffled many. I feel that any book which unfolds the Wonder and the Glory of God's Creations is a good book-therefore "Steps to the Stars" is emphatically a very special book.

Laure, my wife, tells so much more, in such fewer words than I, allow me her expression in prose.

From the Goodness of His Heart

God reached out and sprinkled our

Heads with a bit of wisdom.

Through pain or knowledge it grew

Into understanding and built the

Steps to the Stars; that human

Footsteps could climb to the

Everlasting Home of Light.

Steps To The Stars

Preface To The Fourth Printing

Because of the continuing and insistent demand for this book, the author has, somewhat reluctantly, consented to a fourth printing, even though the book has been out of print for more than five years.

In the intervening years several of the concepts expressed in the book, which were completely new to cosmology when the book was first published, have now been generally accepted because of new evidence obtained during the recent Geophysical year. Some of the statements, however, which were perfectly true when the book was first published, only nine years ago, now sound almost as if they were prehistoric utterances. For example, the statement on page 37 indicating that the greatest height achieved by any rocket was little more than 250 miles. This statement was perfectly true in 1955, but sounds utterly ridiculous in 1965. We are, however, allowing the 1955 statements to remain in the book as a reminder to the reader that the present rate of scientific progress is such that it constantly amazes even those who are foremost in its pursuit.

INTRODUCTION

The establishment of contact between earthmen and extraterrestrials, is by no means a new phenomenon. Individual instances of such contact have been recorded as far back as the written history of the earth can trace. They usually take place at a time when our earthly civilization, or some deserving portion of it, is in dire need of such assistance. The possibility of such contacts is usually doubted and denied by almost everyone except those who are actually contacted, yet some great good, some definite advance along the path toward true civilization seems invariably to follow such a visitation.

It is not the purpose of this book to trace these incidents back through history; but a single example may serve to illustrate the point. There is a legend in our country's history to the effect that one of the men who assisted in the formation of our constitution was a man who apparently was completely unknown to any of the others. His name does not appear on the document, and as far as can be scertained, he was never seen again after its completion. Yet it was he who, time after time, stepped into the breach when a deadlock seemed certain between opposing beliefs or interests, and pointed out a simple compromise which was acceptable to all parties. Of course, this is only a legend; it is not mentioned in any of our elementary or high school history books, probably because it seems to smack of metaphysics or the occult. Nevertheless, it is a subject which has been discussed in all seriousness by intelligent and learned men. As an example, I offer the following excerpt from an oration before the American Philosophical Society by David Rittenhouse, well-known astronomer, physicist and philosopher, in 1775.

Speaking on the possibility of extraterrestrial life and intelligence, Rittenhouse said- "Neither religion nor philosophy forbids us to believe that infinite wisdom and power, prompted by infinite goodness, may throughout the vast extent of creation and duration have frequently interposed in a manner quite incomprehensible to us when it became necessary to the happiness of created beings of some other rank or degree.

"How far indeed, the inhabitants of the other planets may resemble man, we cannot pretend to say. If, like him, they were created liable to fall, yet some if not all of them may retain their original rectitude. We will hope they do. The thought is comforting. If their in habitants resemble man in their faculties and affections, let us suppose they are wise enough to govern themselves according to the dictates of that reason their creator has given them, in such a manner as to consult their own and each other's true happiness on all occasions. We 'e will hope that their statesmen are patriots and that their kings, if that order of beings has found admittance there, have the feeling of humanity. Happy people! Perhaps more happy still that all communication with us is denied."

♦ ♦ ♦

This statement is a direct answer to the question which is being asked by millions of people today, yet as we see, this question was asked and answered one hundred and eighty years ago. It has also been asked and answered many times in previous ages and eras. Today we find that the same "Infinite wisdom and power" prompted by the same "Infinite goodness" has again interposed in a manner quite incomprehensible to most of us, at a time when it was certainly necessary; not only to the happiness, but to the very existence of created beings on earth.

There is one significant fact which we should always remember. The present series of extraterrestrial visitations began at the exact time when the thinking men of earth had begun to realize with terrible certainty that mankind had at last achieved the ability to destroy itself completely, *without* having acquired the understanding necessary to prevent itself from doing so.

Scientists, philosophers, and statesmen were desperate. There seemed to be no way in which the holocaust could be prevented.

During the last year (1955) however, a tremendous change has become apparent in international relationships. A change which makes it obvious that in spite of the disbelief and ridicule with which they were met, our visitors are accomplishing the purpose for which they came.

If in future years, the present series of visitations should, in its turn, become reduced to mere legend, history will nevertheless record that this era produced, not only the greatest danger which our civilization has ever faced, but also the greatest advance in our ability to understand ourselves and each other.

Most of those persons who have, in one way or another, established contact with extraterrestrial intelligence, or to put it in the usual way, with beings from other worlds, have, as a result of this contact, received, among other things, certain somewhat advanced concepts of the physical science. Too often, however, the recipient of these advanced concepts is almost or totally unfamiliar with our present position and beliefs in the scientific field. The result is that when he attempts to make public these advanced thoughts, they are usually rejected by our scientists on the ground that there is no apparent connection between them and our present concepts.

In the physical science of today, the algebraic formula or equation is the dominant factor. Our greatest scientists are the first to admit that we have but little actual understanding of the ultimate laws or facts of the Universe. We do have a great mass of mathematical formulae, by the use of which we can, with a fair degree of accuracy, predict the results of certain physical conditions. In recent years, however, there have been comparatively few attempts to reduce these formulae to simple concepts which can readily be grasped by the mind. There has been a growing tendency among our scientists to adopt the attitude that "if we know what happens, and how it happens, then there is no need for us to concern ourselves with why it happens." In other words, we have a great deal of knowledge but very little understanding.

This book is being written with the hope that it may bring a little of the light of simple understanding to bear upon a few of our more puzzling mathematical 'laws,' and to demonstrate that a pathway can be laid from our present, rather confused position, to the firmer ground of the new age of science.

For thousands of years man has dreamed of the day when, at last, he will break the bonds of his terrestrial prison and soar freely out into space, to explore at will, the utmost reaches of a boundless universe. The time has come when man is about to realize this ambition of the ages. Men now living will stand upon the surface of Mars and Venus, and a few will observe at close range the fourteen major planets which orbit about those next nearest luminaries known to us as Alpha and Proxima Centuari.

Man's attempt to escape from the irksome confines of his tiny planet has always been hampered by his lack of understanding of four of the basic factors of the universe: gravity, space, time and energy. It has always seemed that there was too much of gravity and space, and not enough of energy or time. About the year nineteen hundred and five, however, it was brought to man's attention that these factors were not the absolute and independent entities that he had always considered them, but that they were variable factors, the value of each of which depended upon the value of the others. Thus the first faint light of understanding began to struggle through the dense screen of absolute determinism which had been erected about the physical or material science.

Unfortunately, our men of science, instead of pursuing this bright gleam of truth, attempted, from force of habit, to shape it into the common pattern of knowledge, by reducing it to mathematical formula which could be used without the necessity of understanding it. We are nearing the limit of the progress which can be made through blind knowledge. If we are to reach the stars we must forget for a time many of the things which we think we know, and strive to learn instead what we can understand.

Those who open this book with the hope of finding herein a blueprint for the construction of a space ship may be disappointed, for no such blueprint will be found within these pages. While I am convinced that such a craft will be built within the next ten years, I have no desire to accept the responsibility which will devolve upon the individual who first builds one. It is interesting, however, and perhaps helpful to consider and discuss the basic physical concepts necessary for the construction and operation of a true space vehicle.

CHAPTER ONE

THE NONLINEARITY OF PHYSICAL LAW

It might be wise, first to devote a little time to the consideration of what we will call the `nonlinearity of physical law.'

