

Antonella Vannini and Ulisse Di Corpo

$$E = mc^2$$

How Einstein Swept Retrocausality Under the Rug

$E = mc^2$ may be the world's famous equation. But few people are aware that it is actually a simplification of a more complex equation that was considered unacceptable at the time. The equation, made famous by Albert Einstein, was actually derived by several others before the young Swiss patent clerk put his mark on it, including the Englishman Oliver Heaviside in 1890, the Frenchman Henri Poincaré in 1900, and the Italian Olinto De Pretto in 1903. But in deriving the equation, Einstein's predecessors made assumptions that led to problems when dealing with different frames of reference. Einstein succeeded where others had failed by deriving the formula in a way that was consistent in all frames of reference. He did so in 1905 with his equation for Special Relativity, which adds momentum to the famous energy/mass equation ($E^2 = p^2c^2 + m^2c^4$, where E is energy, m is mass, p momentum, and c the constant of the speed of light). But since this equation is quadratic, it must always have two solutions: one positive and one negative.

The positive or forward-in-time solution describes energy that diverges from a cause, for example light diverging from a light bulb or heat spreading out from a heater. But in the negative solution, the energy diverges backward-in-time from a future cause; imagine beginning with diffuse light energy that concentrates into a light bulb. This, quite understandably, was considered an unacceptable solution since it implies retrocausality, which means that an effect occurs before its cause. Einstein solved this thorny problem by assuming that the momentum is always equal to zero; he could do this because the speed of physical bodies is extremely small when compared to the speed of light. And so, in this way, Einstein's complex energy/momentum/mass equation simplified into the now famous $E = mc^2$ equation, which always has positive solution.

But in quantum mechanics this simplification is not possible, since the spin of particles nears the speed of light; therefore the full energy/momentum/mass equation is required. In 1925 the physicists Oskar Klein and Walter Gordon formulated the first equation that combined quantum mechanics with Einstein's special relativity. But since the negative time solution was considered unacceptable, it too was rejected. Werner Heisenberg, one of the most influential physicists of the 20th



