# Chapter 1

# The Apes of Objective Science

***"I sought great human beings, but found only the apes of their ideals."***

***~ Friedrich Nietzsche***

In the author's experience of the Work, he has repeatedly noticed and experienced a definite tendency in Work groups to accord credibility to the theories of contemporary science. He even once heard a definite opinion that "In Gurdjieff's time, science was less advanced and so Gurdjieff's scientific understanding was clearly 'off the mark.'"

This chapter disputes that opinion without an atom of compromise. For the sake of brevity, it confines itself just to modern physics and it proposes that modern physics, even in terms of its own approach to knowledge, is misguided and wrong-headed in respect of the theories it espouses. It is "off the mark," by a country mile.

## The Fundamentals of Contemporary Science

The paragraph below, taken from Wikipedia, briefly describes the scientific method:

> *The scientific method is a body of techniques for investigating phenomena, acquiring new knowledge, or correcting and integrating previous knowledge. To be termed scientific, a method of inquiry is based on empirical or measurable evidence subject to specific principles of reasoning.*

We can formulate it as a series of easy to understand actions, as follows:

- **Observation:** Some phenomenon is observed that is deemed worthy of investigation in order to arrive at an explanation that can be expressed as a set of principles.

- **Problem statement**: A statement of the phenomenon is made as accurately as possible, perhaps in the form of a question such as: How does A react with B to produce C?
- **Prior evidence:** Prior validated evidence relating to the phenomenon (if any exists) is examined and used if necessary as reference material.
- **Hypothesis:** A hypothesis is proposed derived both from existing evidence and the formulation of the problem statement. The general rule here is that the hypothesis must be falsifiable.
- **Prediction:** A set of unambiguous and well-defined predictions representing the logical consequences of the hypothesis are formulated.
- **Experiment(s):** The predictions of the hypothesis are empirically tested with measured results being obtained.
- **Analysis:** An analysis of the outcome of the experiments is conducted in an effort to prove the hypothesis wrong. If the hypothesis is not negated by the experiments, the outcome of the experiments can be regarded as support for the hypothesis.
- **Reformulation:** If the hypothesis is disproved then it may be reformulated and another iteration of prediction, experiment and analysis may take place.

So, scientists observe the natural world, formulate hypotheses, test them experimentally and then adjust the hypotheses if necessary in response to experimental outcomes. If the hypothesis is general enough, and has sufficient experimental support, it becomes a theory that is taken to apply to many contexts. If there is enough scientific consensus for a long enough time, the theory may even be accepted as a "law," implying that it holds unfailingly in a set of well-delineated contexts.

So, for example, we have Boyle's Law, which states:

> *The absolute pressure exerted by a given mass of an ideal gas is inversely proportional to the volume it occupies if the temperature and amount of gas remain unchanged within a closed system.*

Note that in the statement of a scientific law, the context is precisely defined (in this example by the terms: absolute pressure, ideal gas, closed system). This theory acquired the status of "law" by being repeatedly proved in all appropriate contexts. Science rarely proclaims something to be a law. For example, Einstein's general theory of relativity is widely regarded as correct at large scale and has been validated to some degree (in the sense of predicting experimental outcomes), but is still only accorded the status of theory.

Science is essentially collaborative. One individual could formulate a hypothesis in a given area and carry out many experiments that (in his opinion) unquestionably proved his hypothesis. On its own this counts for nothing: the scientist may be incompetent, he may be competent but have made an error in the design of his experiments, he may have failed to account for some factor that could impact the results and so on.

Consequently, within the scientific community, these hypotheses and experiments are subject to peer review by other scientists working in the same field. Hypotheses and the results of experiments are shared via the publication of papers, articles in scientific magazines and by presentation at scientific conferences. Comments and criticisms ensue and, over time, a general consensus emerges as to what is regarded as true, or likely to be true, in any scientific field.

In areas of science that attract the interest of the general public, information is disseminated by way of articles in magazines, newspapers and documentary television programs. Information is also disseminated through the education system, as various theories and "accepted truths" are included in school and university curricula.

The body of scientific theory, knowledge and information gradually expands over time, with some theories being adjusted and others being abandoned in favor of new ones. Occasionally some scientific hypotheses and experiments prove to be revolutionary, provoking a whole area of science to be rethought and reconstructed.

In some areas, science has become an expensive activity because of the cost of equipment needed to carry out well-designed experiments. This is the case, for example, in many areas of physics, chemistry and materials science. Here, funding is provided by governments and commercial interests, some of whom hope to profit from their donations. While this can at times exert an influence on science, it is rarely a malign influence.

Direct political influence in various eras has interfered with scientific activity, most obviously as occurred when the Roman Catholic Church tried and failed to enforce a biblical world view in contradiction to the ideas of Galileo and Copernicus. Science in Nazi Germany and Soviet Russia was deflected for a while by political interference, but this eventually faded when the political weather changed. In recent times oil interests have interfered politically with climate science, but this also is now fading. In such situations, the inherent idealism of science—the search for the truth—is difficult to suppress indefinitely.

This is not to suggest that science is truly impartial. Some theories are established, become popular within the scientific community and eventually represent vested interests that the community defends against any contrary view. Sometimes a scientific idea becomes so offensive to the scientific establishment that, as Gurdjieff describes in *The Tales*, the one who proposed it is "pecked to death," within the scientific community, and at times in the court of public opinion. This was the fate of Mesmer, and more recently the fate of both Immanuel Velikovsky and Wilhelm Reich. This is not to imply that the theories of these individuals were correct; only that they suffered the process of being "pecked to death."

The Gurdjieff Work itself has received the occasional "peck" from the representatives of the scientific establishment, usually being dismissed as mystical claptrap and Gurdjieff himself being described as a charlatan or worse. This is to be expected. Contemporary science tends to denigrate the mystical.

## Points to Ponder Concerning Contemporary Science

The question to ask is: How useful is contemporary science as a source of knowledge? There are good reasons to be cautious about its various theories and proclamations. Consider the following.

### *Suggestibility*

As normal human beings we are suggestible. Throughout our life we have received many suggestions that originated with contemporary science. Mostly, we believed these suggestions without question.

Most of the things we think we know we simply accepted "in good faith." For example, ask anyone who is not in the Work about "how life came to be" and you will normally be treated to a mishmash of ideas that revolve around Darwinian evolution. Most likely the person describing these ideas will not have studied the field at all and will simply have accepted "in good faith" what they were taught at school, or encountered in the media, or have read about in books and magazines. They are unlikely to provide a critical view. Even if they do provide a critical view, it is most likely that their critique will reflect something they read or heard, rather than their own thinking.

To consider the opinions of another to have any validity, one needs to know their source. If they themselves are not the source, one needs to determine who was the original source and consider how they arrived at their opinion. An agreement with the opinion requires either a review of how the original opinion was arrived at, or one's own analysis that arrives at the same opinion via a different route.

### *Contemporary science has no unity*

We might believe that the body of scientific thought constitutes a unity, allowing perhaps for the reality that this body of thought is gradually evolving. However, it has no unity; it is a consensus reflecting the opinion of those highest in the scientific hierarchy. You can see this. You might think otherwise, if you peruse Wikipedia, which is a large conscientiously maintained scientific information source. However, if you choose any particular theory at random and google the topic, you will usually discover opposing theories and dissenting opinion. Wikipedia has evolved into the "official" mouthpiece of science.

There is no individual in any scientific field who is the acknowledged "master." Even in fields where one individual's work and opinions are dominant for a while, it is unlikely that he or she is conversant with all hypotheses and experimental results in their own field. And their expertise beyond their own field is likely to be thin or non-existent.

Even if we assume that such atypical individuals have achieved genuine knowledge in their field, it is not our knowledge. We, who have never delved deeply into their scientific domain, can only accept their theories and proclamations "on faith." And unless there is evidence to the contrary, it will be prudent to assume that they are normal human beings endowed with the usual failings. It would not be prudent to assume that they know anything "for certain."

"Scientific truth" is and will forever be the aggregation of many 'I's.

### *Are scientific experiments truly repeatable?*

The repeatability of experiments is a supremely important criterion for accepting any scientific hypothesis. Some experiments certainly are repeatable. If you mix a given amount of silver nitrate with a given amount of sodium chloride at a specific temperature, you will produce a precipitate of a given amount of silver chloride. You always get the same result. So it is with some scientific experiments. However there are also many notable failures to repeat "discovered" phenomena.

One famous area of disputed claims is the ESP research of J B Rhine, which suggested experimental "proof of telepathy." It was never independently verified. Once you enter the area of scientific psychology, you encounter the problem of the experimenter unwittingly influencing the experiment, and the additional problem that one group of subjects is not necessarily equivalent to another. Rhine's experiments may have suffered from both of these failings. Perhaps J B Rhine and his methods were at fault, and perhaps not.

As Heraclitus noted "No man ever steps in the same river twice, for it's not the same river and he's not the same man."

The point is that repeatability is not easy to establish, because all the factors that influence the outcome of an experiment may not be known.

Where you do not have repeatability, the scientific method rules itself out—in theory. In practice that important criteria is not always enforced. Some experiments, notably those carried out in the Large Hadron Collider (LHC) that is buried beneath the France-Switzerland border, escape the "rule of repeatability" because there is only one LHC and the demands for its use far outstrips availability.

Even if you successfully "exactly repeat" an experiment with this equipment, until someone builds another equivalent LHC, you cannot know for sure that there wasn't some subtle fault in the experimental equipment.

### *The problem of "the closed system"*

It is usually the case that a scientific hypothesis is expressed in terms of cause and effect, in the sense that a particular action in a particular situation causes a particular result. The problem in proving such a hypothesis is that the scientist needs to design an experiment that eliminates all extraneous influences. A closed system needs to be created which includes only the relevant components. However since the scientist cannot know everything that must be eliminated—since he is dealing to some extent with the unknown—it is difficult to be certain that an experimental design creates a genuinely closed system.

More to the point, the truth is that there are no fully closed systems. The only truly closed system in the universe is the universe itself and even that it a conceptual assumption. It is also worth noting that almost all the experiments that have been carried out since the dawn of science have been carried out on the planet Earth.

All, including those carried out in orbit around Earth or in its vicinity, are proven only in this locality. If there is some influencing factor in this locality that does not generally apply throughout the universe, then the generality of all of science is in question.

## *The statistical problem*

Where scientists cannot create a closed system, they will attempt to verify a hypothesis statistically. If an experiment does not always provide the same result, but when repeated produces the result a statistically significant number of times, the hypothesis is deemed to be supported if not proven. Common examples of this are found in the field of medicine.

When searching for the cause of a particular disease, epidemiologists will conduct experiments to try to identify the responsible pathogen. If you review such experiments, you will find that there is normally a control group of people in the locality under investigation, who show no symptoms of the disease. Their health is compared to a group suffering from the disease. If the pathogen is isolated, it will normally be found, by test, to exist in the bodies of most of the infected group—but not all of them. In the control group it will be found to be absent in the bodies of most, but not all. This is a strong sign that the identified pathogen is the cause.