A few years ago, our physical laws were considered to be linear. That is: we had, by trial and error, by observation and test, developed a set of laws which apparently held true for all of the small segment of nature, which we were able to observe at the time. We assumed, therefore, that these laws would hold true in any segment of nature, no matter how far removed from our point of observation. When, however, the study of physics moved into the microcosm, that is, when we began to examine the interior of the atom, we found there a set of laws which did not agree with those to which we had been accustomed. They too appeared to be linear, but operated at an angle to our established laws. The same disturbing situation was discovered in the macrocosm. When our astronomers developed the giant telescope capable of peering many millions of light years into space, they found there, still another set of laws operating apparently at an angle to both of the others. For a time, we attempted to accustom ourselves to the existence of three sets of physical laws, each set linear within its own range of observation, but each set operating angularly with respect to the others. Then, with the development of the principles of relativity, we began to realize, or at least we should have realized, that these different sets of linear laws were not actually linear, nor were they different sets of laws, but that they were simply three segments of the one great curve of natural law. As long as we were dealing with quantities which could be observed with the unaided eye or with simple instruments, we were unable to detect the curvature, because the segment we were observing constituted such a tiny portion of the curve that its deviation from linearity was too slight to be detected. For most practical purposes connected with the ordinary mechanics of our daily lives, these laws are still considered to be linear. Calculations are simpler when they are so considered, and the resulting error is negligible. For the same reason, a surveyor who is surveying a small residence lot does not find it necessary to take into consideration the curvature of the earth, because the error resulting from this neglect is not detectable even by the most sensitive of his instruments. If, however, the surveyor is to make accurate measurements of large areas such as a State or a Continent, it does become imperative to consider the curvature of the earth's surface, and to do this, of course, it is necessary to have a reasonably accurate knowledge of the radius of that curvature.

The necessity of an accurate determination of the radius of curvature of the natural laws was first realized perhaps by the late Dr. Einstein, who devoted a large part of his life's work to this problem. The results which he obtained have filled a number of text books, and have been of inestimable value in the progress of the physical science. They proved to be the key which opened the door to the utilization of nuclear energy, and as soon as a successful effort is made to reduce these mathematical formulae to simple concepts easily grasped by the mind, these concepts, together with the additional truths which will then become self evident, will open the door to space travel with a surety and ease which we would now find hardly possible even to imagine.

The difficulty with our present mathematical approach to the problem of relativity lies not in any error of the mathematics themselves, but in the fact that the methods and terms used in the attempt to explain them, often lead to incorrect thinking and assumptions.

For example: the best known formula perhaps, which has emerged from the study of relativity, is the expression $E = MC^2$ which simply states that the quantityof energy (in ergs) which is inherent in any mass, is equal to the number of grams of that mass, multiplied by the square of the quantity C. The quantity C is considered to be a constant, in fact the only constant which has survived in a relativistic world.

In almost every text book on physics in the world today the statement is made that the quantity C represents the velocity of light (in centimeters per second), yet every student in the world who has studied the subject, knows that the velocity of light is not a constant. That its velocity, in fact, varies slightly with each different medium through which it is propagated. Any student who has ever passed a beam of sunlight through a prism to produce a spectrum of color, has demonstrated that not only does the velocity of light vary in different media, but that the change in velocity varies somewhat with the frequency of the light when propagated in material media. This of course is the principal upon which all of our spectroscopes are designed, although most textbooks state merely that the light is refracted or 'bent' in passing from one medium to another. There are many who will dispute the statement that the change in velocity varies with the frequency, but when sufficiently precise tests are made. entirely within a single medium, the results indicate convincingly that this is true.

At this point most students will remark that the quantity C refers to the velocity of light in a perfect vacuum, but where in the universe can we find a perfect vacuum in which to test this assertion? Astronomers and physicists have estimated that even in the remotest depths of intergalactic space there will probably be found, from three to seven nuclear or atomic particles per cubic centimeter. A beam of light traveling at approximately $3x10^{10}$ centimeters per second would still encounter a rather large number of such particles during each second of its journey. While it is true that the proportionate decrease in velocity which would be produced by this minute concentration of matter is so small that it might be negligible for all practical purposes of measurement, nevertheless it demonstrates the fact that we have chosen as our sole remaining 'constant,' a quantity which actually can never be a perfect constant anywhere in the known universe.

Fortunately there is a value to which the quantity C can be assigned which is a constant. Moreover the assignment of the quantity C to this factor makes possible a much better understanding of the natural laws involved in the propagation of energy.

The quantity C is actually the kinetic energy equivalent of the mass energy of matter. In other words, if we take a gram (or any other quantity of matter: Newtonian mass) and convert that matter gradually into energy according to the formula $E=MC^2$, and if the resultant energy, as it appeared, were constantly

applied to the remaining matter in such a way as to accelerate it uniformly in a given direction, when all the matter had been so converted we would find that we had zero

Newtonian mass, infinite inertial mass, and a resultant velocity equal to the quantity C, or approximately $3x10^{10}$ centimeters per second (with respect to the given reference or starting point). The maximum velocity attained would always be the same regardless of the quantity of matter with which we started. This is a fact which can easily be verified by anyone who is mathematically inclined, and who is familiar with the laws of acceleration. The energy required to accelerate each gram of mass to the velocity C through energy conversion is exactly equal to the total energy inherent in any matter having that mass.

This fact forms the true basis of the statement in our present day physics that the velocity C is a maximum or limiting velocity, since it represents the greatest kinetic energy differential which can exist between two given reference points. Since a good understanding of this concept is of great importance, it will be referred to again, and discussed more fully in the chapters on energy and matter.

We must always remember that our ordinary physical laws, as they are usually expressed, do not hold true when carried to an extent which permits the error to be measured, because they do not follow a straight line reaching to infinity, but a curve of finite radii. In a

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timeless universe, this curve would be represented by a circle, but since the laws operate through time as well as space, the curve is more readily understood if depicted as a 'sine wave.' In this case the base line of the wave represents zero, and the portions above and below the line represent the positive and negative aspects of the law.

Thus we see that there are points and conditions in which the natural laws reach zero value with respect to a given reference point, and that beyond these points the laws become negative, reversing their effect with respect to the observer.

The constant repetition of the term 'reference point' or 'observer' is necessary to emphasize the frequently unrecognized fact that none of the basic factors of nature have any reality or significance except when considered from a specified position or condition.

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CHAPTER TWO

GRAVITY

Perhaps the greatest obstacle to man's achievement of his dream of space travel has been a factor which has been given the name of Gravity. Its 'discovery' is usually credited, in elementary school text books, to a seventeenth century mathematician and physicist, Sir Isaac Newton. Actually, of course, every man 'discovers' gravity soon after birth; and the stone age man who first roiled a boulder down upon the head of the cave bear who was attempting to scramble up the cliff after him, was making a practical application of this force. It was, however, Sir Isaac Newton who first made a complete mathematical analysis of the subject. His conclusions were compatible with subsequent observation and test, and were virtually unchallenged until the dawn of the era of relativity.

In brief, his conclusions were that gravity is a quality which is inherent in all matter, and that it manifests itself as a mutual attraction between all bodies of

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matter. The value of this attraction between any two given bodies was said to be directly proportionate to the product of their mass, and inversely proportionate to the square of the distance between them. The attraction between the earth and an object near its surface is known as the weight of the object. The difficulty with the statement that the force varies inversely as the square of the distance lies in the implication that if the distance becomes zero, the force should become infinite. Thus it would at first seem that a man standing or lying upon the surface of the earth would be one of two bodies between whom the distance was zero, therefore, the weight of the man should be infinitely great. The reply to this assumption is that the force acts as though it originated at the center of the mass, called the `center of gravity,' and that. the man on the surface of the earth is still some four thousand miles from its center of gravity. This explanation, however, creates a new problem in that, if we accept it literally, we must assume that if there were a well or shaft extending to the center of the earth. and if a man descended this shaft, his weight would increase as he approached the center of gravity, becoming infinite as he reached it. Actually, of course, his weight would decrease, becoming zero when his center of gravity coincided with that of the earth. So we are forced to the further explanation that gravity is inherent, not in `bodies,' but in particles of matter, and

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since a man at the center of the earth would have an equal number of particles attracting him from every direction, the resultant of the forces would be zero.

If we assume the gravity to reside independently within each atom, our problem is solved as far as the man and the earth are concerned, but if we look within the atom itself in the attempt to find the point where the distance becomes zero, and the force infinite, we find that the same problem again confronts us. We have not solved it, we have only changed our scale of observation. There is conclusive evidence that the attraction, called the binding energy, which exists between the Newtonian particles, (the protons and the neutrons) is intense almost beyond our ability to describe. This force, however, does not increase uniformly with increasing mass, but at certain points not only reaches zero but actually becomes negative.