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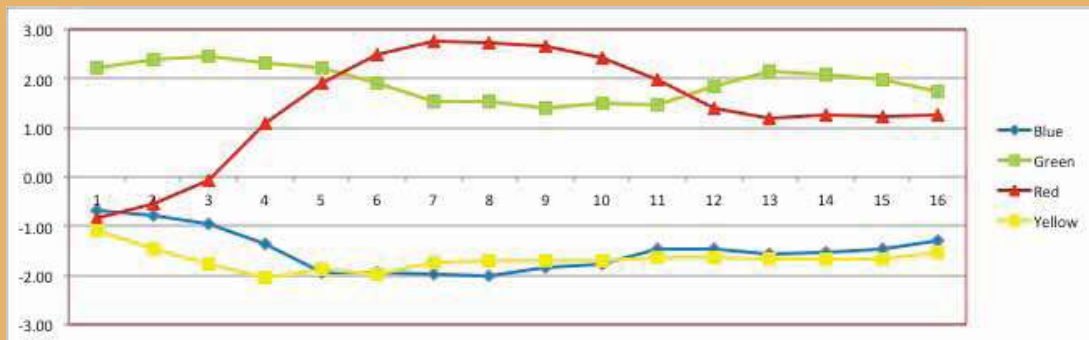
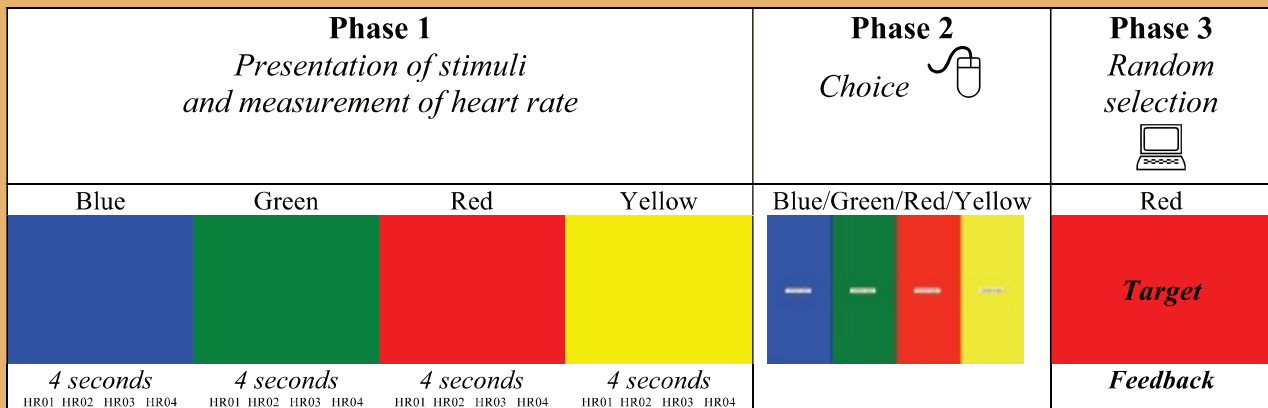
century, wrote to Wolfgang Pauli: "I regard the backward in time solution ... as learned trash which no one can take seriously." In 1926 Erwin Schrödinger removed Einstein's equation from Klein-Gordon's equation and suggested that time be treated in essentially the classical way— as only moving forward. But whereas the Klein-Gordon equation could explain the dual nature of matter (particle/wave) as a consequence of the dual causality (forward and backward in time causality), Schrödinger's equation was not able to explain the wave/particle nature of matter. Consequently, Bohr and Heisenberg met in Copenhagen and suggested an interpretation of quantum mechanics in which matter propagates as waves that collapse into particles when observed. This interpretation, in which the act of observation creates reality, was well accepted by the Nazi establishment of the time since it supported the idea that men are endowed with God-like powers of creation. Einstein's formula was rejected because he was a Jew and because it was felt that Jewish science undermined the power of the Third Reich. But when Schrödinger discovered how Heisenberg and Bohr had used his equation with its ideological implications, he commented: "I do not like it, and I am sorry I ever had anything to do with it."

Life is Caused by the Future

In 1941 the mathematician Luigi Fantappiè (1901–1956), while working on the properties of the equations that combine quantum mechanics with special relativity, realized that the forward-in-time solution describes energy and matter that tends towards a homogeneous and random distribution. When heat radiates from a heater, it tends to spread out homogeneously in the environment; this is the law of entropy, which is also known as heat death. Fantappiè showed that whereas the forward-in-time solution is governed by the law of entropy (from the Greek *en* = diverging, *tropos* = tendency), the backward-in-time solution is governed by a symmetric law that Fantappiè named syntropy (from the Greek *syn* = converging, *tropos* = tendency). The forward-in-time solution describes energy that diverges from a cause, and requires that causes be in the past. But the backward-in-time solution looks—to us moving forward in time—like the energy is concentrating,

rather than dissipating. The mathematical properties of syntropy are energy concentration, an increase in differentiation and complexity, a reduction of entropy, the formation of structures, and an increase in order and information. These are also the main properties that biologists observe in life and which cannot be explained in the classical (time forward) way. This realization led Fantappiè to suggest, in *The Unitary Theory of the Physical and Biological World*, published in 1942, that *life is caused by the future*.

A full professor at the age of 27 and one of the foremost mathematicians of the last century, Fantappiè was invited by J. Robert Oppenheimer to become a member of the Institute for Advanced Study, but he failed to devise experiments that could test his retrocausal hypothesis. Then in 2007 Antonella Vannini formulated the following testable hypothesis: *if life is sustained by syntropy, the parameters of the autonomic nervous systems that supports vital functions should react in advance to*



Antonella Vannini conducted four experiments using heart rate measurements in order to study Fantappiè’s retrocausal effect. Each experimental trial was divided in three phases:

1. Presentation phase: Four colors are presented one after the other on the screen of the computer. Each color is shown for exactly 4 seconds. The subject is asked to look at the colors, and during the presentation the heart frequency is measured at fixed intervals of 1 second. For each color, 4 measurements of the heart frequency are saved, one each second.

