27 Nutshell Science and Quantum Weirdness

As mankind began to discover the use of tools, he also began to manipulate various states of matter in his environment to increase his sense of security and comfort. He piled up solid bodies to make walls and shelters. He used water currents to float boats downstream, then he used skins or fabrics to catch winds and move boats upstream. He learned how to generate fire and use its heat and light for cooking, lighting, and then more advanced technologies such as firing pots and metallurgy.

Basic tools began to evolve into a few fundamental machines. Franz Reuleaux (1829-1905) made a study of over 800 types of machines and identified six devices at the foundation of these machines: inclined plane, wedge, screw, lever, pulley, and wheel with axle. He further analyzed that the first three devices involved an object sliding on a flat surface at an angle from an arbitrary "horizontal" reference surface, and the second three involved a body rotating on a pivot. The wedge is a movable inclined plane, and a screw is actually a combination of the incline and the pivot of a lever. A gear is a specialized wheel with axle. The gear teeth serve as a form of lever attached to a wheel to enhance the gripping power of the wheel rim against another object. The technology of inclined planes and the lever are both encoded in the Senet Oracle Board. The first appears as diagonal lines, and the second appears as the Scales of Maat used in the Weighing of the Heart.

The use of tools and their more complex offspring, machines, was promoted, because it appeared to promise something called “mechanical advantage”. Careful inspection reveals that there is no real mechanical advantage except from a limited local viewpoint. An inclined plane allows one to move a heavy weight up a hill more “easily”, but the trade-off is that you have to move the weight farther, plus there is loss of energy through friction.

The lever has the same trade-off. To lift a heavy weight more “easily” on a short arm you must move a long arm of the lever much farther than you can move the weight. The key to the lever is its fulcrum that acts like a pivot. This is really the first step toward developing the wheel, a remarkable machine that can give repetitive motion that appears to increase mechanical advantage even more. However, in the long run there is no free lunch. Maat (Truth and Justice) has everything balanced out.

Newton summarized all that had been learned about tools and machines in his three laws of mechanics. To do so he introduced formal concepts that he called mass and force.

Newton's first law was a conservative law that all mass tends to conserve its condition (inertia if it is at rest and momentum if it is in motion) until and unless it experience a "force" from outside itself. Here he sneaks in the notion of an object with boundaries, an assumption that sounds reasonable enough to a casual observer.

Newton's second law was his "force" law. He defined a force as a mass times an acceleration. ($F = ma$.) In other words, a force applied to an object could move the object out of its conservative state of inertia or momentum and change its dynamic condition. Where does the force come from? Someone or something has to exert willpower in some way to make the change in condition. "Mass" means that the object resists the application of force to it, and this led to his third law.

The third law is that, whenever a force is applied to a "mass", the mass simultaneously resists the force with an equal and opposite reactive force. The end result is a "stalemate" unless the force applied is greater than the reactive force of the mass. That means someone (guess who) has to apply extra "force" to get anything done.

Newton's law explained how the Empire system operating in the England of his lifetime works (or does not work). One group stores up a lot of energy and then applies force on another group or groups to bend them to its will. The unfortunate result is that the group being forced spontaneously resists being forced, and the imperial enforcer has to work extra hard to keep his empire following orders. This Natural Law (Maat) of Balance applies to both organisms and inanimate objects. Organisms are more complex, because they also have wills and can exert counter forces on their own.

Newton added another "discovery" when he developed his "Law of Gravity". He did not really understand gravity. He just took the astronomical data of Brahe and the equations of Kepler, and created a universal formula for describing the motions of planets in our solar system and the way objects tend to fall to the earth. His formula has a constant, "G", that Newton could not measure in his day, but conceptualized with units of measurement that we can now measure with fair accuracy. The formula (basically for two interacting massive bodies) says that the force of gravity equals his constant "G" times the product of

the the two interacting masses divided by the square of the distance between their centers of gravity. This means that his "constant" has the dimensions of a distance cubed divided by time squared and a mass of some kind. The distance cubed divided by time squared came right out of Kepler's calculations of movements in our solar system. The mass had to be one of the two massive bodies. Newton applied his reaction law to the idea that the two bodies were mutually interacting. The larger mass would be the anchor of the system, and the motion would be an ellipse (as Kepler had already discovered) with the "subordinate" body sweeping equal areas in equal times as it moved around the anchor. Two bodies of the same size would go around each other.

Newton had no idea what gravity was. He just made a general mathematical formula that described how it behaves. Now that we study galaxies with powerful telescopes, we find that Newton's formula works a bit differently in such systems, but the formula still seems basically valid. They just have to work in a bunch of invisible and undetectable "dark matter" to make Newton's equation work.