We can demonstrate this fact by adding a single unit of Newtonian mass, a neutron, to the nucleus of an atom of Uranium 235. When this is done, we find that the gravitational force within the nucleus, instead of increasing actually becomes negative, that is, the attraction between its parts becomes a repulsion, and the parts begin to separate with considerable brisance. During the expansion, however, several new centers of gravity are formed, which, because of the smaller amount of mass involved in each, are strongly positive. The result is that two or more simpler atoms are

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formed, plus a few neutrons which have acquired too great a velocity to be captured by this regrouping process.

This phenomenon, if carefully examined and considered, will furnish several strong clues to the nature of gravity itself, but let us for the moment, content ourselves with the observation that it demonstrates that a gravitational field can, under certain conditions, become negative.

Because of the manner in which our gravitational laws have been expressed, it has commonly been assumed that a gravitational force can manifest itself only as an attraction between two bodies of matter. This is not, however, a necessity of thought, since there is no logical reason why it should necessarily be true In fact if it were true, it would set gravitational fields apart as the only force fields with which we are familiar which could not produce a repulsion, as well as an attraction between bodies of matter. The reason for the assumption of a universal attraction is simply that all of our early and limited observations seemed to indicate that this was true. However, as we have already mentioned, any number of observations, if made on a sufficiently limited scale, will tend to indicate that the earth is flat, rather than spherical.

For many years a school of thought existed which recognized that gravitational fields, like all other fields, must possess a dual polarity, They called these poles,

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gravity and levity. They assumed that some objects and materials normally possessed the quality of gravity, while others normally possessed the quality of levity. An object possessing levity would be repelled by all objects possessing gravity. The theory eventually became discredited, and was almost universally discarded, not because it was ever disproved, but because so many attempts had been made to assign this quality of levity to objects and materials which did not actually possess it. For instance it was, for a time, assumed that gases such as hydrogen and helium possessed levity because when they were contained in a light bag or envelope, they were observed to rise against the gravitational field. It was soon demonstrated, however, that their rise was caused, not by any quality of levity, but simply because of the fact that their specific gravity was less than that of the air they displaced. After a number of unsuccessful attempts to assign the quality of levity to specific materials or objects, the theory fell into disrepute to the extent that the very word levity has become synonymous with humorous nonsense. Nevertheless, the philosophers who developed the theory were perfectly correct in their primary postulate. They erred only in failing to realize that gravity and levity are not properties of specific materials but are conditions under which all matter may come.

We have now observed negative gravitation in the

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microcosm (the interior of the atom), we also observe it in the macrocosm, (between the galaxies).

Many technical articles have been written in recent years concerning "Our Expanding Universe," yet where, in any of them, can we find any logical explanation or reason why it should expand at all? Under the theory of universal attraction, all of the matter in the universe should be rapidly coalescing into one gigantic lump. Instead, we find that every one of the large groups of stars which we call 'galaxies,' is rapidly retreating from every other group, at velocities which increase with their distance from the observer. Velocities of recession exceeding 25,000 miles per second have been calculated.

A number of interesting but hardly convincing theories have been advanced in the attempt to reconcile the observed state of the universe with the existing concept of universal attraction. Some of our cosmic theorists have proposed that at one time all of the matter in the universe was contained in a single tremendous star, or 'atom.' For some reason, which is not given this atom exploded, hurling outward the matter which has become the star clusters, and imparting to them the motion which we now observe, several billions of years later. Since this theory will be discussed further in succeeding chapters, we will only point out here that such a theory will not stand up when examined under our linear concept of physical

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law. In the first place, such an inconceivably huge mass of matter, even at the very great temperature which was assumed for it, would, under Newtonian laws, produce a gravitational field so intense that no velocity less than that of light itself would be an `escape' velocity. In fact it has been calculated that even the light emitted by this huge sun would not escape completely, but would circle in a comparatively small orbit about it. Through the concept of the curvature of physical law, however, we see that the addition of mass to an existing body does not, necessarily, increase the force of attraction between its parts, but may, under certain conditions, cause the field to become negative, and the attraction to become a repulsion. We can explain the observed actions of the present universe by postulating that an attraction exists between the individual bodies within a galaxy, because their total mass and distance is such that they are within the positive portion of the gravitation curve with respect to each other. In the vast spaces between the galaxies however, the curve dips below the zero line, with the result that a repulsion exists between the galaxies themselves. This also explains why matter, although rather evenly distributed throughout the known universe, is not distributed uniformly, but is found in quite similar concentrations at comparatively regular distances.

At this point we hear someone say, "These explanations

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may be very interesting to the astronomer or to the theoretical physicist, but how can they help us in achieving space travel?" The answer is, of course, that we must have some understanding of the physical laws before we can make the proper use of them in attaining our own personal ambitions.

In his dream of space travel, man has generally considered only three possibilities of escaping from the earth. First, gravity must be destroyed. That is, the operation of the gravitational field must cease between the space craft and the earth, so that it will not hinder the departure of the craft. While a number of highly imaginative stories have been written along this line of thought, no theory has ever been evolved, or test conducted which could give us any hope that such a condition can be achieved.

Despairing of the first possibility, we pass on to the second. Gravity must be shielded. Some type of screening material must be interposed between the craft and the earth to cut off or absorb the gravitational field so that while it still exists, it will no longer act upon the craft. Here again we have found imagination raising our hopes, and reality disappointing, for no material has been discovered which shows any promise of fulfilling such a function. With our hopes considerably subdued, we pass on to the third possibility. Gravity must be overcome. We must apply a greater force, so that we can rise against the pull of gravity, even

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though we must pay an exorbitant tribute of energy for each foot of progress. In this last plan, we have a slight degree of initial success. Rocket motors have fought and struggled their way upward against the implacable, if impersonal, pull of the earth's gravitational field, for distances of up to two hundred and fifty miles. `'While this is a very small step toward complete escape from the earth, the fact that any progress at all could be achieved, has so stimulated the age old ambition, that science is now devoting a large portion of its total efforts to this 'last hope of escape.'

When man attempts to attain his ends by pitting one natural law against another, he usually finds that it is a wasteful and laborious process. While it is true that it is perfectly possible to propel a rowboat by throwing rocks from the stern, it is not a method which an intelligent man would choose if he were aware of other possibilities. In the first place, the thrown rock must accelerate, not only the boat, but all the rocks which remain to be thrown. If a long journey were planned, the greatest problem would be to find enough room in the boat to store the required number of rocks. Since the thrust produced is equal to the mass of the rock multiplied by the velocity of its ejection, it is obvious that there are three limiting factors. First, there is the total mass of the available rocks, which is limited by the size of the boat which contains them. Second, there is the total amount of energy available. (This is a

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factor only because we have so little understanding of the true nature of energy.) The third, and at the present time the most serious factor, is the limited mechanical strength of the throwing arm.

In a rocket motor, the 'rocks' are represented by a gas produced by combining or 'burning' the fuels within the combustion chamber, The gas, at a high temperature and pressure, is expelled through an opening or 'venturi' in the stern. Since the amount of fuel is limited by the size of the rocket, the only means of increasing the total thrust is to increase the velocity of ejection, but this can only be accomplished by increasing the temperature and pressure of the gas within the combustion chamber. Regardless of the amount of energy which is available, the amount of thrust which can be produced is limited by the ability of the chamber to withstand the temperatures and pressures involved. Since these limits are reached (and often exceeded) by ordinary chemical energies, it is clear that the vastly greater energies available in nuclear reactions are, at the present time at least, of academic interest only to the rocket engineer. In the case of craft which remained in our atmosphere, of course, more 'rocks' could be taken aboard while in flight, by scooping up the atmosphere through which the ship was traveling, and allowing the surplus energy to act upon it. In space flight, however, this is not possible, and it is hardly likely that the efficiency of the rocket motor can be

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increased sufficiently in the near future to permit of practical or economical space travel.