You might protest the fact that the pathogen cannot be isolated in every one of the infected group, and that it can be found in one or two of the "uninfected" group. But the human body is a very complex system and there can be great variability from one such system to another. The few in the uninfected group, who show signs of the pathogen may have very robust immune systems and antibodies that can cope with the pathogen. On the other side of the line, those who showed no evidence of the pathogen, but had symptoms of the disease, may have been affected by undetectable levels of the pathogen.

In any event, with epidemiology, that is merely the beginning of the story. The next steps are to proceed from these results to identify how infection by the pathogen occurs (by contagion, by insect bite, etc.) and to find ways to prevent transmission. Where such campaigns are successful it is clear that the pathogen has been nailed.

The point is that the statistics only demonstrated a correlated association. Such associations do not prove causation at all, they only indicate the possibility of causation. Nevertheless, such statistical data is often imputed to demonstrate causation, even among scientists. The fault is not in statistics itself, but in its abuse.

The book *Spurious Correlations** presents many excellent and amusing examples of correlations that are clearly have no direct relation to causation. They include:

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* *Spurious Correlations by Tyler Vigen*

- Figures from 1999 to 2009 demonstrate a 99.79% correlation between US spending on science, space and technology and US suicides by hanging, strangulation and suffocation.
- Figures from 1996 to 2008 demonstrate a 95.23% correlation between Math doctorates awarded in the US and the amount of uranium stored at US nuclear power plants.
- Figures from 1999 to 2009 demonstrate a 95.45% correlation between US crude oil imports from Norway and US drivers killed in a collision with a railway train.

At above 95%, all of these are very high correlations, demonstrating how slippery correlation can be in any scientific context. And yet, contemporary science cannot proceed without using statistical correlation. If a scientist can present high correlation along with a convincing explanation of why A causes B, the hypothesis is likely to be given credence. Contemporary science is obliged to walk this line.

### *Scarcity of data*

In some areas of scientific study there is insufficient data to offer strong support to any theory. If we take cosmology as an example, the field of study is handicapped because we can only make observations of the universe from the Earth or from satellites within the solar system. The accurate data that has been gathered is confined to a relatively short period of time—a few hundred years at best—less than the blink of an eye in the life of the universe.

Similarly, paleontology, the study of ancient life, is restricted to what can be discovered via the fossil record. Data is confined to the specific times when fossils were created. And the fossil record from any given era is only a minuscule snapshot of that time. This leaves huge gaps in the evidence for any theory in this field.

Other areas of science are not so constricted. For example, with modern instruments, zoologists can examine both living and recently dead specimens of a species in fine detail and gather very large amounts of data to support or oppose any specific theory.

## The Hypnotic Power of Mathematics

Mathematics is not a science per se. It is a very useful related discipline that provides scientists and engineers with extremely useful tools—statistics being just one of them. Nevertheless, the point needs to be understood at the outset that mathematics does not and cannot prove anything in relation to reality.

Albert Einstein said, famously;

> *"As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality."*

He got it exactly right. There is only one area where mathematics aligns almost completely with reality. That is in the act of counting. You might argue philosophically that, say, "three apples" in the real world only embody the concept of "threeness," but it is splitting hairs to distinguish that from their embodying the concept of "appleness." When there are three apples, there are three apples. The counting numbers—the natural numbers, as mathematicians call them, can reasonably be taken to denote a reality of the real world.

Beyond that, when we talk in terms of negative numbers, real numbers, irrational numbers, or complex numbers, we are manipulating abstract concepts that cannot be demonstrated to exist in reality. They are inventions of the mind of man that can, nevertheless, be put to good use to model reality. And that's just for starters. We can introduce algebra, geometry, calculus and all the various fields of mathematics, most of which can also be put to excellent use in modeling reality.

Contemporary science and engineering employ mathematics to model reality and, time and again, the models turn out to be so close to reality that it predicts the real world accurately. In some instances the very laws that science proposes can be expressed mathematically—as for example with Newton's Laws of Motion.

Indeed, Newton serves as an excellent example of the productive use of mathematics, since his gravitational theory and its associated equations are pretty much all you need to spray space shots around our solar system. He formulated it more than 200 years before the first space shot.

And none of that proves Newton's gravitational theory correct. In fact nowadays his gravitational theory is regarded as incorrect and has been superseded by Einsteinian gravitation. The mathematics did not and never could prove the theory correct, but it created a very close-to-accurate model of reality.

## *The Map is not the Territory*

There are several things to be concerned about with mathematics. The first is to note that in terms of the models it can create, mathematics can be divided roughly into two parts: discrete mathematics and continuous mathematics.

Discrete mathematics is the study of mathematical structures made up of separate components, individual items, like quanta. So the objects studied in discrete mathematics, such as integers and statements in logic, have distinct, separated values.

In contrast, continuous mathematics deals with objects that vary smoothly, without gaps. An example of this continuity is the simple equation $y = 2x$. The two linked variables, y and x, in the equation are continuous.

We can ask the question: Is reality continuous or discrete?

The evidence from quantum mechanics is that reality is discrete. So, for example, a spectrometer viewing the light emissions form a particular substance shows us spectral lines rather than a continuity of wavelengths. This, incidentally, accords with the objective science view of reality. However the way our minds model the world is necessarily that way. We see, for example, an iron bar. It is a thing and hence discrete. However we see it and conceive of it as continuous from end to end. We can imagine that it is composed of atoms—discrete things—but we do not know for sure. Even if we possessed a microscope that was powerful enough, and could clearly see the atoms, we could not know for sure whether the space between them was really empty rather than containing some kind of material or energy.

While it is the case that discrete and continuous mathematics can be used together in some contexts, a mathematical model of a real situation always depicts the world as one or the other, discrete or continuous. If the models work well, it will be valued. For example, the mathematical models that were used to calculate artillery tables were valued by the military because there were very accurate within practical parameters, but they were not perfect.

We adopt the same attitude to the problem of infinity—a concept that emerges in both continuous and discrete mathematics. We require the concept, for example, to establish calculus. We cannot demonstrate infinity in the real world, we can only presume it. Nevertheless, if we're careful in using it, we can employ it productively in mathematics, and employ the mathematical models we create productively. Mathematics can be right within its own context of modeling and mapping. However the map is not the territory.

## *Extrapolation*

Mathematically, extrapolation is where you extend a method (say a formula or a technique) outside the range of proven real world applicability, and logically deduce that it applies to all areas outside the range. Mathematics even has a specific kind of proof (the inductive proof) that works by extrapolation.

This is fine in the domain of mathematics, as it does not need or even care for real world confirmation. It is correct axiomatically and thus an inductive proof applies all the way to infinity. All mathematical extrapolation is valid for the mathematical map, but the map is not the territory.

As soon as you apply extrapolation in science you are on shaky ground. Consider, for example, an activity as fundamental to geology as estimating the age of rocks. Such ages are calculated on the basis of radioactive decay. For example, the element Uranium 238 decays to become Thorium, which in turn decays until it becomes Lead. There are many steps to this process. The geological dating of a specimen can be achieved by estimating the original content of Uranium 238 and all the elements and associated isotopes in the rock sample when the rock was formed. The rock's age is deduced according to the quantities of those elements and isotopes. The known proven-in-the-laboratory pattern of decay of Uranium 238 is applied. This is an extrapolation.

The accuracy of the calculation suffers from three problems:

1. The estimate of the original content of U238 and the elements and radioisotopes it decays into could be incorrect.
2. The rock could have been contaminated during its long life in a way that altered the ratios.
3. The normal (predictable) process of radioactive decay could have been accelerated or decelerated by unusual conditions some time during the lifetime of the rock.

One example of an anomaly is sufficient to demonstrate this problem. Radioactive dating on recent (roughly 50-year-old) lava flows at Mt. Ngauruhoe, New Zealand, have yielded a rubidium-strontium "age" of 133 million years, a samarium-neodymium "age" of 197 million years, and a uranium-lead "age" of 3.9 billion years. In each case, the dating method gives a wildly incorrect result and, as you can see, they are not even close to agreeing among themselves.

But what is the geologist to do? There are no better methods for estimating the age of rocks. It may even be that some of these estimates are correct in some cases. However, there is good reason to doubt.

### *Cognitive Bias and Mathematical Manipulation*

In formulating hypotheses and proposing scientific models of real-world events, scientists almost always encounter the fact that their carefully designed experiments do not produce the hoped-for result, but may provide something that is close to the hoped-for result. In this area we encounter the problem of "cognitive bias."

The term "cognitive bias" describes errors in thinking processes caused by holding on to individual preferences in the face of contrary evidence. This could be described as "unintentional dishonesty," in that the individual affected by it is completely unaware of their bias. Where it crops up in scientific experimentation (outside of psychology, where it is an area of study), it is described as "confirmation bias." It is the tendency to interpret experimental results in a way that confirms one's cherished hypotheses or even pre-existing beliefs. In science pre-existing beliefs are often just fashionable theories.

The scientific method is supposed to eliminate such bias by the process of peer review. Other experts in the field review the published results produced by a specific scientist or scientific team and offer critiques. However, peer review is only effective if the reviewers are not also suffering from the same confirmation bias.

As we review some of the theories of modern physics in the coming pages, we will encounter the existence of "adjustable parameters." We can explain by example:

Consider the trajectory of a ball thrown at an upward angle through the air. It will follow a parabolic curve almost exactly, rising in the air at first and then falling. It's position in the air at any point will depend on the initial upward angle of its trajectory and the time elapsed since it was thrown. If there were no other forces affecting the ball it would move in a perfect parabola. However, the resistance of the air to the movement of the ball inevitably distorts the parabola.

If we adjust the mathematical equation by adding an "adjustable parameter," we can compensate for the air resistance. Adding a fixed parameter might do the trick, but air resistance can vary. It will be different at sea level than on a high mountain, and hence the parameter will need to be adjusted, for context.

This does not mean that the theory of the parabolic movement is incorrect, just that we need to adjust the model. The scientific problem is not that adjustable parameters are necessarily wrong—they may not be. But if you cannot assign a cause to the adjustable parameters in a model, then the model is clearly suspect. You can usually make inconvenient results look respectable by resorting to adjustable parameters.

## The Genesis of Standard Models

The problem of geological dating highlights a common occurrence with contemporary science. If any new phenomenon is observed in a given area of science, it is soon accompanied by a theory to explain it, no matter how little empirical support the theory has. The motivation to invent a theory is considerable. It's likely that the interesting observation occurred as the result of some hypothesis the scientist was investigating, so it is logical for the scientist to explain the hypothesis when he documents the observations. His reputation within the scientific community will be greatly enhanced if he is recognized as the scientist who invented the accepted theory. If he simply reports the phenomenon, he will be asked for an explanation anyway.

And there are questions that are natural for anyone to ask, and science feels obliged to provide an answer, even when there can be little certainty. How old is the Earth? How did life develop on Earth? Why does the Earth have a magnetic field? When did mankind first appear on Earth?