2. Choice phase: An image with four color bars is shown in order to

allow the subject to choose (using the mouse) the color that he or she thinks the computer will select. The subject is asked to guess the color the computer will select.

3. Target phase: The computer randomly selects the target color and shows the selected color full-screen on the computer.

In the figure, heart rate differences (for one subject) are graphically represented. It is possible to see how each color differs from the base value when comparing the average heart rate value of the trials according to the target color selected in phase 3. In the absence of retrocausal effects lines should vary around the base value (the 0.00 line).

stimuli. And indeed an impressive number of studies have now shown that the autonomic nervous system (as measured by skin conductance and heart rate) can react *before* a stimuli is shown. The first experimental study of this kind was conducted by Dean Radin and monitored heart rate, skin conductance, and fingertip blood volume in subjects who were shown a blank screen for five seconds followed by a randomly selected calm or emotional picture for three seconds. Radin found significant differences in the autonomic parameters *preceding* the exposure to emotional pictures versus the calm pictures. (A review of the experiments and the description of four experiments conducted by the authors can be found in “Retrocausality: experiments and theory,” Vannini and Di Corpo, 2011.)

Gravity is Syntropic

Another hypothesis that stems from the theory of syntropy is that gravity is a diverging force that propagates backward in time. Equations show that forward diverging forces cannot exceed the speed of light, whereas backward in time diverging forces can never propagate at speeds lower than the speed of light. Consequently, if the backward-in-time solution is real, we should observe that gravity propagates at an instantaneous speed. This would contradict the standard model of particle physics, which states that gravity is caused by massless particles called gravitons that emanate gravitational fields. Gravitons tug on every piece of matter in the universe and prevent gravity from propagating at speeds faster than that of light.

But can we perform experiments in order to measure the speed of propagation of gravity and test which of the two models is correct? The answer has been provided by Tom van Flandern (1940-2009), an American astronomer who specialized in celestial mechanics. To better understand what is happening, let's begin with an example: light from the Sun requires about 500 seconds to travel to Earth. So when it arrives, we see the Sun in the sky in the position it actually occupied 500 seconds ago rather than in its present position. Consequently the light from the Sun strikes the Earth from a slightly displaced angle and this displacement is called aberration. If gravity propagates with a finite speed, we would expect gravity aberration. In other words, the Sun's gravity should appear to emanate from the position the Sun occupied when the gravity now arriving left the Sun. But Van Flandern noted that observations showed that none of this happens in the case of gravity! There is no detectable delay for the propagation of gravity from Sun to Earth. The direction of the Sun's gravitational force is toward its true, instantaneous position, not toward a retarded position, according to our best observations. Gravity has no perceptible aberration and this tells us that it propagates with infinite speed.

In order to better understand the implications of the syntropy hypothesis it is important to differentiate the three types of time, which the fundamental equations predict:

- *Causal time* is expected in diverging systems, such as our expanding universe, which is governed by the properties of the positive solution of the equations. In diverging systems, entropy prevails,

causes always precede effects, and time moves forward from the past to the future. Since entropy prevails, no advanced effects are possible, such as light waves moving backward in time or radio signals being received before they are broadcasted.

- *Retrocausal time* is expected in converging systems, such as in black holes, and it is governed by the properties of the negative solution of the equations. In converging systems, retrocausality prevails, effects always precede causes, and time moves backward from the future to the past. In these systems, no forward effects are possible and this is the reason why no light is emitted by black holes.
- *Supercausal times* would characterize systems in which diverging and converging forces are balanced. An example is offered by atoms and quantum mechanics. In these systems causality and retrocausality coexist, and time is unitary: past, present, and future coexist.

This classification of time recalls the ancient Greek division in: *kronos*, *kairos* and *aion*.

- *Kronos* describes sequential causal time, which is familiar to us, made of absolute moments that flow from the past to the future.
- *Kairos* describes retrocausal time. According to Pitagora, *kairos* is at the basis of intuition, the ability to feel the future and to choose the most advantageous options.
- *Aion* describes supercausal time, in which past, present, and future coexist. This is the time of quantum mechanics, of the sub-atomic world.