Actually, the rocket has been obsolete for centuries. There has not been a single basic advance in the rocket concept since the year 1214 A.D., when the invading hordes of Genghis Khan were met by the .military ordnance rockets of the Chinese defenders in their walled cities, more than seven hundred years ago. True, we have produced stronger combustion chambers, we have improved slightly the shape of the venturi, and we have developed fuels with considerably higher specific impulse, but we have done nothing to advance the basic concept. We are still propelling our boat by throwing rocks over the stern.

Men now living will stand upon the surface of Mars and Venus, but they will not go there in a rocket. There are better and simpler ways.

It is time to reexamine our position to see if there is not something we have overlooked. Have we forgotten the old saying, "If you can't. lick 'em join 'em?"

We have tried for centuries to 'lick' the force of gravity. We have tried to destroy it, and failed. We have searched for some method of shielding ourselves from its effect. We have not discovered it. We have attempted to overcome it by opposing it with superior force, and found it a wasteful and cumbersome process. Isn't it about time we gave up the idea of fighting the

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force of gravity, and began to consider the possibilities of making use of it?

We have learned that gravity, like all natural factors, has a negative, as well as a positive value. If after building our space craft, we could arrange conditions so that the ship was in the negative portion of the gravitational curve, it would fall away from the earth as easily and as naturally as a stone dropped from a tower falls toward the earth.

Of course, we hear at once the objection that, while negative gravitational fields have been shown to exist, they have been found only within the atom and at inter-galactic distances. How can we place a space ship within the negative portion of the curve, with respect to the earth? The answer to this question lies in the fact that, as we have already learned, the natural laws are not absolute, but relative. That is, the size and shape of the curve of one law is dependent upon the value and position of the others. We have seen that the nucleus of the atom of uranium 235 dips below the zero line with the addition of only one mass unit, making a total of 236, yet the nucleus of the atom of uranium 238, although close to the zero line is still on the positive side of the curve because of the fact that the shape of the gravitational curve is modified not only by the mass present but also by the number and position of the electrical charges.

Lest someone charge us with ignorance by pointing

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out that there are the same number of electrons (92) in each of these atoms, we will make haste to state that we refer not only to the charges in the outer shell of the atom but to those within as well, and especially to the fact, not always realized, that the neutron possesses both a positive and a negative charge, although when united within the neutron they are not discernable as charges, but exist as energy which produces the gravitational field).

When we acquire a better understanding of the laws, we will be able to produce any shape of curve we desire, with the earth as one reference point and the spacecraft as the other.

Suppose you were to hand a bar magnet and a similar bar of soft iron to a man who was intelligent, but uneducated, with the request that he examine and test the two objects in order to determine their properties. One of the properties which the researcher would be certain to list would be the 'inherent' property of mutual attraction between the two objects. He would observe that when either end of one bar approached either end of the other bar, a condition of attraction was observed. He would probably conclude that the attraction was an inherent quality of these objects, and that it would continue to persist regardless of anything which could be done.

We know, of course, that if a length of insulated wire were wound around the soft iron bar, and a

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flow of electrons were induced in the winding, the two bars could be made to exhibit a repulsion as readily as an attraction. Note that in this case we have not destroyed the field of the permanent magnet, we have not shielded the field, nor have we overcome it. We have simply produced a field which is in opposition to it, or to state the case more concisely, we have polarized the field, by placing one end of the soft iron bar within the negative portion of the magnetic curve with respect to each end of the permanent magnet which is already so polarized.

The same possibility exists with respect to gravitational fields except that the results are not obtained in quite the same way. It is not too difficult, however, to work out means of polarizing a gravitational field, once we discard the old assumption that it is impossible.

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SUMMARY

To sum up as concisely as possible, the conclusions reached in our discussion of the factor of nature which we call gravity, we will propose the following corrections and additions to the gravitational theory as it is now commonly taught.

1. The law of gravity is not a linear law but follows a curve common to all factors of nature.

2. The gravitational field does not diminish precisely as the square of the distance as Newton believed, but because of the curvature of natural law, it diminishes normally at a slightly greater rate so that it reaches zero value, not at infinity as is usually supposed, but at a finite distance or degree of separation. Beyond this distance or degree of separation the force becomes negative.

3. We can define a gravitational field as negative when the application of the factor called time tends to increase the degree of separation between any two reference points in the factor called matter.

4. The value of the gravitational field at any given point is controlled by the values of the other factors of nature at that point.

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5. The electric charges within the atom are a factor which modulates the shape of the gravitational curve of the nucleus.

6. Gravity is not the enemy of space travel. It is a friend, but there must be true understanding before the friendship can bear fruit.

7. It is perfectly possible to produce a negative gravitational field between the earth and a given object on or near its surface by the proper application of moving electric charges. Such a field would be effective only with respect to the given object. All other matter in the vicinity would remain within the positive portion of the curve.

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CHAPTER THREE

MATTER AND MASS

Much of the confusion which exists in our scientific concepts today is brought about by our failure to distinguish carefully between matter and mass. Until a comparatively few years ago, it was assumed that mass was a property which was exhibited only by matter. Upon closer examination, however, it appeared that energy also possessed mass, since when energy was added to a body, of matter, the mass of the body was increased.

We should, perhaps, pause at this point to define the terms which we are using lest we add to the confusion instead of resolving it. Mass is defined as resistance to change in the existing state of motion. It is measured by the amount of the energy which is required to produce a given change in velocity. All matter has the property of mass, but not all mass has the properties of matter. For the purposes of this discussion, we will postulate that there are two types of mass, inertial

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mass, which is simply the property of resistance to change in a state of motion, and the mass inherent in matter, which we will call Newtonian mass, because it includes all mass which obeys the original laws laid down by Sir Isaac Newton. Since the reader may be under the impression that all mass obeys the Newtonian laws, let us pause here long enough to examine the facts and to point out the differences in the properties of inertial and Newtonian mass.

All physicists of today are agreed that the electron has mass. Yet if it were possible for us to hold an electron between two of our fingers and then suddenly release it, we would find that there was not the slightest tendency for the electron to fall to the earth (unless the surface happened to be positively charged at the moment). The electron is not in the least affected by the gravitational field of the earth, so long as it is at rest with respect to that field (if the electron is moving through the field, however, the direction of the motion will be affected).

The electron has mass only because it has an electric charge. As we know, when an electric charge is accelerated in space, a magnetic field is produced, and energy is required to produce this field. The energy 'spent' in producing this field, is said to be the 'mass' of the electron, since it is the entire cause of its resistance to acceleration. The greater the degree of acceleration, of course, the more intense the field, and the

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greater the amount of energy required to produce it. So we say that the electron gains `mass' with every increase in its velocity. If an electron could be accelerated to the velocity C, (commonly called the velocity of light), it would have acquired the maximum velocity with which energy can be propagated. It is obvious, therefore, that no amount of energy could further accelerate this electron. (with respect to its original reference point), so it would be considered to have acquired 'infinite' mass.

Let us take time to examine this statement carefully, since it is a point upon which there is much confusion. The electron would have acquired infinite mass only in reference to its original energy level. If observed from a reference point which had itself received the same degree of acceleration, the mass of the electron would not have changed a particle. This increase of inertial mass with increasing velocity, is simply the measure of the kinetic energy differential between the observer and the point which he is observing.

We will attempt a simple analogy, in the hope of making this more readily understood. An observer is stationed in 'free space' far from any gravitational or other fields which might affect the results of the experiment which he proposes to make. He has in one hand, a sphere of cork or other light material which has a mass of 10 grams. In the other hand he has a pistol which fires bullets also having a mass of 10

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grams and a velocity of 1000 feet per second. The man holds the ball out at arms length, and fires a bullet from the gun into it. The bullet is not absorbed by the cork, but shares its kinetic energy with it, so that after the impact, the bullet and the cork ball each have a velocity of 500 feet per second. The observer now fires a second bullet at the cork. This bullet also has a velocity of 1000 feet per second with respect to the observer, but now the target has a velocity of 500 feet per second in the same direction, so that there is a differential of only 500 feet per second which the bullet can share with its target. After this impact, the bullet and the ball each have a velocity of 750 feet per second. When the observer fires the third bullet, he finds that now there is a differential of only 250 feet per second between it and the target, so that the velocity of the target is raised by only 125 feet per second, and so on.