Providing some theory or other—the best theory available or the accepted theory—always seems preferable to "I don't know." Contemporary science abhors "I don't know"—it abhors a theoretical vacuum.

In time, as various theories are threaded together to generate a common narrative, a "standard model" emerges, which becomes the scientific world-view in a given area. This is only to be expected. Psychologically, men develop formatory attitudes about many things. Hence it is to be expected that societies of mechanical men will develop a consensus world-view. There are standard models in astrophysics and in quantum mechanics. The theory of evolution provides the standard model in botany and zoology.

These standard models are absorbed into the education system in most countries and nowadays educational documentaries, regularly broadcast on television, spread the narratives to the general public. They are happily accepted without question and usually without discussion.

This is no different to what happened in previous eras. In the Middle Ages, when the Roman Catholic Church was the arbiter of knowledge in Europe, its standard models were spread in a similar manner. Man's suggestibility ensures the success of this.

## The Cosmology of Contemporary Science

Currently physics abides by a Standard Model of Cosmology for astrophysics (the macro scale), and an entirely different Standard Model for quantum mechanics (the micro scale). Although attempts have been made to reconcile these two Standard Models, it has so far proved fruitless. Quantum mechanics does not scale up, and astrophysics does not scale down.

It is useful to examine these models from the perspective of objective science, primarily to demonstrate that objective science and contemporary science do not agree at all.

The Standard Model of Cosmology is referred to popularly as The Big Bang Theory, but among physicists it is usually named the Lambda Cold Dark Matter model. It can be summarized as follows:

- The universe originated in a rapid expansion of energy from nothing. This original "nothing" is commonly referred to as a "singularity"—a term borrowed from mathematics. In mathematics, a singularity is a point at which a given mathematical object is not defined, usually due to such problems as "dividing by infinity." In terms of astrophysics the original "nothing" was a gravitational or spacetime singularity—a point where the gravitational field was infinite, or at least exceedingly large.
- The expansion from this "nothing" is described in terms of Einstein's general theory of relativity. Consequently, the "nothing" from which expansion began was not a "nothing" located somewhere in empty space. There was no empty space. In theory the space came into existence because of the expansion; it was created by the expansion. This expansion from a "nothing" occurred around 13.7 to 13.8 billion years ago, and the universe has been expanding ever since. The act of expansion caused cooling of the energy within the expanding space.
- As a consequence, at some point after the beginning, the energy condensed into atoms of hydrogen and helium (very light elements). The expansion gave rise to cooling and the cooling continued. There were thus gas clouds. Under the influence of gravity these gas clouds condensed, forming stars and eventually, planets.
- The process of planet formation involved a large number of supernovas. Contemporary science has just one explanation for the formation of heavy elements. They are believed to be formed by nuclear fusion within stars. Once a star explodes in a supernova, heavy elements of every variety are scattered into the surrounding space and many of these heavy atoms eventually participate in planet formation.
- Some stars do not explode in a supernova event, but condense so completely that they become "Black Holes." They become regions of spacetime with such a strong gravitational field that nothing (no particles or radiations of any kind) can escape from inside.

- The stars grouped themselves into galaxies, the galaxies we observe today. Thus the universe consists of galaxies composed of billions of stars and the stars (or at least many of them) are accompanied by planets, which in turn may have moons.
- Currently this Standard Model includes the idea of "dark matter." The dark matter is non-luminous matter in the sense that it does not emit light and hence is undetectable directly. Dark matter is estimated to constitute roughly 27 percent of the whole universe. Additionally the Standard Model includes the idea of dark energy. This is non-luminous energy and it is estimated to constitute about 70 percent of the whole universe. Thus only around 5 percent of the universe is believed to be luminous (in the sense of being visible to telescopes and other scientific instruments).
- At the farthest reaches of this expanding universe, the extreme edge of its expansion consists of thermal radiation left over from the time soon after the expansion began when hydrogen atoms first formed. This is called the Cosmic Microwave Background Radiation (CMBR).
- The universe is expanding, but it is not expanding at a constant speed, the expansion is accelerating.

This is currently the dominant model. It is not the only scientific model and it is not without its critical opponents within the scientific community. It is very likely that it will be updated with new details or superseded as time passes. It may even have been updated since we wrote these words.

### *"Evidence" for The Big Bang Theory*

In the absence of evidence, the Standard Model of Cosmology may seem bizarre if you have never encountered it. However, those who adhere to it seem comfortable with it and cite evidence for it in four main areas.

1. **The Recession of Galaxies.** One interpretation of measured galactic observations is that the galaxies are moving away from each other. This is taken to demonstrate, if we go back in time, that they originated from a common point.
2. **CMBR.** The existence of Cosmic Microwave Background Radiation with a black body spectrum and a temperature of 2.725 K is observed in every area of the sky (between stars). This is interpreted to be evidence of expansion.

3. **Galactic Evolution.** Galaxies appear to evolve in the sense that those furthest away appear to be in earlier stages of evolution. (astrophysics models galactic evolution).
4. **Light Elements.** The abundance of the "light elements," hydrogen and helium, observed throughout the universe, is deemed to support the Standard Model, although it would be more accurate to say it is simply consistent with it.

Objective science agrees that there was a moment of creation when the current universe came into existence from a previous state. It disagrees with the proposition that it began with a singularity. Its proposition is that the moment of creation occurred when the laws governing the universe were changed by the actions of the Absolute (an intelligence that dominates the universe). The universe then proceeded to develop according to the Ray of Creation, which we discuss in detail in the next chapter.

Objective science asserts that all levels of the Ray of Creation exist within each other. It does not suggest that the universe is expanding or that it is contracting. The presumed recession of the galaxies of astrophysics is based upon the assumption that distant galaxies must be receding because of the Doppler shift of light (the redshift) from far galaxies. This is an extrapolation that we will discuss in more detail later. But first we need to discuss the merits of extrapolation.

## *The Problem of Extrapolation*

In the objective science world view, extrapolation is not valid beyond a certain point. This is a simple consequence of the Law of Seven as described in the progress of an octave. An octave progresses from ***do*** to ***re*** and the same rate of progression persists from ***re*** to ***mi***. Between ***mi*** and ***fa*** lies an interval which deflects the octave. From ***fa*** to ***sol***, we get a rate of progression that persists from ***sol*** to ***la***. However the progression from ***la*** to ***si*** is disharmonized. Between ***si*** and ***do*** there is a second interval which deflects the octave. With this kind of disruption in the progress of an octave, extrapolation is simply not valid. Things do not proceed in a straight line.

Given this fundamental law, backward extrapolation from the present to 13.7 billion years into the past has no validity. Whatever the circumstance, when we encounter any extensive extrapolation in the theories of contemporary science, we would be wise to consider the octave.

We can also look at this another way. From the perspective of objective science everything is alive and hence capable of action within the context of its existence. To suggest that the behavior of galaxies, suns and planets is mechanically predictable presumes that these living entities always repeat the same action without choice. In contrast, objective science proposes the existence of intelligence at every level, with at least some ability to choose.

### *Space*

Our usual understanding of space is that it has three dimensions: length, breadth and height, and that these dimensions extend in every direction without end. We tend to think the universe exists in this infinite space and maybe it too extends infinitely. This is the view that Isaac Newton held of space.

The Lambda CMD model takes the view that the universe is expanding and that the only space which exists is the space within that expansion. Space is bounded and there is no space beyond it. The universe is thus like an expanding balloon with nothing, not even space, outside the balloon. From a philosophical perspective the distinction between these two views is almost meaningless. Whether there is or is not space outside that theoretical "balloon" can neither be proved nor disproved. So it does not matter. Whether the universe is infinite or finite within infinite space does not matter either.

The Lambda CMD model is deduced from Einstein's theory of relativity. In this theory, Einstein treats spacetime as a single four-dimensional framework, with time as the fourth dimension. While the three dimensions of length are not necessarily related to the contents of the four dimensional space, this is not so in respect of time. The dimension of time was deemed to relate directly to the force of gravity. Four dimensional spacetime could thus be curved, with time distorted by gravitational force and hence responsible for the curvature.

Objective science does not align with this view of time, as will be discussed later. Here it is sufficient to note that, from the perspective of objective science, the nature of time is determined by the cosmos within which time is being considered.

There is a conceptual question that can be posed in respect of space, which is as follows:

> *If a particle is moving at a constant speed in space in a given direction with respect to the three dimensions of space and suddenly the rest of the universe disappears, is the particle still moving?*

This question cannot be resolved by experiment in the real world, but it is important because it is fundamental. Newton took the view that the particle would indeed still be moving, implying that empty space itself provides a frame of reference. A further question that can be asked is:

*When the universe is removed, does the particle have any mass?*

It could not have mass by virtue of gravity since there is nothing else in this hypothetical environment that could generate a gravitational force. So the question is whether it would have mass by virtue of inertia and this is not easily answered.

Inertia (the resistance to a change in motion) could only be detected by the intervention of some force on the particle. But the conditions of this "thought experiment" eliminates that possibility. If space were utterly empty, then there would be nothing to provide a resistance to change, and so the conclusion that it has no inertia and hence no mass, seems valid. However there is another possibility that can be considered—that space can never be empty, but is filled with "aether." If that is the case then the particle could have mass by virtue of the aether. To pursue this any further we need to discuss what we mean by "aether."

## *The Aether*

The existence of aether was suggested by the Ancient Greeks and generally believed to be an aspect of the universe for many centuries, although there were few assertions about its properties and how it influences anything. The aether became important with the study of the wave characteristics of light. Vibrations of sound in the air, or ripples on the surface of water, exhibit a wave characteristic through the material mediums of air and water respectively. They are phenomena that are conducted by fluids (air and water). Because light also exhibited this wave characteristic, even in a vacuum, it was assumed that light waves propagated through a (fluid) medium. That medium was presumed to be the aether.

The ground breaking work of Clark Maxwell in providing a theory, complete with practical equations, to describe the propagation of light and magnetism assumed the existence of an aether through which electromagnetic radiation propagated.

Incidentally, another reason for presuming the existence of aether was the force of gravity. It was clear that masses attracted each other, but through what medium did such an attraction take place and how? The aether provided a possible answer to that too.

Objective science assumes the existence of an aether, as Gurdjieff states somewhat obtusely in *The Tales*. This provides us with good reason to be interested in contemporary science's experiments to determine the existence or otherwise of the aether.

The assumption of an aether was never doubted until the famous Michelson-Morley experiment, which attempted to measure the aether but failed to find strong evidence for it. This warrants some comment. First of all there are two possible theories as regards aether. The first is that the whole of space is filled homogeneously with aether. The second also has the whole space filled with aether, but the aether is "entrained" by the activity of the material it surrounds. The second idea proposes that the aether is a fluid of some kind. So the entrainment of aether by the Earth is analogous to the "entrainment" of water by a ball under water, which is both spinning and orbiting some central point. The water in the vicinity of the ball will tend to be dragged with the ball, but water at a distance will not be affected.