As scientists examined finer and finer aspects of the material world, they discovered something the ancient Greeks had already suspected: matter is made of tiny particles (atoms) that may cohere in various mysterious ways. The study of chemistry then led to the three laws of thermodynamics that began to explain how the tiny particles behave. It all depended on the amount of "energy" and the subtle "forces" that led particles to cohere or not to cohere. The particles all more or less tended to jiggle, and the more energy they had, the more they jiggled. Extra energy could cause a solid to melt into a liquid or a liquid to evaporate into a gas. Very much extra energy would cause material to glow and become a plasma. Techniques were developed to measure the amount of heat energy in a substance. Thermodynamics tended to develop into a general statistical science, because the numbers of particles in systems was so huge.

The first law of thermodynamics is that mass and energy are conserved. This is a subtler form of Newton's conservation of inertia and momentum. Energy can be transmitted and transformed, and the particles also can be transmitted and transformed, but over all they remain conserved.

The second law was rather depressing. It stated that any "orderly" system tends to dissipate its "order" over time. Energy is lost from the system and spreads into the environment. Things rust and fall apart. A local system can find ways to maintain itself, but that also tends to further

dissipate energy. So it is important for a system to find a large reservoir of energy to draw from in order to maintain itself. Our sun is such a bountiful reservoir and the earth catches some of that abundant energy overflow to maintain its ecosystem. The jiggling of the particles that we call heat tends to dissipate energy from the system. Heat spontaneously flows toward cold, but cold does not spontaneously flow toward heat (unless driven by a current of some kind.)

The third law, known as Nernst's Law, states that there is an absolute zero temperature, and cooling a system toward that low temperature increases its orderliness and reduces entropy -- except that it takes energy to cool a system to a temperature lower than the ambient environment, because of the second law.

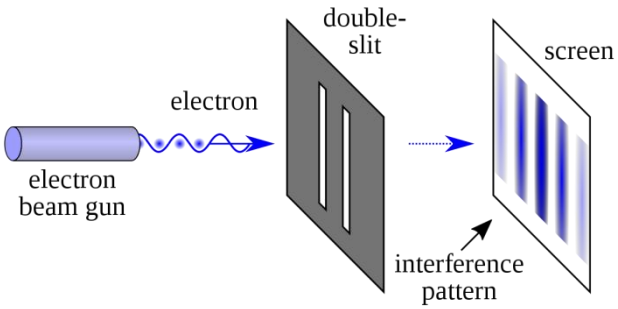
As the study of material science continued, they discovered more about how the particles cohered into various states. The particles often have a mysterious property called charge that makes them stick together, and sometimes makes them push apart. Understanding of magnetism and electricity led to discovering that they are components of the same form of energy, and that light is a sometimes visible form of this energy. The energy depends on a frequency of electromagnetic (EM) vibration, and this has a range that goes far above and far below our perception of it as visible light. James Clerk Maxwell wrote down formulas that describe how EM phenomena behave and he discovered the link that shows it is all a form of light. Experiments with this EM energy led to the development of more and more technologies to generate it, store it, transmit it, and use it in many ways. This technological revolution continues apace, and has led to the realization that the EM interaction runs the universe. In fact, it was found that the law for the EM interaction (Coulomb's Law) is basically the same as that for gravity, except that it is many orders of magnitude greater than gravity and involves a different constant.

During the past century and a quarter the pace of scientific and technological progress has accelerated, bringing new surprises. Planck discovered a new constant hiding deep within energy processes that turned out to be fundamental to how the material universe works. He discovered that his constant quantizes energy in a way heretofore unsuspected. Einstein declared that anomalies in very fast motions indicate that EM interactions also occur with a constant speed, so that the relative motions of objects cause the EM light interactions to appear to shift frequency (wavelength) in order to maintain that constant interaction velocity. This means that time and space can appear to warp at relativistic

(close to light speed) velocities. Einstein's relativity theory opened a new and more general understanding of motion and energy. His photoelectric theory (validated by Millikan, who also measured the charge constant) confirmed the Planck quantization of energy and showed that EM light is quantized as photons, thus not only having a wavelike nature, but also a particle-like nature, even though the light particles have only momentum and no measurable mass. Then de Broglie turned it around and showed that particles with mass also vibrate in a wavelike manner. Atomic structure began to be understood, and the behavior of electrons and nuclei showed the same quantization of energy into levels. This developed into advanced chemistry and atomic chemistry as well as methods of releasing energy from atomic nuclei. This energy is just EM frequencies released by breaking or fusing of atomic nuclei. In different ways. It differs from chemical energy in that the nuclear structure is changed rather than compounds of atoms interacting. This is a very mixed blessing, because atomic waste material may radiate for hundreds or even thousands of years and techniques have not yet been developed and applied to speed up the return of such waste to safe radiation levels.