The observer notes that each succeeding bullet, although it has the same energy with respect to him, produces a smaller and smaller acceleration in the target. He would observe that the 'mass of the target' (its resistance to acceleration) appears to increase with its velocity. If he made mathematical calculations based upon his observations, they would show that the greatest velocity which he could ever induce in the target would be 1000 feet per second (the velocity of the bullets), and that to produce this velocity it would be necessary to fire an infinite number of bullets. His

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experiment demonstrates conclusively that as the velocity of the target approaches 1000 feet per second, his ability to further accelerate it approaches zero. Persons with lesser intelligence or insight than our observer might be convinced that this figure of 1000 feet per second was an absolute and inescapable limit. The observer, however, as we said, has greater understanding. After he has accelerated his target to the 'limiting' velocity of 1000 feet per second (by firing an infinite number of bullets), he steps aboard a small space ship (with which he has thoughtfully provided himself), and takes off in the direction of the target. He accelerates his ship to a velocity of 1000 feet per second, with respect to his starting point, and now finds that he is back upon exactly the same energy level as his target, and he can begin his shooting all over again. He observes that his first bullet accelerates the target to a velocity of 500 feet per second with respect to his new reference point, and he notes that the 'infinite mass' of the target returns to its original 10 grams, as soon as he reaches the same energy level. He realizes then that the 'increasing mass' of the target is only the measure of the kinetic energy differential which exists between them. The mass approaches infinity only as the energy level approaches that of the accelerating force. (In this case it is 1000 feet per second.) In the case of the quantity C, usually tailed the velocity of light, the differential is equal to the

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total energy inherent in matter, (about 3×10^{10} centimeters per second or 9×10^{20} ergs per gram.) It is, therefore, a maximum or limiting velocity, but only with respect to a given reference point.

In our discussion of non-linearity of physical law, it was pointed out that the energy inherent in a gram, or any other quantity of *matter* is precisely the quantity of energy necessary to accelerate its mass to a velocity equal to the quantity C by energy conversion. This statement may be hotly disputed by some students who have not yet learned to distinguish between matter and mass. Their argument is to the effect that no mass can ever be accelerated to the velocity of light since the mass would then be `infinite' and consequently the energy required to produce the velocity would also be `infinite.' The incorrectness of this assumption can be demonstrated simply by pressing the button of a pocket flashlight. A beam of light will be produced which any physicist will agree has mass and which, by its very definition, is moving at the velocity of light. Yet all the energy required is released by a small amount of chemical change taking place within the cells of a battery.

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CHAPTER FOUR

SPACE

Among all of the great basic factors of the Universe, perhaps the most difficult to define or explain is that which we call space. While many of our greatest philosophers and scientists have attempted definitions, few have succeeded in offering anything which the average mind could readily grasp. The German mathematician Leibnitz said, "Space is simply the order or relation of things among themselves." Several centuries afterwards, the late Dr. Einstein used almost identical terms. "Space has no objective reality except as an order or arrangement of the objects we perceive in it."

The average man's definition of space is: "That in which matter can be placed" or "that which matter occupies." This last definition is subject to dispute by those who maintain that matter does not occupy space, but is itself, only a warp or distortion in space. Another school of thought insists with equal vigor, that while

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matter does occupy space, it creates a warp or distortion in the space surrounding it. Since both of these concepts are subject to the same set of mathematical laws, the same laws can be offered in support of either. There is little, however, in either of these postulates which seems to furnish a good foundation for understanding and it is understanding rather than algebraic formulae that we are seeking in this discussion.

For our purpose, a simple definition will suffice. Space is that which separates bodies of matter, whether these bodies be atoms, galaxies or any component part of either. We can extend this definition by stating that the *degree* of separation which exists between any two bodies is determined by the degree of curvature of the natural laws which exist between them. In making observations, of course, we must remember that, since the natural laws are relative, the mass of the body itself influences the degree of curvature. In the theories of relativity given to the world by Dr. Einstein, the natural laws, in general, retain their linearity, but the space in which they operate is considered to be curved. This concept offers the simplest mathematical presentation, since all of the observed deviations from linearity can thus be explained by a single postulate. Unfortunately, like most of our mathematical presentations, the concept offers but little for the mind to grasp. A curved space cannot be pictured mentally, nor can it be drawn upon paper. There is always something

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remaining outside the curve. Furthermore, attempts to rationalize this concept lead to many paradoxical statements which become more and more evident, the greater the effort to explain.

One of the best efforts to bring to the average mind an understanding of the principles of relativity, was made by Lincoln Barnett in his well known book, "The Universe and Dr. Einstein." Because of its careful preparation and its explicit presentation of present theory however, it brings out very clearly the paradox which must exist between successive assumptions. For instance: reference was made, as has already been noted, to the theory of Abbe Lemaitre, which supposed that at one time all the matter in the universe was contained in one huge lump or star. Since the curvature of space is considered to be determined by the amount or density of the matter present in it, at that time the universe was very small. That is, it had a very high degree of curvature. Light and other forms of energy do not move outward from this curve, but follow the circumference, so that the light emitted by this body, after a comparatively short journey, returned to its starting point. No attempt was made to speculate upon the length of time in which this body had existed, or the origin of the matter and energy of which it was composed. The theory merely supposed that, after perhaps an infinity of quiescence, this body suddenly exploded. Portions of the mass moved outward

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in all directions and thereby enlarged the radius of space. If the radius of space was increased, it is obvious that the matter did not follow the curvature of space, but actually moved perpendicularly to it, (or perhaps at a tangent). At any rate, we see that while the radiated energy followed the 'curvature' of space whose radius was determined by the mass and density of the matter, when the matter itself expanded, instead of following the curve, its motion increased the radius.

It is interesting to note that the statement is repeatedly made that this sudden expansion began about two billion years ago, yet in the preceding paragraphs it has been stated that the calculated radius of the universe is now about 35 billion light years. Simple calculation would indicate then that the universe, or at least that portion which we call space, must have moved outward at an average velocity equal to about seventeen times the velocity of light. Either this velocity of expansion is still maintained or at some period in the past it must have been even greater.*

These statements raise some perplexing questions. In our theories of relativity it is assumed that light follows the 'curve' of space. Yet it is difficult to picture

* It has since been announced by Walter Baade of the Mount Wilson and Palomar Observatories that, as a result of the recalibration of the cephid variable stars, the previously calculated size of the universe must be increased by a factor of 2.8 However the correction factor also applies to the time of expansion, so that the rate of expansion remains the same.

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a photon following a curve whose radius is expanding at a rate equal to seventeen times the velocity of the particle.

In the book "The Universe and Dr. Einstein" it is also stated that: while space is expanding rapidly, the matter of the universe, which is likened to "inelastic patches on the surface of an expanding balloon," is not expanding with the space, since if it were, we could not detect the expansion.

If it is *space* that is expanding, it is difficult to understand why we have never detected the increasing distance between the earth and the moon or the sun. No attempt was made to explain why the space which exists between the individual atoms, and between the component parts of those atoms, should not expand also.

None of these difficulties, of course, invalidate any of the mathematical laws from which the concepts have been derived, but they do emphasize the great need for explanations which are more compatible with reason and understanding. For instance, in the above case would it not be simpler to assume that the degree of separation which exists between the Galaxies, when considered as individual bodies, is apparently increasing because they occupy opposite portions of the sine curve of natural law?

If we exchange our postulate of linear laws and a 'curved space' for a concept which incorporates the

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curvature of natural law, we find that we have not thereby destroyed or invalidated any of our present mathematics, but we have achieved a position from which the operation of the natural laws can be pictured by the mind, and can be charted upon paper. Thus we have taken a great stride in the direction of understanding.

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SUMMARY

In summing up our discussion of space we should recall

1. Our definition- Space is that which separates bodies of matter. This separation is a vector function of the time, energy and mass differentials.

2. The degree of separation which exists between any two bodies, or reference points, determines the degree of curvature of the natural laws between them.

3. The natural laws are relative. That is, the value of one can be altered between any two reference points by altering the value or relationship of the other. This last fact should always be borne in mind when we hear some dogmatist solemnly declare that we are forever barred from reaching the stars by the hopelessly great degree of separation which exists between us.