The Michelson-Morley experiment was attempting to discover "unentrained aether." It did so by trying to find a difference in speed between two rays of light that travelled at right angles to each other, using an interferometer. We will not go into the fine details of the experiment here, they are well documented elsewhere. The experimenters expected that their results would reflect the approximately 30 km/sec speed of the Earth around the Sun. It did not.

Nowadays if you read about this experiment, the narrative describing it will often insist that the experiment produced a null result, proving that the aether did not exist. That was not the case. Michelson expected that because of the Earth's 30 km/sec motion, his interferometer experiment would yield a result showing a fringe shift equal to 0.04 fringes, but the highest value measured in a number of separate experiments showed a deviation from zero of only 0.018 fringes, and other measurements were much less. His conclusion was that the hypothesis of a stationary aether was not confirmed.

In reality he could never have obtained the result he expected even if there were a stationary aether, because, while the Earth moves in orbit at 30 km/sec, the whole of the solar system is also moving and it moves at much higher speed than that.

Another scientist, Dayton Miller, conducted far more detailed experiments over a period of almost 30 years, also using an interferometer, but with a far more precise set up. One distinct difference between the two experiments was that Miller's experiments were conducted on Mt Wilson, at an elevation of 6000 ft. He was not investigating the idea of stationary aether, but of Earth-entrained aether. The expectation was that the aether would move at a faster speed at such an elevation than at sea-level.

His experiment yielded consistently positive results, which varied according to time of day and season. Analyzing his experimental data, he eventually concluded that there was an entrained aether. He also concluded that the Earth (and the whole solar system) was moving at a speed of 208 km/sec. towards an apex in the Southern Celestial Hemisphere.

After Miller's death, it was discovered that the solar system is indeed moving—it is gradually orbiting the Milky Way and the speed of its motion is approximately 230 km/sec, not so different to the 208 km/sec figure Miller suggested. (And, incidentally, the Milky Way is also moving)

Unfortunately for Miller, and his place in contemporary science, by the time he was publishing his results, the world of physics had become enamored of Einstein's relativity and so his results were ignored. Later, after he died, his experimental results were "pecked to death" by critical review. Nobody made any attempt to replicate his work, it was simply dismissed. The fact that Miller had predicted (within 10%) the speed of the solar system was also ignored.

Other experiments in the last hundred years which seem to suggest the existence of an aether, including those by M G Sagnac, M Allais, E Silvertooth, R DeWitte, and Y Galaev have tended to be ignored or dismissed, or simply "explained" away. No matter how much modern science would like to deny it, there are experiments that support the existence of aether.

As we shall soon see, the Standard Model of Cosmology is in considerable disarray. Until the model ceases to be based on Einstein's general relativity, it will never accommodate aether. Einstein himself declared that proof of the existence of aether would invalidate relativity.

### *The Recession of The Galaxies*

There is a "law" derived from general relativity equations by Georges Lemaître which defines the expansion of the universe. The estimated value for the rate of expansion is called the Hubble constant and the "law" is called Hubble's Law. It states that:

- Objects observed in deep space (extragalactic space) show a Doppler shift in the light they emit. This can be interpreted as relative velocity away from Earth.
- The Doppler shift measured velocity of various galaxies receding from the Earth, is approximately proportional to their distance from the Earth (for galaxies up to a few hundred megaparsecs).

The reason that Edwin Hubble's name is attached to both the constant and the law (and also the famous orbiting telescope) is that Hubble originally provided "evidence" for this expansion of the Universe using measurements of Doppler redshift from a collection of galaxies.

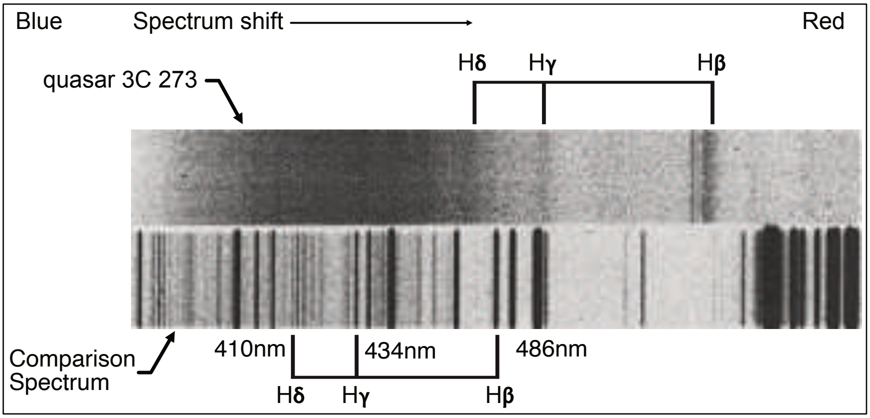


*Figure 1. Redshift of Quasar 3C 273*

It is important to understand what redshift means. You can recognize particular elements (hydrogen, helium, etc.) from their spectral fingerprint. An element emits light only on certain well known wave lengths. If you detect the spectrum of hydrogen from any source near or far, you know it is hydrogen from the pattern of wavelengths of light detected. Examining such spectra from a set of 23 galaxies, Hubble noticed that their pattern was as expected, but their wavelengths had shifted towards the red end of the spectrum—hence the term "redshift."

A redshift comparison of two spectra is illustrated in *Figure 1* above. The lower spectrum is an interferometer recording of a light source on Earth and the upper one shows the interferometer recording of light from the quasar 3C 273. The blue end of the spectrum is on the left and the red end on the right. In both spectra the location of specific wavelengths, Hδ, Hγ and Hβ are marked and, as can clearly be seen, they are shifted towards the red end of the spectrum in the reading from the quasar.

An explanation of such shifts is that the source of light is receding and the shift is a Doppler effect. This would mean that the quasar's motion away from us slightly stretches out the wavelengths of the light it emits as it recedes, which reveals the speed at which it is receding. Galaxies that are fainter are probably further away, so if they register higher redshifts you have evidence that these more distant galaxies are probably receding at a greater speed.

Hubble's original graph of redshifts for 23 galaxies certainly seemed to indicate such a pattern. However, there were errors of extrapolation in the way that his graph had been constructed, and when such errors were removed, the presumed pattern disappeared. Hubble, to his credit, eventually admitted the error and denied that his work had demonstrated the redshift Doppler effect.

His admission came too late. The redshift of galaxies was almost instantly accepted as a genuine phenomenon demonstrating an expanding universe. General relativity suggested expansion and the general consensus was that Hubble had provided the necessary evidence. This laid the foundation for the Standard Model of Cosmology (The Big Bang Theory). If the distant galaxies are speeding away from each other, then you can extrapolate back in time to points where they were much closer together. Go back far enough—say 13.8 billions years—and then maybe they all emerged from a single point.

The situation subsequently became perplexing when astrophysicists began calculating a particular number generally referred to by the letter $z$. This "z" denotes the ratio between the recessionary velocity of a distant stellar object and the speed of light. It can be expressed simply by the equation $z = v/c$, where $v$ is the recessionary velocity and $c$ the speed of light. $z$ classifies stellar objects according to their recessionary velocity as measured by Doppler redshift.

Unfortunately and inconveniently, some distant objects, particularly quasars, exhibited a value of $z$ that was greater than 1—in other words the galaxy appeared to be speeding away from us at a speed greater than the speed of light. The quasar ULAS J1120+ 0641 currently holds the highest measured value of $z$, at about 7.1.

In theory, distant objects cannot recede at such speeds because Einstein's special theory of relativity insists that the speed of light places an absolute limit on velocity. As relativity lies at the foundation of The Standard Model of Cosmology, a clear contradiction had emerged. An adjustment to the Standard Model needed to be made—and it was.

The alternative explanation was this:

> *The expansion of the universe itself created new space-time in between our galaxy and those distant galaxies and quasars. As new space-time was created, it slightly stretched out the wave lengths of the light from those sources.*

The uncertainty surrounding Hubble's original work was dealt with by assuming that the expansion of space-time was not detectable in the local galaxy cluster (of which our galaxy is a component) because of local gravitational effects. All of this was acceptable because it could fit into a mathematical model that represented an expanding universe.

## *The Quasar Evidence*

The word "quasar" is short for quasi-stellar. They are not stars as we normally understand them, for two reasons. First, they are extremely luminous—they emit vast amounts of light. How much? Some quasars are estimated to have a luminosity 100 times greater than that of our Milky Way, which is estimated to consist of anywhere between 100 billion and 400 billion stars. Secondly, the spectra of light from a quasar contains very broad emission lines, unlike any from known stars, indicating the presence of many more incandescent elements than are evident in typical stars.

The current consensus theory for quasars is that they are highly compact accretions of matter at the center of a galaxy that surround a massive black hole—the light being caused by mass from the quasar gradually vanishing into the black hole.

There is, however, a problem with the empirical evidence. Many quasars are found in visual proximity to galaxies, often in pairs—and the galaxies have very different redshift values to the quasars. When such associations between galaxies and quasars were first noticed, they were explained away as coincidental. The redshift values "indicated" that the quasars in question were simply billions of light years further away—they just appeared to be associated by chance.

Halton Arp, an empirical astrophysicist and avid collector of quasar images and data, has been embarrassing Big Bang theorists for many decades with evidence of this clear and obvious association. The reward for his honest efforts has been to have his research work suppressed by almost all the journals of astrophysics. Although he died in 2014, his work is available in a number of books including *Seeing Red: Redshifts, Cosmology and Academic Science.* This book presents a great deal of evidence for galactic-quasar associations and is justifiably critical of the academic establishment.

## *What Causes Redshift?*

Because of Halton Arp's work, the Lambda CDM theory is dead in the water. Nevertheless, the astrophysics establishment has plugged it into an elaborate intellectual life support machine and declares it to be in perfect health, but it shows no signs of life—"its heart is not beating and it breatheth not."

From the perspective of objective science we need to pay it little attention. We were obliged to distrust it from its lack of empirical support and its over-investment in mathematical modeling. And we have no option but to reject it because of its devil-may-care extrapolations.

However, there are reasons why redshift should interest us. It is undoubtedly the case that redshift can be the result of a Doppler effect when a distant stellar object is genuinely moving away from us. Blue shift is also possible when a distant stellar object moves towards us. For example, the Andromeda galaxy appears to be moving toward our Milky Way galaxy because light coming to us from there exhibits a definite blueshift.

The problem with redshift is that the Doppler effect alone is inadequate to explain many empirical observations. The most blatant of these is the quasar data. Quasars, in many instances, are clearly associated with nearby galaxies, but their redshift exhibits a far greater displacement than the light from the associated galaxy. As the light from both passes through approximately the same regions of space to reach us, the causes of the redshift must, to some degree at least, be related to the source. It is possible that the redshift is caused by a quasar's gravitational forces or by local electromagnetic effects, but as we know very little about quasars, aside from the fact that they emit a great deal of light, all theories of the cause are speculative at best.

Such quasar light must also pass through a vast distance between its source and our solar system. We do not know for sure what occupies that space. The current theory is that it is close to being a vacuum, but contains a plasma of hydrogen and helium, plus various other particles, particularly neutrinos, and possibly traces of other elements (dust) that may or may not be in the form of plasma (plasma is a state of matter where the electrons are not bound to the atomic nucleus). Space is also dense with electromagnetic radiation passing through in every direction and may be awash with magnetic fields. We do not know for sure, because we cannot yet take accurate measurements, but the above description seems likely to be accurate given current evidence.