In the supercausal time, syntropy is available and consequently at this level life can originate. A question naturally arises: how do the properties of syntropy pass from the quantum level of matter to the macroscopic level of our physical reality, transforming inorganic matter into organic matter? In 1925 the physicist Wolfgang Pauli (1900–1958) discovered in water molecules the hydrogen bridge (or hydrogen bonding). Hydrogen atoms in water molecules share an intermediate position between the sub-atomic level (quantum) and the molecular level (macrocosm), and provide a bridge that allows syntropy (cohesive forces) to flow from the quantum level to the macroscopic level. The hydrogen bridge makes water different from all other liquids, increasing its cohesive forces (syntropy) with behaviors that are in fact symmetrical to those of other liquid molecules. For example, when water freezes it expands and becomes less dense, the process of solidification starts from the top; water shows a heat capacity far greater than other liquids. Consequently, the syntropy hypothesis expects life to appear whenever liquid water is available (also when conditions are extreme, such as on comets).

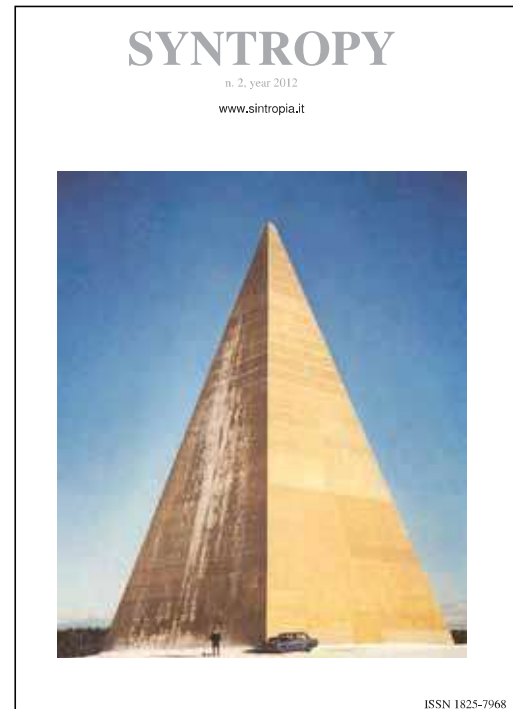
A Converging Teleological Universe

A similar description of life was reached by Pierre Teilhard de Chardin (1881–1955), a well-known evolutionary scientist who became famous after his death with the publication of *The Phenomenon of Man and Towards Convergence*. Both Fantappiè and Teilhard were subject to strong censorship for believing that causes retro-act from the future. According to Fantappiè, life is subject to a dual causality—efficient causality and final causality—and for Teilhard life is guided by final and converging aims. Teilhard argued that while astronomy detects an initial event from which the physical world originated (the Big Bang), paleontology identifies an end point towards which life is evolving and converging. Teilhard calls this end point the Omega point and believed that a correct reading of sacred texts shows that the origin of life is in the future and not in the past. Teilhard's claims sparked debate within the Catholic Church and a decree of the Holy Office chaired by Cardinal Ottaviani, in 1958, asking religious congregations to withdraw the works of Teilhard from their libraries for offending Catholic doctrine.

In the 1920s Albert Einstein theorized a cyclic model of the universe that followed an eternal series of oscillations, each beginning with a Big Bang and ending with a Big Crunch; in the interim, the universe would expand for a period of time before the gravitational attraction of matter caused it to collapse back in and undergo a bounce. The Big Crunch hypothesis is exactly symmetrical to the Big Bang and maintains that the universe will stop expanding and begin collapsing on itself because of the strength of gravitational forces. Eventually all matter will collapse into black holes, which would then coalesce, producing a unified black hole or Big Crunch singularity, and the universe would collapse to the state where it began and then initiate another Big Bang. And so in this way the universe would last forever, but would pass through phases of expansion (Big Bang) and contraction (Big Crunch). According to this hypothesis, time flows forwards during the diverging phase (Big Bang) and backward during the converging phase (Big Crunch).