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CHAPTER FIVE

THE QUANTITY C

We have seen that the factor known as the quantity C has a greater significance than is usually credited to it. It is not merely the velocity with which light and other forms of energy are propagated in a vacuum. The quantity C is a degree of energy differential. We can define it as the maximum differential which can exist between two reference points in the factor which we call matter. We can also define it as the minimum differential which can exist between a reference point in matter, and one in energy. This is only true, however, when the reference point in matter is at the same energy level as the observer.

One of the postulates of the theory of relativity is that as a body of matter accelerates and approaches the velocity of light, or a kinetic energy differential equal to the quantity C with respect to a given observer, the body loses dimension in the direction of motion. If the velocity reaches the velocity of light it will appear

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to have lost all of its dimension in this direction. To this observer it would no longer be matter, since matter, by definition, requires three dimensions. The matter would have become energy insofar as the original observer was concerned since it would now exhibit a kinetic energy differential equal to the total energy inherent in the original matter.

This statement, however, seems to produce a misconception in the minds of many students of physics. We will therefore attempt to clarify the concept by the use of a simple analogy. We will assume that we have three space ships assembled at a given point upon the surface of the earth, (or at a given point in space.) For the purpose of this analogy we will assume that the ships are capable of any desired degree of acceleration. We will dispatch two of these ships into space, flying side by side in a given direction. We will launch the remaining craft in the opposite direction in space. We have an observer upon each of the three craft and a fourth observer who remains at the point from which they departed. We will designate the ships which departed together as A and B, the ship which is moving in the opposite direction as C, and the observer at the starting point as D. When we have accelerated all three of the ships to a velocity equal to one half that of light, (with respect to the starting point) we pause to determine what changes, if any, have taken place. To the observer at the starting point D,

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the three ships have become slightly shorter in the direction of their motion, and have gained a small amount of `mass,' but are otherwise unchanged. The observer upon the ship C, however, discovers that while he and his own ship appear to be unchanged, the ships A and B have lost all dimension in the line of motion, because they have reached the velocity C with respect to his reference point. They have ceased to exist as matter and have entered the plane of energy. The two observers upon the ships A and B also note that C has ceased to exist as a material object, but when they examine themselves and each other, they find that no change whatever has occurred to them or to their ships since they are all upon exactly the same energy level and no differential exists between them.

We will now accelerate all three ships to the velocity C with respect to their starting point D. At this velocity the three ships cease to exist materially insofar as the observer at D is concerned, since they have entered the plane of energy, and are also at the zero point of the curve of time with respect to him. The observer upon the ship C would note that the ships A and B were again in existence but that they were now in the negative portion of the curve. Since this concept may prove somewhat difficult to grasp at the first attempt, it will be explained further and a simple analogy given in the chapter on Time.

The foregoing analogy also demonstrates that the

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term velocity has no meaning or significance except as an observed kinetic energy differential between two specified points of reference.

If we examine this analogy carefully, we will find that we have demonstrated the most important aspect of the factor which we have named the quantity C. C is a constant, the only true constant in the universe, because it is the pivotal point about which the natural laws become manifest. It is the factor for which many great physicists have spent years of search, even though they had it constantly in their possession. In short, the quantity C is the measure of the radius of curvature of natural law. It is the factor which will enable us to determine precisely the degree of change in the curvature of one law which will be brought about by a specified change in the application of the others. It is the factor which will eventually tell us how to place our spacecraft in either the positive or negative portion of the gravitational curve with respect to the earth or any other planet which we may choose to visit.

When we state that the quantity C is the radius of the curvature of natural law, we mean simply that if a differential of energy equal to this quantity exists between the observer and the point which he is observing, the natural laws will be suspended. If the energy differential is in excess of the quantity C, the laws will appear to operate in reverse at that point. As we

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stated earlier, this effect will be demonstrated by a simple analogy in our discussion of the factor called time.

While we have repeatedly referred to the quantity C as an energy differential, we have heretofore considered it only in terms of kinetic energy. Some may believe that it can be reached only when there is a rate of increase or decrease in the degree of spatial separation between the reference points, equal to $3x10^{10}$ centimeters per second, or in simpler terms, a velocity equal to that of light. It is necessary therefore to point out the fact that an energy differential does not necessarily manifest itself as a velocity. It can also exist as a frequency. Our present laws of physics state that the energy level upon which an electron, a photon, or other particle exists is proportionate to its frequency. The mathematical rule is E equals Fh where E is the energy, F is the frequency and h is a factor called Planck's constant.

We can now see that a frequency differential which by the above formula is equal to $9x10^{20}$ ergs per gram also represents the quantity C. When such a frequency differential exists between the observer and the point which he is observing, we again find that the natural laws at the observed point reach zero value with respect to the observer. If the frequency differential exceeds this value, the action of the laws will become negative. A material object such as a spacecraft upon

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or near the surface of the earth would cease to exist as matter and would enter the plane of energy insofar as the observer on earth was concerned, but as we have previously pointed out, an observer upon or within the object, whose frequency or energy level had been raised to the same degree as that of the craft, would be unable to detect any change.

We must clear our minds of the thought block produced by the assumption that the quantity C is a factor of absolute limit. We must realize that it is a limiting factor only with respect to two given reference points, and that it is perfectly possible to conceive of a series of consecutive reference points between each two of which a differential equal to the quantity C may exist.

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CHAPTER SIX

TIME

In his examination of the natural laws or facts of the Universe, man is greatly handicapped by the fact that insofar as time is concerned, he has never progressed beyond a uni-dimensional perception. Those who are familiar with the analogies used to explain some portions of the theory of relativity, will recall that in attempting to achieve a concept of a four dimensional continuum, the reader is asked first to imagine a man who is conscious of only one dimension in space. His entire universe consists of a single line. If a dot were placed on the line in front of him, and one behind, he would be completely imprisoned, since he would not be able to conceive of going over or around them. As his intelligence and consciousness developed, he would eventually become aware of a second dimension, and to imprison him then, it would be necessary to enclose him in a circle. With further development, he would become aware of a third dimension in which a sphere would be a prison, and so on.

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We are now conscious of three dimensions of space, and have done considerable mathematical reasoning in regard to a fourth. Unfortunately, insofar as time is concerned, our consciousness has never progressed beyond the first dimension. We are confined to a single line in time. We have no concept of lateral motion, nor can we even turn around upon that line. We can only go forward. Many of the difficulties which we encounter in our attempt to understand the operation of the natural laws arise because of our severely restricted concept of the nature of time.

Time has often been referred to as the `fourth dimension' by those who attempt to explain our present concept of relativity. It is usually pointed out that, since all known bodies of matter in the Universe are constantly in motion with respect to each other, if we wish to describe the position of any body, it is necessary to give a point in time as well as a spatial relationship to any other body or bodies. There is, however, a more convincing method of demonstrating that time is a dimension, although we believe it would be more precise to consider it as the first dimension rather than the fourth since it is the one dimension in which all motion must take place. We are at the present, conscious of three dimensions of space, and we know that motion can take place in any one of the three, but whichever dimension of space is involved, the motion must also take place in time. Our

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term for the rate of motion is the word velocity, which is defined as being the degree of change in location per unit of time. If an object has a velocity of 1000 feet per second, with respect to our point of observation, we will see that in one thousandth of a second the object will have moved one foot. In one millionth of a second it will have moved only one thousandth of a foot, and so on. We can easily see that if the time becomes zero the motion must also become zero.

The science of photography has reached a state of development which permits us to take photographs with very short exposure times. By the stroboscopic method of photography, which is now being superceded by an even faster method, we were able to take several hundred thousand consecutive pictures in one second. In these pictures even the fastest projectile seems frozen into immobility. We have taken pictures of a rifle bullet penetrating an ordinary electric light bulb, in which three complete and consecutive pictures have been made between the time the bullet first touched the bulb and the time that the first crack appeared in the glass. In these pictures, the bullet appears to be completely motionless. Of course the taking of the pictures actually did involve a very small elapse of time, and so a very small amount of motion did occur during the taking, but it again illustrates the fact that no motion which we can perceive,

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can take place except within that dimension of time of which we are conscious.