The plasma density in intergalactic space is currently estimated to be one hydrogen atom, i.e. one proton and one corresponding electron, per cubic meter. But estimates vary, with the space near the center of a galaxy estimated to be denser—as much as 1000 protons and electrons per cubic meter. Traveling through space with such a minimal density, light could pass from a source millions of light years from Earth with little chance of encountering a single proton.

If redshift is not caused by a Doppler effect, then the light must lose energy somehow between its origin and its destination. The wave length of the light has increased and its frequency has been reduced. It is possible then that the loss of energy occurs during its journey. Theories that propose how such a loss of energy could happen are generally referred to as "tired light" theories and there are many. We will list them here without venturing to explain any of them:

> *Thomson/Compton scattering, Rayleigh scattering, gravitational drag, atomic secondary emission, dispersive extinction, plasma redshift, redshift theorem, coherent Raman Effect on incoherent light, electronic secondary emission, Wolf effect, spectral transfer redshift, extinction Compton scattering by relativistic electrons, thermalization, gravitational interaction and eternal contracting universe.*

This list was sourced from the book *The Static Universe**, which we recommend to those readers who wish to explore the competing cosmological theories of contemporary science. We include it here primarily because it clearly indicates that there are more than one or two astrophysicists who have not been mesmerized by the currently dominant Standard Model of Cosmology (The Lambda CDM theory).

To that list we could also add "the loss of energy due to movement through the aether," which was measured by Dayton Miller during the early part of the 20th century in an experiment that no-one has ever attempted to replicate, but was "pecked to death."

## Darkness

A schoolboy prank that used to do the rounds in the 1960s worked like this:

> You pick a victim whom you were reasonably certain was unfamiliar with the prank, and ask them: *"What is the first sign of madness?"*
> They would respond predictably with: *"I don't know."*
> You then say: *"Hairs on the palm of your hand."*
> The victim would invariably and immediately take a look at the palms of their hands.
> You would then say: *"Do you know what the second sign of madness is?"*
> They would respond *"No."*
> You would say *"looking for them."*
> Caught by the prank they would usually smile and as they did so, you would continue: *"And you know what the third sign of madness is?—finding none."*

We could rephrase this a little for the benefit of many modern astrophysicists. The first sign of madness is: belief in the idea of dark matter. The second sign of madness is looking for it, and the third sign of madness is finding none.

* *The Static Universe* by Hilton Ratcliffe

The sad truth is that the motion of stars within galaxies cannot be explained by the force of gravity. The assumption is that you can estimate the mass of stars by measuring their brightness. The brightness of a star at the estimated galactic distance is taken to indicate its mass. However, if you model galaxies in this way, the outer stars appear to be orbiting the galactic center too quickly. You either abandon the idea that gravity is the only force involved, or you invent the existence of matter that is undetectable: dark matter.

The opponents of Copernicus and Galileo, who rejected the heliocentric model of the solar system and adamantly defended the once dominant Ptolemaic model, did not resort to a magic invisible fix to defend their cherished model. When the empirical evidence became increasingly unfavorable, they gradually acceded to the heliocentric model. And yet, from a mathematical perspective, there is no difference between the geocentric and heliocentric models. It merely reduces to the question of where you place the origin of the three dimensional framework marked out by the ***x, y*** and ***z*** axes.

The heliocentric model is preferable merely because it results in much simpler equations to define the orbits of the planets and their moons. The addition of the force of gravity to either mathematical model (along with accurate estimates of the mass of the planets and the sun) does not alter this. The heliocentric model is still far simpler, but both models can be made to work mathematically. The problem that astrophysics faced was that it could find no way to explain the outer orbits of suns (and their solar systems) around the center of a galaxy. Their model simply did not work. Kepler's laws of planetary motion, which Newton demonstrated as derivable from his laws of motion and gravitation, do not apply to the empirical data of the orbits of suns within a galaxy.

Once astrophysics was faced with such empirical evidence, it had to make a choice. It could either search for forces other than gravity that might be responsible for this inconvenient galactic behavior, or invent the existence of mass that was "currently undetectable." The fact that the consensus of physicists chose to adopt the "magic dark matter" proposition is a testament to their identification with the Standard Model of Cosmology.

Current estimates suggest that dark matter makes up about 27% of our universe. How is that figure arrived at? It's the ratio of "dark matter" to real matter that would need to exist to account for the orbit of suns within galaxies according to standard gravity models.

Just as you do not need to be a master carpenter to detect a wobbly table, you do not need to be an astrophysicist to realize that dark matter is an absurdity.

Nevertheless, if you search the Internet you will find abundant "proof" of dark matter's existence—"proof" of hairs on the palm of your hand. It is a testament to the power of mathematics that, given a little selective empirical evidence and a strategic choice of variables and constants, you can produce impressive models of things that cannot, do not and never will exist in reality.

As for dark matter, so for dark energy. Dark energy is a newer fantasy than dark matter. In 1998 two independent supernova projects which treated particular types of distant supernovae as standard candles produced results that could be interpreted as demonstrating that the universe was not only expanding but the expansion was accelerating. This was of course a shock to the world of astrophysics, because there was nothing in the Standard Model that could account for this inconvenient acceleration. It had to make a choice. It could either question all the assumptions of the Standard Model or invent the existence of energy that was "currently undetectable."

The fact that the consensus of physicists chose to adopt a "magic dark energy" solution pretty much demonstrates that the Standard Model of Cosmology is no longer a theory. It is an atheistic "article of faith."

Chronologically, the first of the dark ideas to emerge from the mind of modern physicists was the black hole. You would think, given the plethora of articles appearing over decades in science magazines and web sites that there could be no doubt whatsoever about the existence of black holes. After all, have not astrophysicists classified black holes according to whether they are stellar, supermassive or miniature and additionally whether they have retrograde rotation, prograde rotation or no rotation? And is it not the case that every month or so some article appears heralding the discovery in some sector of the sky of yet another black hole? Didn't they even produce a picture of one?

In reality a black hole is a theoretical construct based on mathematical modeling and extreme extrapolation. By extreme extrapolation, we mean that assumptions are made about what happens in conditions that are impossible to produce in a laboratory or observe in the sky. They are very much like hen's teeth.

## The Cosmic Microwave Background Radiation

"Our vast universe expanded to its current vast size over 13.8 billion years after its initial emergence from a singularity." This is undoubtedly a very bold assertion, especially as the same physicists who assure us this is the case, also assure us that when a critical mass of matter exists within a given volume of space it will collapse into a black hole. Clearly, this collapse always takes place, except in the rare circumstance that a universe is being created.

It is mathematically challenging to model the creation of the universe from a singularity, especially given that there is no empirical evidence at all and never can be. Nevertheless, physicists have done their best with their "laws" and mathematical equations, with the help of a convenient assumption here and there. If you throw in the idea of dark energy, which is currently estimated to account for about 70 percent of the whole universe, it's hard to imagine that you wouldn't be able to cook up such a model in some way.

Before there was any evidence of any background radiation, the Standard Model theorists had predicted what (perhaps) should be found:

1. It should be isotropic (i.e. detectable in every direction and always be the same).
2. It should exhibit black body radiation.
3. The radiation should have a longer wavelength than light.
4. It should exhibit a temperature between $28^0$ and $50^0$K.
5. It should not be explicable as coming from any other source.

Clearly, if we are looking back into the origin of a universe that began with a big expansion, then the most distant thing we should be able to detect is the initial expansion, which logically would have to be the same in every direction. The expansion model suggests that the primordial matter that we might be looking at in this way should have cooled down and be inert. It should thus exhibit black body radiation. It would have to have a lower wavelength than visible light otherwise we would detect it as light or very energetic electromagnetic radiation, and anyway given the temperature estimate ($28^0$ and $50^0$K) it is only likely to be detectable as thermal radiation.

When Arno Penzias and Bob Wilson were working together at Bell Labs on a telecommunications satellite project in 1965, they kept encountering interference to signals in the microwave band. Naturally they tried to eliminate the interference in various ways, but they soon discovered that they couldn't, because the interference came from all directions and its level was always roughly the same. Their accidental discovery had them scratching their heads to determine a cause, but that problem was quickly snatched from their hands. Standard Model physicists were soon swarming all over this newly discovered radiation like ants on an ant hill. They had little doubt as to what the cause was.

This microwave interference was soon named CMBR, declaring by its nomenclature that it came from the "very edge of the universe." The fact that this radiation was definitely not isotropic and its temperature proved to be a mere 2.7$^0$K, well below the predicted value, were not allowed to intrude on this "clear validation of the Big Bang."

There has been a great deal of study of the CMBR. Two different satellites have been launched at great expense and they have gathered masses of data in an effort to measure the CMBR in every possible direction. Scientists have tortured the data and manipulated their models every which way but loose in an effort to explain why the empirical evidence does not show this radiation to be isotropic.

Rather than being concerned by their heroic effort to marry the data with the theories—an arranged marriage of epic proportions—let's consider one simple question.

> *When scientists calibrate this radiation, whether doing so from Earth or from a satellite, how do they know how far away the source of the radiation is?*

The answer to this is that they don't. Science has no means for distinguishing between electromagnetic radiation of a given wavelength that has its source a few miles down the road and round the corner, and radiation that has its source 10 billion light years away. And this matters. There clearly is a ubiquitous microwave radiation, but its source could be the local space between the planets of our solar system, which is also ubiquitous from our viewpoint. Or it could be the space between our viewpoint and the nearest stars, or it could be the space between our viewpoint and the rest of the Milky Way, or it could be intergalactic space, or it could indeed be the edge of the universe (if there is one).

The only clue available to determine its true origin is the fact that it is not isotropic even though, according to Big Bang theory, it should be. Astrophysicists explain away this fundamental disparity by claiming that the electromagnetic radiation from the CMBR is distorted in various ways in its passage to our system by interstellar dust or gravity wells or whatever.

## *Distances*

You might believe that when astrophysicists assign distances to various objects in the universe they have an accurate means of measuring such distances. This is not exactly the case.

Currently the best technique for estimating distance of an astronomical object is through parallax. In half a year the Earth goes from one side of the Sun to another, points that are roughly 186 million miles apart. Consider a very distant galaxy that appears stationary and a star that is relatively close to our solar system in almost the same place in the sky. As the Earth moves, the apparent distance between the two objects will vary slightly due to stellar parallax. By measuring the variance, the distance of the far nearer star can be estimated with reasonable accuracy.

Sadly, the best instruments we have, space-based telescopes, are not capable of measuring parallax angles of less than 0.001 arcsec, which limits this technique to about 1000 parsecs (3260 light years). The Milky Way is about 30,000 parsecs in diameter, hence this technique is only useful for a small population of stars in our own galaxy.