However, recent evidence—to be precise the observation of distant supernova—has led to the speculation that the expansion of the universe is not being slowed down by gravity but rather accelerating. In 1998 the measurement of the light from distant exploding stars led to the conclusion that the universe is expanding at an accelerating rate. In the attempt to explain these observations, which contradict the hypothesis of a cyclic universe, physicists introduced the idea of dark energy. The most important property of dark energy would be its negative pressure, which is distributed relatively homogeneously in space, a kind of anti-gravitational force driving the galaxies apart.

But, on the contrary, the syntropy hypothesis suggests that the increase in the rate of expansion of the universe would not be due to the effect of dark energy or to any mysterious anti-gravitational force, but rather to the fact that time is slowing down. In June 2012, Professors Marc Mars and Raúl Vera of the University of the Basque Country, Bilbao, and José Senovilla of the University of Salamanca, Spain, published a paper in the journal *Physical Review D* in which they dismiss



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dark energy as fiction. Senovilla says that the acceleration is an illusion caused by time itself gradually slowing down. The team proposed that there is no such thing as dark energy at all and that we have been fooled into thinking the expansion of the universe is accelerating, when in reality, time is slowing down.

Teilhard de Chardin considered life organized in concentric spheres. The innermost sphere is the Omega point (which coincides with the Big Crunch), in which all of matter will be transformed into organic and conscious matter. The outer sphere is the most distant from the Omega point, the realm of inanimate matter. Teilhard relates the Omega point to consciousness and Fantappiè considers syntropy the source of the Self, the feeling of life. Consciousness and the Self are attributed by Fantappiè and Teilhard to the final attractor (Omega Point / Big Crunch). The closer we evolve towards the final attractor, the more conscious we become.

In *The Unitary Theory of the Physical and Biological World*, Fantappiè argued that all the laws of the universe derive from one equation. But he also realized that the equations that can yield a coherent universe are infinite in number. So why is our universe governed by an equation based on a dual solution and not by other equations? According to Fantappiè, the answer to this question implies the existence of a theological plane, one that is external to our universe, in which the choice of the equation took place.

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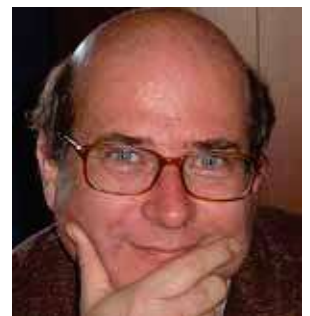
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ULISSE DI CORPO has a degree in psychology and in experimental psychology, and a PhD in statistics and social research. Di Corpo works in the field of social research and provides methodological support and software tools to researchers. In 1977 he developed the vital needs theory, which was the subject of his thesis in psychology and statistics, and since 1977 he has been working on the law of syntropy.

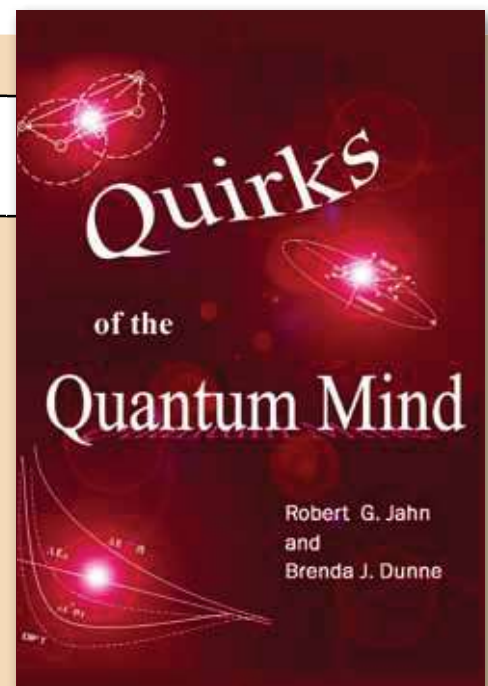


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