Having pointed out the limitations of our consciousness concerning this factor which we call time, let us now go back and examine it as best we can, with that degree of consciousness and understanding which we have.

We will again attempt to choose the simplest possible definition. We defined space as ‘that which separates bodies of matter,' so we will define time as 'that which separates events.' (If there is no discernible separation in this respect, the events are said to be simultaneous.) Of course we immediately hear the objection that events may be separated by space as well as by time, or that they may be separated by apace without being separated by time. This statement, while usually considered to be true, yet forms a stumbling block which has precipitated many a philosopher into the quagmire of misunderstanding and paradox. The difficulty arises in our attempt to define the term simultaneous. If two events are separated by space, how shall we determine whether or not they are separated by time? The observer cannot be present at the site of both events, and so must observe one or both of them through the separation of space, and therefore through the curvature of natural law which the separation represents. In referring to this problem in the introduction to his first book on relativity, Dr. Einstein

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pointed out that since our only contact with the world about us is through our senses, and since all of the knowledge which we have concerning the universe has come to us through them, if we are to formulate mathematical rules based upon our observations, we must begin with the postulate that the things which our senses tell us, are true. If we should observe, through a large telescope, the creation of a nova in a remote galaxy, and at the same time observe the eruption of a volcano upon our own earth, we must assume, for the purpose of our mathematics, that the two events are simultaneous. This a postulate which is difficult to accept because the faculty which we call reason immediately interposes the objection that a separation in space involves an elapse of time between the event and our perception of it. However, Dr. Einstein points out that if we allow our reason to modify our observations, we will be evolving a concept whose value is based only upon the validity of our reason rather than upon the accuracy of our observations. We must postulate that events which are observed simultaneously, occur simultaneously insofar as that observer is concerned, and that, therefore, the simultaneity of events is a condition which depends entirely upon the position of the observer with respect to those events.

If we examine this concept carefully, we find that time follows the same curve of natural law which is

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apparent in the operation of all the basic factors of nature, and again the radius of that curvature is measured by the quantity C. A simple analogy may serve to make this statement more readily understood. Suppose we were to start today to build a space ship. We will postulate that the ship will require one year of our time to build, and that when completed, it will be capable of infinite acceleration. We will assume that a continuous supply of energy is available from an outside source, and that the craft will continue to accelerate so long as this energy acts upon it. During the year which we spend in building the craft, light is being reflected from us into space, so that an observer with a telescope stationed at some other point in space could follow the course of its construction. When we have completed the construction of our craft we will enter it and take off for a destination which we will assume to be a planet orbiting about Alpha or Proxima Centauri, our next nearest suns, about four light years distant. We have a telescope of unlimited power in the rear of the craft pointed toward the earth which we are leaving, and another telescope at the front, focused upon the planet which is our destination. We will set the field strength for a constant acceleration, and seat ourselves at our telescopes to observe the result. After we have risen a few miles from the surface, we will, for the purpose of furnishing an additional reference point, eject from the craft and its

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field, a cannon ball or other sphere of metal which has been specially painted so that it can readily be observed from any distance with the aid of our unlimited telescopes. Since we had not yet reached escape velocity when the ball was ejected, we will observe that it soon begins to fall back to earth.

As we continue to accelerate, we will observe that the kinetic energy differential which we are producing between ourselves and our points of observation is producing exactly the effect upon time which is predicted by our postulate of the curvature of natural law. Since the distance or degree of separation between ourselves and the earth is increasing with time, the energy differential is negative, which means that the natural laws at the observed point will be displaced towards the base or zero line of the sine curve, insofar as our observations are concerned. If we reach a velocity equal to one half that of light, and then observe a clock on earth through our telescope, we will see that in ten hours of our time, only five hours have been recorded by the earth clock. If we observe the test sphere which we ejected during our take off, (assuming that it has not yet reached the ground) we will see that it is not falling at the rate predicted by our laws of gravitation, but at a rate only half as great. We will also observe that the sphere is not accelerating at the rate predicted by our laws, nor even at half that rate. Since we ourselves are still accelerating, the observed

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acceleration of the sphere is diminished by a factor which is proportionate to ours. We must remember that we can only observe events through the light which is emitted or reflected by the objects concerned with those events, and if we ourselves have a motion equal to one half that velocity in the direction in which the light is moving, then a column or sequence of light impulses which were emitted from the earth during a five hour period, would require ten hours to pass our point of observation.

When the velocity of our craft reaches that of light with respect to the earth, there will be a negative energy differential, equal to the quantity C, existing between us and our point of observation. We will observe that all natural laws upon the earth have reached zero value with respect to us. All motion and all changes have ceased. If we observe our test sphere we will see that gravity is no longer acting upon it, since it has ceased to fall. All laws of motion are in abeyance and the factor which we call time has ceased to have any significance.

To make these observations, of course, we would require one of the new telescopes which operates on the retention of vision principle, where the last image to arrive remains upon the viewing screen until a new light image arrives to change it. When we reach the velocity C, no new light will arrive, hence the picture will not change until we change our velocity.

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Since we postulated at the beginning of this analogy that our craft was capable of unlimited acceleration, and since the postulated force continues to act, our velocity will continue to increase and we will have between ourselves and the earth, a rate of increase in the degree of separation which is greater than that specified by the quantity C. We can do this from our point of reference although, as will be explained later, we cannot do it from the point of view of an observer upon the earth. When we have passed through the velocity C, a startling change occurs in our observations. We no longer observe the earth from the telescope at the rear of the craft. The earth now appears in the telescope at the front, and we are no longer leaving the earth, we are now approaching it. We will see a craft which is identical to ours, and which is indeed our own craft, detach itself from us and move back toward earth ahead of us at a rate which is proportionate to our excess over the velocity C. If we observe the earth, we discover that all natural laws are operating in reverse. If we observe the test sphere we will see that it is now falling *away* from the earth rather than towards it. Gravity between the earth and the sphere has become negative *with respect to our point of reference* as have all the natural laws. We observe this through the forward telescope rather than that at the rear, because we are now overtaking the light which had passed us before we had reached

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the velocity C, and since we are now overtaking it, we encounter first the light which had passed us last. All events occur in reverse, just as would the scenes in a motion picture film which is being run backwards.

If we complete our journey to the planet which is our destination, at an average velocity equal to 4 times C, we will arrive with an elapsed time of one year as measured by the clocks on our own craft. During the journey, however, we will observe the elapse of five years of time upon the planet which we are approaching, and the elapse of three years of negative time upon the earth which we are leaving. In other words we will arrive at our destination three years before we left the earth. If immediately upon our arrival we seat ourselves at a telescope of sufficient power to observe the earth at close range, we will see ourselves going about the daily tasks which we performed two years before we began to build the space craft in which we made the journey. If we then focus the telescope upon the proper point in space we will see ourselves in our space craft, flying backwards toward the earth.

We are now in a position from which we can observe the sine curve nature of all natural law, and to measure precisely the radius of the curvature. If we observe the earth, we see that time there is positive. That is: it is moving in the direction which we consider normal. Since there is no significant energy

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differential, the time *rate* is essentially the same, but because of the degree of spatial separation there will be a displacement along the time curve, between the observer and the point which he is observing. According to our theory of the curvature of natural law, this displacement should be equal to D divided by C, where D is the distance and C is our basic factor. In the case of our present observation the distance is equal to 4C Years, which if divided by C will equal 4 years, which is precisely the degree of displacement which we observe. If we now turn our attention to the space craft, we find that we are observing it through an energy differential which exceeds the quantity C and therefore the craft is within the negative portion of the curve, and all natural laws will be operating in reverse at that point. We are now in a unique position, in that we now can, from a single point in time or at least from a single point in the only dimension of time of which we are conscious, observe ourselves occupying three rather widely separated positions in space, First: our position at the telescope as the observer. At this point time is positive. Second, our position on the surface of the earth. Here time is also positive but has a negative displacement upon the time curve which is equal to four years. Third, our position in the space craft: here time is negative, as demonstrated by the fact that we observe it flying backwards toward the earth, and all actions taking place within

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it occur in reverse order. This is, of course, due to the fact that the craft had a velocity greater than that of C and so was constantly leaving behind the light which was emitted or reflected from it. As we observe the craft from our new reference point, the last light which it emitted arrives first.