Beyond such distances, in trying to measure the distance to other galaxies, astrophysicists seek out "standard candles." In theory, if we know the actual brightness of a distant object in another galaxy then we can estimate its distance from us according to how bright it appears to us. Astrophysicists currently use Cepheid variable stars as one means of making distance estimates. These stars are very bright, they pulsate in a predictable way, and conveniently, the Cepheid star's period (its frequency of pulsation) is directly related to its luminosity.

The problem with this is threefold:

1. No Cepheid star is near enough to provide a baseline that could be confirmed by the parallax method.
2. The inverse square law used to determine the distance presumes that there is nothing present in interstellar space that might affect the observed luminosity.
3. Redshift distortion, which we have already discussed.

The point is that while you can find purported "maps of the universe" in books and on the Web, they only represent "the current best guess."

## The Birth of The Elements

Where did the elements come from? The scientific narrative is roughly as follows:

> *After the Big Bang, the universe expanded rapidly (exponentially) during "inflation," as a kind of soup of fundamental particles, gradually cooling as it grew. At first there was radiation and then quarks combined together to form protons and neutrons. When 3 minutes old, it became cool enough for the protons and neutrons to combine into nuclei. The four lightest elements, hydrogen, helium, lithium, and beryllium then formed, but only as*

> *nuclei, not as fully fledged atoms with orbiting electrons. After about 300,000 years atoms formed. And that was phase one. Having formed, these elements then gathered together in clouds, which condensed to become stars, which organized themselves into galaxies.*
>
> *Once a star had formed, a continuous process of nuclear fusion was presumed to begin in the star's interior giving rise to its output of electromagnetic radiation. Thus heavier elements than the initial four, all the way down to iron, could form by nuclear fusion in stars that were large enough. In stars that were very large, supergiants, the theory is that the center of the star would eventually become dominated by iron atoms, and that this concentration of iron would eventually leads to a massive explosion. The nuclear fusion process to create elements heavier than iron absorbs rather than emits energy. It is presumed that up to a point there is a balance between the energy streaming out from the star and the star's own gravity. This now collapses, the force of gravity condenses the mass of the star into a smaller sphere and the sphere explodes.*
>
> *In theory, the core of the supergiant generates gamma rays that are powerful enough to break apart the iron atoms and a vast amount of energy is released in what becomes a Type II supernova. The shock wave that tears the star apart is supposed to be hot and dense enough to allow the formation of all the elements heavier than iron and these are scattered around the neighborhood by the vast explosion. These elements then go to participate in the formation of planets*

The purpose of this myth is to explain the existence of elements heavier than iron. There are far more credible theories. Nevertheless this myth and the observed abundance of particular elements in the firmament is usually deemed to offer support for Big Bang, although it does not offer proof of any cosmological model. The universal abundance of most elements was predicted correctly by Fred Hoyle decades ago on the assumption of a steady state universe.*

Big Bang theorists co-opted the data on observed elements and focused on the abundance of light elements. However, their mathematical models for predicting the abundance of each such element necessitated an adjustable parameter. There is no indication of what this adjustable parameter corresponds to, other than it makes the model work.

* *https://en.wikipedia.org/wiki/Steady-state_model*

## The Evolution of Galaxies

The final "scientific" pillar that is supposed to prove the correctness of the Big Bang model is the evolution of galaxies. Because galaxies change very slowly we are unable to observe their evolution directly, but it is clearly the case from observation that very distant galaxies (where what we see through telescopes occurred 10 billion or more years ago) look different to closer galaxies (where what we observe happened just a few billion years ago). Astrophysicists have thus been able to model galactic evolution and their view is that galaxies form roughly as follows:

- They begin with smaller clusters of stars.
- These clusters coalesce (or collide) to form larger disk-shaped clusters.
- The rotation speed appears to increase.
- Stars form rapidly inside the disk and a spiral structure emerges.
- Galactic mergers occur, possibly leading to the creation of elliptical galaxies.

When small galaxies collide or coalesce there is no indication that any of the stars within those galaxies collide with each other directly. Big Bang theorists naturally assume a prior stage to the first step described here in which small clusters of stars are formed from gas clouds.

Galactic evolution is the best evidence that there was a beginning of some kind to the universe. No mature galaxies have been observed at very far distances. It is also worth noting that quasars appear to be most numerous in very distant galaxies.

## The Big Bang Objections

There are those who scoff at the various myths that ancient peoples recorded and gave credence to (in some way) as explanations of the creation of the universe. They are many and various, from the familiar Biblical creation of the Earth in seven days to the very philosophical formulation in the Tao Te Ching, which states:

*There was something featureless yet complete,*
*Born before heaven and earth;*
*Silent—amorphous—it stood alone and unchanging.*
*We may regard it as the mother of heaven and earth.*
*Not knowing its name, I style it the 'Way.'"*

None of these creation myths seem as outrageous and intellectually bankrupt as the Big Bang myth. It claims that, at the beginning of time, something occupying a space as small or smaller than the Planck volume* expanded over approximately 13.8 billion years to become the current universe. The Plank volume is considerably smaller than a hydrogen atom. Indeed, a hydrogen atom is roughly $10^{73}$ times larger than the Planck volume.

Think about that. The current universe is estimated to contain roughly $10^{80}$ atoms. And, in current theory, it also contains a vast amount of invisible dark matter and dark energy, made up of no-one knows what. There's a lot more of this dark stuff than the atoms we know and love. All in all, that's quite a magic trick.

Our great great grandchildren will laugh at us for taking anything so absurd seriously. However, if you aspire to be an astrophysicist at the moment, you'd better take it seriously, otherwise you're likely to be in want of a job.

Here below, for the record, are a list of scientific objections to this absurd theory. Although very long it is by no means exhaustive:

- The static universe models fit observational data far better than any expanding universe models. (Of course the fit is not perfect, but it requires far fewer "adjustable parameters.")
- The element abundance predictions based on the Big Bang is awash with adjustable parameters. They are not predictions within the usual meaning of the word.
- The microwave "background" (CMBR) is clearly not isotropic unless you add many adjustable parameters. There are a variety of more credible explanations, one of which is: the CMBR is simply the temperature of space (2.8$^0$K), the minimum temperature that any body in space would cool to if only warmed by distant starlight. No adjustable parameters are required for this explanation.
- The predictions of the CMBR background temperature based on the Big Bang do not indicate a temperature anywhere close to 2.8$^0$K without the intervention of an adjustable parameter.
- The Big Bang time-scales don't work. There are too many large galaxies to credibly form in the supposed time of 13.7 billion years (unless you add in some adjustable parameters).
- The proposed age of the universe is questionable even if you accept the ridiculous extrapolation. Using the same time measurement approach you can find globular clusters (early galaxies) that appear to be older.

* *https://en.wikipedia.org/wiki/Planck_units*

There's even a star, known as the Methuselah* star, in our own galaxy which has been dated as 14.5 billion years old.

- The most distant galaxies in the Hubble Deep Field show evidence of too large an amount of metals in their composition. The Big Bang theory requires the stars, quasars and galaxies in the early universe to be mostly metal-free. A great number of supernovae would be needed to build up the metal content found in stars. Those distant galaxies have more metal than they should have. This challenges the calculated age of the universe in another way.
- The Big Bang asserts that exactly equal amounts of matter and antimatter were created in the initial expansion that began the universe. Antimatter is identical to matter but us oppositely charged. So an antimatter electron (a positron) spins around an antimatter proton in an antimatter hydrogen atom. Antimatter has been created in laboratory conditions—it is not a theoretical fiction. There is no trace whatsoever of the antimatter that was supposedly created in the Big Bang. If it was destroyed by encounters with matter, then all the matter in the universe would have been destroyed, leading to nothing.
- Quasar data and observations are problematic for Big Bang, by virtue of redshift measurements. When the $z$ redshift value is 7 for example, it implies a distance of 13.172 billion miles, making the quasar older than the galaxy it is associated with. As the whole Big Bang theory rides on the back of redshift assumptions, redshift anomalies like this undermine the theory.
- Dark matter is best thought of as the most adjustable of all adjustable parameters. We cannot detect it, so we can assume it is anywhere we want it to be—for example, to explain the motion of spiral galaxies, which gravity alone cannot explain.
- Dark energy is yet another adjustable parameter—for which there is no evidence. It has been invented in yet another effort to breathe life into a dead theory.
- The Big Bang violates the first law of thermodynamics. This quite reasonable law maintains that energy can neither be created nor destroyed. The Big Bang requires that new space filled with "zero-point energy" is continually created between the galaxies.

* *https://www.space.com/20112-oldest-known-star-universe.html*

– The whole narrative of the Big Bang violates the third law of thermodynamics, which can be roughly stated as: in a closed system entropy increases. According to this law, the initial gas clouds that created galaxies would not form as the universe expanded, they would disperse.

The most damning objection to this theory is none of the above. It is that the Big Bang theory has predicted almost no new observations correctly. When a theory is close to the truth the tendency is for new observations to confirm the assertions of the theory. With Big Bang quite the opposite has happened. New astronomic observations result in astrophysicists having to perform painful intellectual contortions.

The theory is based on fantastical extrapolation, mathematical modeling and nothing else. At every turn, astrophysics seeks to bend reality to its models and when it cannot, it creates new adjustable parameters to bend its models towards reality.

## The Quantum Mechanical Morass

Einstein spent a substantial amount of time trying to harmonize his theories of relativity with the experimental results and theories of quantum mechanics, in search of a theory of everything. Physics believes there to be four fundamental forces acting at various scales in the universe. These are: gravitation, the electromagnetic force, the strong nuclear force and the weak nuclear force. If it were possible to find some equation which related all four of these forces together in some proven way, it would probably be possible to unite astrophysics (the physics of objects on a cosmic scale) and quantum mechanics (the physics of objects on a very small scale).

From our perspective, having investigated the Standard Model of astrophysics and found it wanting, it makes sense for us to take a look at quantum mechanics in the hope of finding a more useful basis for examining the phenomena of our universe. As with astrophysics, quantum mechanics has a Standard Model which claims to provide a map of all subatomic particles. This is illustrated in *Figure 2* and includes what physicists currently believe to be all the basic particles from which an atom is formed.