The difficulty in the new quantum mechanics of grasping how something could be a particle and a wave at the same time led to mathematical descriptions that treated the particles as waves of probability. Physics lost its promise of certainty and became a matter of statistical probability. Heisenberg showed that, because of the Planck relation, the position and momentum of a particle is uncertain. The act of observation disturbs a very tiny system so much that you can not know both characteristics at the same time. The Planck relation also links energy and time in this way.

One of the classic experiments in quantum mechanics is called the 2-slit experiment. If you shoot a beam of electrons at a partition with two slits, the electrons will as if pass through both slits and interfere with each other like waves, making a pattern on a screen behind the slits. However, if you put a sensor near one slit to see which electrons go through that slit, the interference pattern disappears. In the early 19th century Young showed the interference pattern with light passing through two slits. In the early 20th century Davisson and Germer showed that electrons do the same thing. Later experiments showed even atoms and molecules can show this wavelike behavior. Weirdly, the light experiments show that the light hitting the screen is in discrete particles (photons) although it still shows the wavelike interference pattern.



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The really weird part of the experiment is when single electrons or photons are sent through the apparatus one at a time. They also show the same interference pattern. This means single particles are also wavelike and can as if pass through both slits simultaneously. This is not possible with classical objects such as bullets. The probability of detection is the square of the amplitude of the wave, but the particles do not arrive in a predictable order or location. Over a number of events the interference pattern appears statistically.

How is this possible? It simply means that at a subtle enough level of observation the particle nature turns out to be really a wave of probability that is non-local in nature. The particle has some probability to be anywhere at all in the universe, but is most likely to be within a local area. When observed, the probability wave collapses into a specific particle event at a specific location.

Going back to our discussion of the reciprocal Velocity Equation, we find that, due to thermodynamics, it is not possible for a particle to be totally still (despite it having a theoretical "rest mass"). However, the slower it moves, the faster its superluminal phase wave component becomes. A very quiet object thus may link its phase component to the entire universe nearly instantaneously. An "object" moving at light speed is independent of time or space. An "object" moving faster than light moves backward in time (anti-matter) or can seem to exist at the same time in multiple locations. A single particle can vibrate in space time so that it seems to be countless identical copies of itself (a clue as to why quantum particles all look identical). These are keys to the ancient Egyptian reciprocal understanding of the universe as a holistic entity and the importance they attached to balance in the Horizon Twilight Zone of the Ra-Horus Ocean Awareness Meditation.

Study the "Double-slit experiment" article in **Wikipedia**. Note especially the "delayed choice" and "quantum eraser" experiments as

well as Feynman's creative mathematical explanation. This weird experiment is at the foundation of quantum mechanics.

We have now entered an era of information explosion and an electronics revolution without the tools for determining priorities or even how to preserve vital information. We are also advancing into artificial intelligence (AI) and appear to be headed toward a singularity point in which AI matches and surpasses human intelligence. Coupled with robotics technology and advanced biological engineering along with decoding of DNA we peer into vistas where we can explore almost any environment and create viable technologies to operate there. What role our current organic bodies will play in this future remains to be seen and experienced. We might do well to take a close look at the wisdom of past ages to see what we may learn to guide us forward.

The weirdness of quantum mechanics arises from the illusion that there are separate "particles". Nothing is ever separate from the unity of the cosmos even it it seems to be just a very tiny particle. Any particle, however small, us always part of the wholeness. The wholeness resides in awareness, which is the "subjective" aspect of our "objective" worlds of light. This aspect is hidden and invisible because it contains all possible particle-waves and their possible phase relations all at once so that they all interfere "destructively" and cancel out into what seems like "nothing", but is actually what modern physics calls the "vacuum state", a field of pure energy potential. There is no zero, and there is no infinity, there is just an undefined field of potential with probabilities to manifest as this or that awaiting for us to define it. It may be time to consider refining our mathematical concepts into a reciprocally balanced unitary system that fundamentally defines a unitary cosmos.

27 Study Questions

* What aspect of reality did Newton describe? What were some of its limitations?

* What aspect of reality did thermodynamics describe? What were some of its limitations?

* What aspect of reality did Maxwell's equations describe? What were some of his major insights?

* What two new major breakthroughs occurred in physics during the past century and a quarter?

* What major breakthrough occurred in biological science in the past century?

* What is the "weirdness" about quantum mechanics, and how might the unitary reciprocal viewpoint of Egyptian classical civilization explain this phenomenon?

* Speculate on where you think our planetary civilization is headed over the next decades and centuries. How would you like our planet and mankind to evolve?

* How does the material in this article relate to the Series Overview?