If we continue to observe for several years, we will eventually see ourselves build the craft and take off into space. At the same time we can see ourselves in the same craft hurtling backward through space toward the inevitable meeting point where the past and the future join to become the present. Since we are observing ourselves simultaneously occupying three different positions in space, we can readily see that we are forced to a concept of time which includes more than one dimension. If we continue to observe the two craft, we will see that the one which is moving away from us is constantly slowing down, while the one coming toward us from the earth is accelerating. At the instant in which the velocity of the receding craft reaches zero, the approaching craft will reach it, coincide with it, and both craft will disappear completely from our view. Our lateral excursion into time has completed its curve and we have returned to the starting point of our uni-dimensional concept.

There is only one thing left to do. We immediately leap into our space craft and begin our return journey to earth. As before, we achieve an average or mean

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velocity equal to 4C. We land our craft near the observatory of an astronomer who is a friend of ours, and rush in to tell him of our return. We find him seated at his telescope observing our landing upon the planet which we had set out to visit. When we inform him that we achieved an average velocity of 4C, his reply is that this is impossible since the laws of relativity clearly state that no object can achieve a velocity in excess of C (with respect to a given reference point.). He will also point out that he has been observing us constantly since our take off from the earth and that only now, today, five years later, were we observed to have reached our destination. Since the journey required five years of earth time, our average velocity was only four fifths that of light.

According to the primary postulate of relativity, that for mathematical purposes we must accept the results of our observations as valid, the astronomer is perfectly correct in his statement that we did not, and could not have exceeded the velocity C. The mere fact that we may have returned, be seated at his side, and may perhaps be assisting him in his work, does not in any way affect the validity of his observations nor the mathematics of relativity which he applies thereto. He can only state that our arrival upon the distant planet, and the moment of our return to earth were in fact simultaneous.

We can see that, even if our energy level bad been

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so close to infinite that the outward trip had required only one second, if during the one second trip we had emitted enough light to make observation possible, the astronomer upon the earth would note that the trip required four years and one second, and so would have undeniable proof of the mathematics which postulate that only with infinite energy may the velocity C be achieved.

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CHAPTER SEVEN

CONCLUSION

We have discussed briefly, a number of those aspects of the principle of relativity which have created what we have described as thought blocks in the minds of many students, scientists and engineers. We have pointed out that these thought blocks are not actually inherent in the mathematics of relativity, but are obstacles created by the arbitrary interpretations which we have placed upon those mathematics. Yet these are the illusionary obstacles which have prevented us from making the one approach to space travel which is certain of ultimate success. We must come to realize that the natural laws are not enemies to be destroyed, neutralized or overcome, but are friends who will, if we but make the effort to understand them, produce for us any end which we may desire. We must realize that the rules of limitation found in our mathematical approach to nature, are limitations only of our own perception and consciousness;

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and have no absolute significance insofar as nature itself is concerned.

Some of the more dogmatic of our scientists still assert that we can never hope to reach even the nearest of our neighboring stars because, even with infinite energy, the trip would require many years. We have seen that while this statement may be perfectly correct with respect to a reference point upon the earth, if we leave the surface of the earth, our reference point will go along with us, and the `limitations of relativity' will always precede us at a distance equal to the quantity C. We need not fear that we will ever overtake or be hampered in any way by those limitations.

The concept of the sine curve nature of physical law is not at all new upon this earth, although the present civilization has not, as yet, achieved any great understanding of it. It has been the knowledge and understanding of this concept which has enabled previous civilizations to accomplish, in their comparatively brief periods of development, many things which our present vaunted science has not yet been able to duplicate.

One of the most convincing evidences of the fact that previous civilizations upon the earth were familiar with the sine wave characteristics of natural law is the symbol which has come down to us from them: the circle with the sine wave passing through its center. The circle, being without beginning or end, symbolizing

the infinite nature of the Universe itself and the sine wave passing through it symbolizing the curved but finite nature of the laws which operate within the infinite whole. This is one of the great basic symbols which have been found in every one of the ancient languages and cultures of the earth. The precise meaning and significance of the symbol has become somewhat blurred through the ages, with the result that the explanations of it vary slightly with different sources. For example, the Chinese describe it as the symbol of Yang and Yin, the male and female principle, or the positive and negative aspects of the natural law. The same symbol is upon the pottery, ornaments and historical tablets left by the prehistoric race known as the Mound Builders of North America, who inhabited the Mississippi valley area an estimated five to seven thousand years ago. To them it symbolized the origin, nature and operation of the *gravitational forces of the. Earth*[1].

In the book, "A Dweller on Two Planets" by Phylos, written in 1886, the symbol is described as referring to the 'day and night side forces of the universe' but here again they are also referred to as the positive and negative aspects of natural law. From Egypt to Easter Island the symbol is found, and at least partially understood by all students, with the sole exception of

1. "Sacred Symbols of Mu" by James Churchward, p. 227.

those who follow that branch of learning which is commonly known as 'Modern Science.' These students have apparently agreed by common consent to discard and ignore all knowledge which had its origin more than a few hundred years ago.

The inherently aggressive nature of man leads him to attack, instinctively, any obstacle which he may find in his path. The prospector in the mountains, who stubs his toe on a pebble and falls upon his face, is much more likely to arise and instantly hurl the offending pebble into the canyon, than he is to examine it carefully to see whether it may contain the gold which he is seeking. The same situation exists in our science of today. Whenever we come upon a natural law which appears to be an obstacle to the particular end for which we are striving, our automatic reaction is to seek means to destroy, to neutralize, or to overcome that law. The result is that our present science follows an almost incredibly complex pattern of basic conflicts. Natural laws are pitted against each other, or a greater degree of one law is applied in opposition to a lesser degree of the same law. We seldom pause to consider the fact that, because of the dual nature of all physical law, if one aspect or pole of the law is a hindrance to our end, the other pole or aspect of the *same law* will provide the assistance which we require.

Having resolved the misinterpretation of our mathematics, the job of the theoretical physicist is done. The

next move is up to the practicing physicist and to the engineer.

If the student of applied physics will examine carefully, in the light of these discussions, the reaction of the atomic nucleus to various changes in mass and charge, the pattern for the modulation of the gravitational curve will soon become self evident. The application of this pattern to the operation of a full size space ship is somewhat more difficult, but by no means impossibly so. Both the physicist and the engineer will find their task greatly simplified, if they will devote a little time to the study of those space craft which already exist and which have frequently been observed within our atmosphere and, in at least a few cases, upon our surface. It is true that the study of these craft is hampered by the rarity of their landings upon our surface and by the agility of their maneuvering in our skies. It is also made difficult by the large amount of chaff which must be separated from the wheat before a serious and successful study may be undertaken. Nevertheless, a sufficient number of careful and reliable observations have now been made, to enable the student to draw a number of conclusions, with a high degree of probability that these conclusions will be correct.

It is not within the province of this book to enumerate or describe the large number of observations which have been accepted as `reliable' by those who have

investigated them, particularly since this task has already been undertaken by competent men whose reports are available to the public. I refer particularly to "The Report on Unidentified Flying Objects" by Edward J. Ruppelt, former head of the Air Force Project Blue Book, and "The Great Saucer Conspiracy" by Major Donald Keyhoe. A number of other earnest and sincere men have spent considerable time and effort in relaying to the public the precise nature of the reported observations.

It is, however, the intention of this writer to issue within the next few months, a text which will incorporate a number of the reliably reported observations, together with the specific conclusions which may be drawn therefrom, in the light of our present day physics and the extensions of that science which have been presented in this book.

A careful survey of our present rate of progress in the physical science, leads inevitably to the conclusion that the Earthman, despite the tremendous amount of effort now being applied in that direction, is about to abandon the obsolete and inefficient concept of reaction propulsion. In its place will come the concept of field propulsion, the natural and universal means of producing kinetic energy differentials. With the development of this concept, the age old barriers of time and space will rapidly dissolve and Earthman will find that it is indeed only a step to the stars.