If you were taught at school that atoms are composed of protons, neutrons and electrons, and you have not kept pace with the development of physics, you may be wondering why you do not see either a proton or a neutron in this diagram. The explanation is that both are deemed to be composed of other particles bound together. A proton is composed of three quarks, two up quarks

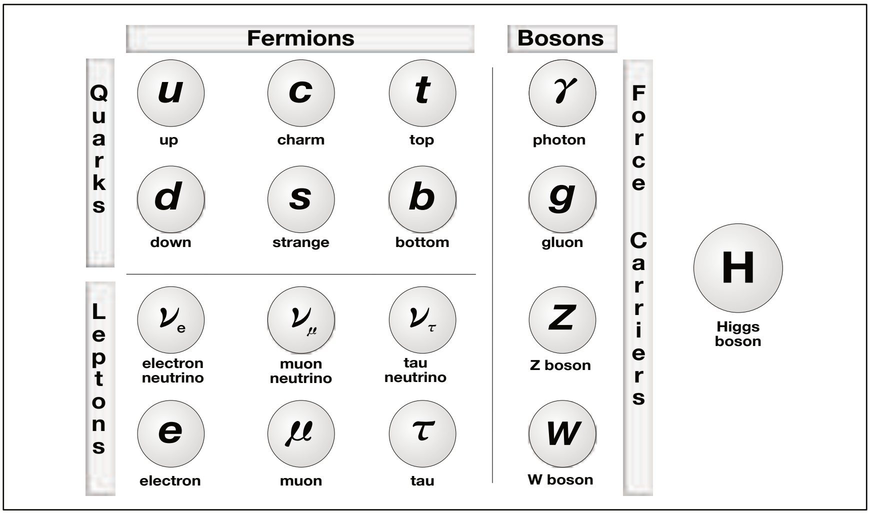


*Figure 2. Quantum Mechanics' Standard Model*

and one down quark, while a neutron is composed of one up quark and two down quarks.

If you are wondering why other particles you may have heard of: positrons, mesons, tachyons, and so on, are not in this table, it is either because they are antiparticles (like the positron), or they are compound particles composed of particles in the Standard Model (like various types of meson), or they are theoretical and yet to be verified (like the tachyon).

In theory, for every particle with an electric charge there is an antiparticle with an opposite charge. Antiparticles do not last long, since when they meet their corresponding particle they are both annihilated, producing energy in the form of photons. For reasons unexplained there is, in theory, a large imbalance between particles and antiparticles in the universe. Experiments suggest that antiparticles are formed in beta decay, a form of radioactive decay, and also by the interaction of cosmic rays (very high energy radiation) when they encounter the Earth's atmosphere. In theory there is a collection of antiparticles that mirrors the Standard Model of particles shown above, but if so this has not been demonstrated.

The twelve fermions in the diagram (six quarks and six leptons) are fundamental particles. Theory has it that these particles cannot be split into smaller particles. Composite particles like the proton are also fermions. The simple distinction between quarks and leptons is that quarks combine to make the compound particles (protons, neutrons, mesons, etc.) while leptons do not; they are particles that can be produced by nuclear reactions.

The four bosons shown in the diagram above are force carriers—particles that give rise to forces between other particles. The photon carries the electromagnetic force and manifests as electromagnetic radiation, such as light, heat, X-rays, etc. The gluon carries (or mediates) the strong nuclear force between quarks, "gluing" them together; hence the name. The W and Z bosons carry the weak nuclear force, providing an explanation for nuclear fission and fusion reactions.

The Higgs Boson is slightly different in that it is deemed to be the particle that confers mass on all other particles. In theory, without such a particle, no other particle would have mass. To better explain the Higgs Boson, we need to also describe the Higgs field. This is deemed to be an energy field that permeates the universe. This energy field continuously interacts with particles, via the Higgs Boson, which carries mass in the form of energy, and thus particles have mass.

Any quantum physicist reading the above description would (and should) regard it as far too simplistic and bereft of many important details. A comprehensive description would require several books and a deep dive into the theoretical characteristics of all these particles (electric charge, spin, mass, color, quantum states, etc). However, the intention here is not to try to explain this Standard Model, just to provide a rough description of it.

It is worth mentioning that the Standard Model of quantum mechanics has a much better (but not perfect) record of predicting and explaining experimental outcomes than does the astrophysics Standard Model.

## The Wave/Particle Problem

The question of whether light consists of waves or particles goes back to Isaac Newton, who was convinced that light was made up of particles. His theory was opposed by Christiaan Huygens who proposed that light consisted of waves. This difference of opinion has never been completely resolved and is still under scientific investigation.

In 1801, Thomas Young performed the first double slit experiment which placed a light source in front of a plate in which there were two thin slits, behind which there was a screen. When this is done, an interference pattern (bright and dark bands) can be seen on the screen as illustrated in *Figure 3*.

If light consists of waves then as the light passes through the two slits, waves of light fan out from each slit. The two sources of light interfere with one another causing the interference pattern. Thus Young concluded that light consisted of waves, not particles.

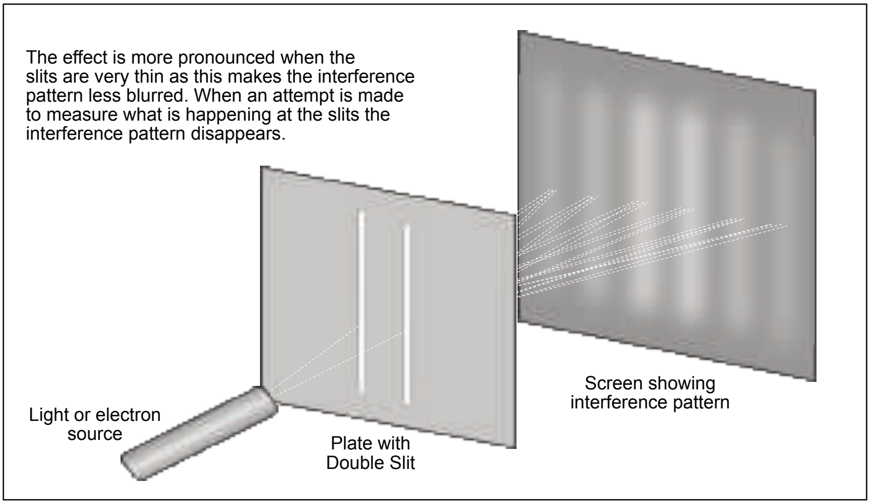


*Figure 3. The Double Slit Experiment*

Nevertheless, as more precise versions of this experiment were carried out, eventually to the point where individual photons of light were sent one-by-one, the light was always found to be absorbed at the screen at discrete points, implying that the light consisted of individual particles. The interference pattern appeared from the varying density of the points of arrival of the many photons.

To make matters more complex, it seems as though individual photons travel as though they are interfering with other (non-existent) photons. Further complications result from the problem that any experimental design which tries to determine which slit the photon passes through, eliminates the interference pattern.

The experiment has been done with electrons, and entities much larger than electrons. Currently, the largest entity used in a double-slit experiment that produced the usual result was a molecule comprised of 810 atoms. The important point about this is that this wave-particle problem is not just confined to subatomic particles.

## Philosophical Discord

Quantum theory was born in 1900 when German physicist Max Planck published his study of the effect of radiation on a "blackbody" substance. He had demonstrated that energy, in some situations, exhibited the characteristics of physical matter. This conflicted with classical physics, which regarded energy as a continuous wave-like phenomenon, independent of the characteristics of physical matter. Planck's theory maintained that radiant energy was made up of particle-like components, known as "quanta." His theory helped resolve previously unexplained phenomena, such as the behavior of heat in solids and the nature of light absorption at an atomic level.

So at its base, quantum mechanics regards energy as both matter and a wave, depending on particular variables. So in the Standard Model one should not think of there being 17 particles, but 17 wave/particle dualities (quarks, leptons and bosons). Quantum mechanics consequently took a probabilistic view of the world, while classical mechanics had always taken a deterministic view of the world, where objects had precise properties, everything could be measured and nothing was left to chance.

Niels Bohr and Werner Heisenberg maintained (in what is called the Copenhagen interpretation) that physical systems generally do not have definite properties prior to being measured, and quantum mechanics could only predict the probabilities that measurements will produce certain results. The act of measurement affects the system, causing the set of probabilities to reduce to only one of the possible values immediately after the measurement. This didn't sit well with Einstein who responded to this idea with the statement, "God does not play dice."

The practical point was that quantum mechanics needed to use probability theory and copious amounts of statistics in order to estimate possible outcomes of events at subatomic levels, and it employed such mathematics with considerable success.

However, common sense suggests that the Copenhagen interpretation is absurd. Simply consider the situation of Mr. Predictable. If it is not raining, Mr. Predictable goes for a jog in the morning, but if it is raining, he does not. Let us also add the fact that it rains in his area 20% of the time in the morning, when he would normally go jogging. If we do not know why Mr. Predictable decides to jog or not to jog, then we will need to observe him to know whether he is jogging at the usual time and why. However, it is absurd to suggest that Mr. Predictable and his environment do not have definite properties until we make such observations.

## The Abuse of Probability and Statistics

Statistics is a useful branch of mathematics. In particular, when we have a situation where we cannot gather sufficient data to predict its outcome, we can use statistical techniques to project possible outcomes. Consider the well proven business of life insurance. We do not have any reliable way of knowing when a specific individual will die. Even in abnormal situations when a particular individual has contracted a possibly terminal disease, all we can do is estimate when death is likely to occur. It is not possible to know and, very occasionally, the disease may not actually cause death.

However if you take a large enough sample of people who suffered exactly the same disease in the past, you can use statistical techniques to predict the likely outcome for any individual and, most of the time, you will be reasonably accurate.

Now, consider the very predictable situation of two balls on a pool table. One ball is stationary and the other has been accurately struck with a cue and is moving exactly towards the stationary ball. It will hit the ball, unless something highly unusual happens, such as an earthquake or, perhaps, someone unexpectedly picks up the stationary ball. We consider such situations to be deterministic: all the possible influences are known and the outcome is thus highly predictable.

Our lives are, to a great extent, deterministic. When we send a letter, we expect it to be delivered, because our experience is that letters get delivered. We expect machines to work as intended. We expect the banking system to work. We expect telephones to work, and so on. Nevertheless the future for most people is uncertain, because we do not know many of the influences that will act. In some situations, statistics can be used to make useful predictions, but such predictions only apply to populations. For individuals, all we can do is assign probability.

As regards quantum mechanics, the situation is no different. Even though it is often thought of as depicting a “weird” subatomic world, the reality is that physicists have been able to gather so little data that they are forced to work with statistical probability.

## Fundamental Forces

Currently physics believes there to be four fundamental forces, two of which we recognize from our own experience. They are:

- **The force of gravity.** We may not know exactly how it works, but we experience gravity by virtue of our own weight and see it in action when things fall to the ground. At school we were taught that the force of gravity obeys an inverse square law, the gravitational forces between two objects weaken as the square of their distance increases. What we were probably not taught is that gravity is a very weak fundamental force even though it is supposedly able to cause the formation of super-massive black holes.

- **The electromagnetic force.** This is the force that we witness via electricity and magnetism, although we may not be sure how it works. Opposite poles of a magnet attract each other and similar poles repel; something that we have no doubt observed. Electricity flows from high potential to low potential. We may be less familiar with the fact that the electro–magnetic force also obeys an inverse square law.

Both these forces are deemed to be infinite in range, although their influence becomes minuscule very quickly as distances increase. What you may not be aware of is that the electromagnetic force is vastly stronger than gravitational force. How much stronger?

Roughly $4.4 \times 10^{37}$ stronger—that's a very large figure.

The other two fundamental forces are deemed to exist in the nucleus of an atom. They are:

- **The strong force.** This is the force that is believed to hold the nucleus of an atom together. It is estimated to be 137 times stronger than the electromagnetic force, but is estimated to have a very short range of $10^{-15}$ meters which is roughly the diameter of a medium sized nucleus. Thus it has no effect outside of an atomic nucleus.
- **The weak force.** This is the force believed to be responsible for nuclear decay and hence radioactivity. It is estimated to have a strength of only $10^{-6}$ of the strong force and its range is roughly one tenth the diameter of a proton.

These two forces are entirely theoretical. There was a need to explain why a collection of protons in a nucleus did not simply repel each other and the nucleus disintegrate. Similarly there needed to be an explanation for nuclear decay, so another force was theorized. So these two theoretical forces were invented accordingly.

The bosons of the Standard Model "explain" how these forces manifest at the atomic level. The photon is the carrier of the electromagnetic force, the gluon carries the strong force and the W and Z bosons carry the weak force.

What is missing is from the model is a particle to carry the force of gravity. There is a theoretical particle called the graviton which is supposed to carry that force, but there is no direct evidence for its existence at the moment.

## The Large and The Small

The practical problems of astrophysics and quantum mechanics are at opposite ends of a stick. Astrophysics is trying to explain the whole universe but it is handicapped by the fact that many of the objects it wishes to gather data on are far away. Distant galaxies cannot be easily analyzed because they move so slowly and very little data can be gathered from them—just the electromagnetic radiation that they throw off. But at least they can be seen. The best data we can get about a star comes from the Sun, but we have just one example. The best data we can acquire about a galaxy comes from the Milky Way, but again we have only one example and it measures somewhere between 100,000 in 200,000 light-years in diameter.

At the atomic level the problem of observation is far worse. With optical microscopes the limitation to what we can observe is about 50 nanometers in diameter, which is better than most experts once believed was possible. That level is remarkable but it doesn't take you down to the atomic level. Electron microscopes are thousands of times better, because the wavelength of an electron can be 100,000 times shorter than the wavelengths of visible light. They can provide pictures of atoms!

However an electron microscope doesn't passively record an image, it focuses a beam of high voltage electrons on the target using a magnetic lens and deduces an image from the interaction between the target and the stream of electrons. Other forms of advanced microscopy (such as photoionization microscopy) suffer from the same problem; the microscope interferes with what you are trying to observe in order to observe it.

The other problem is that, in the extremely small environment under observation, everything is in motion to some degree and sometimes moves very rapidly. Any picture one attempts to take is inevitably blurred and distorted in some way, and there is no means of correcting the distortion, because it isn't possible to compare the picture to the real thing. The use of such observing devices requires the application of deduction and extrapolation.

When one investigates how the Large Hadron Collider gathers its data one encounters the same situation. For example, protons can be accelerated to a high speed to collide with the nuclei of lead atoms. Various data collection devices record the event and the results are analyzed using deduction and extrapolation and a good deal of software to try to model what happened. Just consider the (surprising) estimate that both the W boson and the Z boson have a mean lifetime of $10^{-25}$ seconds. That isn't something that can be directly observed and measured. Any experimental result can only be arrived at by extrapolation from collected data.

There is a great deal of uncertainty in LHC experiments. The physicists have no doubt done their best to eliminate all possible defects in the 17-mile-in-circumference experimental apparatus, but it is trying to identify such small distances and time scales that any small anomaly could interfere with results. That doesn't just apply to the 17 mile ring, but also all collectors and all preparation devices and so on.

To add to the uncertainty, this is not dealing specifically with specific particles in specific locations, but with probabilities of particle locations. A single software error could lead to the apparent discovery of something new, when in fact it is not. Plus there's the problem of whether the LHC is truly a sealed system. How can we know whether some particular result wasn't influenced by a passing neutrino or two. And in strict violation of the usual scientific methodology, there is no possibility of using another identical LHC to test any supposed results.

We are not claiming here that quantum mechanics is wrong, only that there are good reasons to be skeptical. Its most disturbing aspect is the number of "adjustable parameters" it requires. The Standard Model, for example, needs 20 such parameters. In modern physics, adjustable parameters ride to the rescue of doubtful theories. The simplest supersymmetric extension of the Standard Model has no less than 105 additional parameters.

Another good reason to be skeptical of quantum mechanics is provided by pilot waves...

## *Pilot Waves*

Pilot Wave Theory was created by Louis de Broglie in 1927, and later gave rise to the De Broglie-Bohm causal interpretation of quantum mechanics. This provides an alternative explanation for the double slit experiment. In 2004 physicists Yves Couder and Emmanuel Fort used pilot wave theory to reproduce many of the quantum effects.

Rapidly vibrating an oil bath, they were able to bounce silicon droplets on the surface, which walked along the surface producing waves through the oil as they moved. They were able to demonstrate single-particle diffraction, tunneling, quantized orbits, and orbital level splitting. Such systems are now known as hydrodynamic quantum analogs.

This could be an explanation for quantum behavior since it uses the same mathematics as other interpretations and thus is supported by the same evidence. In pilot wave theory the particle and the wave are separate but related phenomena. The particle induces a pilot wave in a medium and that determines how the particle moves. The position and momentum of a particle are considered to be the hidden variables and the observer doesn't know the precise value of these variables, and cannot know them precisely because any measurement disturbs them.

This is analogous to the Heisenberg uncertainty principle.

If we consider an all-pervading aether to be the medium for the wave then we have, conceptually at least, an alternative theory. And as we are in the orbit of quantum mechanics, we could postulate that the Higgs field and the aether are in fact the same thing. Thus the particles can be viewed as moving through the medium of the Higgs field in tandem with a wave in that field.

This brings us face to face with the problem that the only wave phenomenon that is believed to occur without the participation of some medium is light (the photon)—since photons are deemed to be massless because they travel at the speed of light.

## Mach and Weber

Aware of the current malaise in physics, both at the macro and micro level, some physicists (a relatively small group) have gone back to basics and have been reevaluating the theories of Ernst Mach (1836 - 1916) concerning the origin of mass, and the theories of Wilhelm Weber (1804 - 1891) concerning electromagnetism and gravitation.

Going back to basics means exactly that. There are two "thought experiments" in physics that are fundamental. The first concerns the motion of an object in a straight line. The question is: from what does an object get its mass?

According to Newton's first law of motion, an object that is at rest will stay at rest unless a force acts upon it, and if it is in motion, it will stay in motion, moving at a constant velocity unless a force acts upon it. For the situation where the object is in motion, this law establishes a frame of reference for its motion, as illustrated in *Figure 4*.

The thought experiment is this:

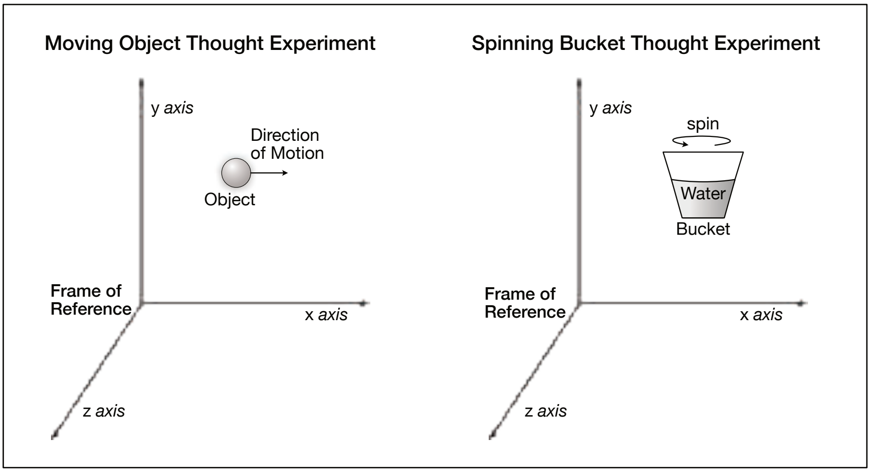


*Figure 4. The Thought Experiments*

> *If you have such an object in motion and immediately the whole of the universe except that object disappears, does the object still have mass and is it still in motion?*

As this is a conceptual experiment that can never be carried out, the preferred answer can only be an opinion. The answer "no" implies that the object acquires its mass and its motion from the rest of the universe, so if that were removed it would have no mass and exhibit no motion. So mass and motion are only in relation to something else. The answer "yes" implies that the mass and motion are intrinsic to the object or in relation to empty space.

Newtonian and Einsteinian physics take the view that the answer is "yes." Mach based his physics on the assumption that the answer is "no."

A second and equally important experiment, proposed by Newton, concerns a bucket half-full of water which is spinning. When you have such a bucket, not only does it have angular momentum (the momentum of its spin), but the surface of the water, which would be flat if the bucket were not spinning will be curved, as illustrated in *Figure 4*.

Again the question can be asked:

> *What happens if you remove the rest of the universe? Is the bucket still spinning and will the surface of the water still be curved?*

The Newtonian and Einsteinian approaches assume that the answer is "yes," while the Machian approach assumes that the answer is "no."

Consider the idea of removing the whole of the universe, you have no basis for creating a frame of reference, since empty space is empty and infinite in every direction. Ernst Mach maintained that the universe in its totality conferred mass and spin on every object that was part of it.* He could as easily have depended on the existence of a mediating aether that conferred mass and spin.

The attraction of Weber's electromagnetic and gravitational theories** are that he proposed a credible model of the atomic nucleus that needed neither the strong nor weak forces to explain atomic behavior.

Our primary reason for drawing attention to Mach and Weber is not a deeply held conviction that their theories are correct, we are simply indicating that modern physics may soon turn in a new direction, because the old direction looks like a dead end.

## What is a Field?

When you study physics you often encounter the word "field," and you rarely encounter a satisfying explanation as to what such a thing actually is. The term "field" first cropped up in the study of magnetism. The magnetic field was deemed to be "something" that conducted the magnetic force in the region of a magnet. After that other fields were postulated: electric fields, gravitational fields, and most recently, the Higgs field of quantum mechanics.

Nevertheless the word "field" is not well-defined and hence can easily confuse. Here are a range of possible definitions:

- A field is a region of space.
- A field is a state of a region of space.
- A field is a real physical entity filling a region of space.
- A field is a medium within a region of space that enables the propagation of a force.
- A field is a mathematical function that returns a value for every point within a region of space.

We can reduce these possibilities, if we decide, as we should from first principles, that, while a field can occupy a region of space, the space itself cannot have any properties. Thus the properties exhibited by a region of space must exist as a result of something which occupies the space. This eliminates the first definition. And we may want to head in that direction anyway, since

* *The Science of Mechanics: A Critical and Historical Exposition of Its Principles by Ernst Mach*
***Weber's Electrodynamics by A.K. Assis*

the current best theory we have of particle physics insists that, at the very least, there is a Higgs field that fills all space.

The final definition—the mathematical one—is nicely precise, and if we adopt that one, while insisting that the region of space referred contains "something" that causes the function to produce the value it does, we can collapse all these definitions into one. This means that "state," "physical entity" and "medium" are simply terms that refer to a "something." It does not at all imply that it is necessarily the same "something" in respect of magnetism, electric fields, electromagnetism, gravity and subatomic particles. However, in every case, the possibility of an aether is not excluded.