

Time-Partition Model of the Cosmos Reveals Helical Momentum as Fifth Fundamental Force

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Abstract

Hubble tension [1], together with results from the Dark Energy Spectroscopic Instrument showing time-dependence of dark energy [2], indicate that the standard model of the universe is inadequate, and the list of unsolved problems in cosmology and physics is uncomfortably long [3]. Here I introduce a theoretical description of a simple geometric model that offers intuitive solutions to these problems and a broad range of unexplained natural phenomena. The Time-Partition Model of the Cosmos is based upon the assumption that the initial singularity was spinning at high angular velocity prior to the Big Bang, resulting in extremely high angular momentum. Big-Bang expansion converts angular momentum into Universal Helical Momentum (UHM), the fifth fundamental force, and dark energy is revealed as a fictitious centrifugal force that we perceive in our spiraling, non-inertial frame of reference. The model conforms to known physical laws, unites the fundamental forces as either centripetal or centrifugal forces of helical motion, and reveals the physical reality of dark energy, dark matter, zero-point energy, and time. UHM acting together with the force of gravitational attraction is the kinetic force that drives matter into helices and continuously higher levels of complexity at every scale, and as such, is the counterbalance to Brownian motion and entropy.

The Nature of Time

The fundamental assumption of the Time-Partition (TP) model is that prior to the Big-Bang the initial singularity of the universe was spinning with tremendously high spin-angular velocity, defined as *stir*, around a discrete axis in absolute space, defined as *the axis-of-stir*, and with tangential velocity orders of magnitude in excess of c , the *measured speed of light* (Figure 1). Our universe therefore has angular momentum and a discrete orientation.

Time in the model is defined as *the rotational motion of matter* and is distinct from the *measured-time* that we read from a clock. Time defined in this manner therefore is an angular velocity, and when observed from the stationary, inertial frame of reference where the

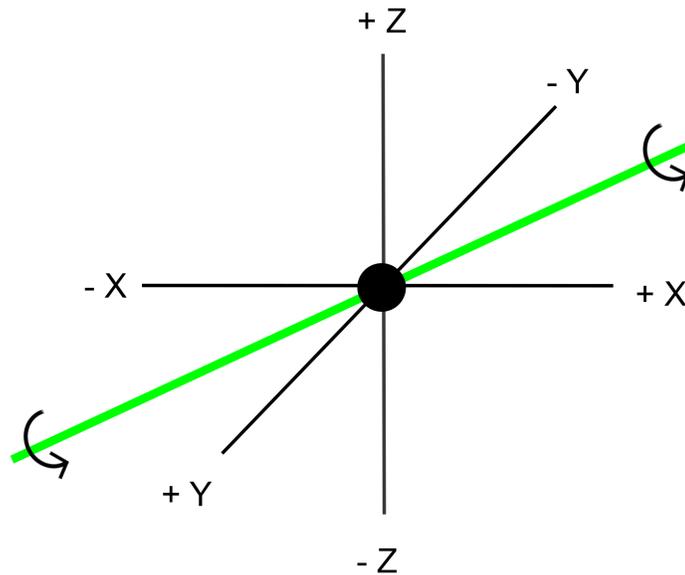


Figure 1 Spin Angular Velocity (Stir) is an Intrinsic Property of the Initial Singularity

The TP model postulates that the nascent universe (black sphere) was spinning, with a discrete spacial orientation defined as the axis-of-stir (green line), a counterclockwise direction of rotation (black arrows), and an enormous initial quantity of spin angular momentum. This view is from the stationary, inertial frame of reference where X, Y, and Z represent the dimensional axes of absolute space.

coordinates of space are absolute, is seen to have a discrete orientation (rotational axis), a clockwise or counterclockwise direction, and a speed characterized by the units of inverse-time. Matter in the TP model is considered to be expanding outwards from the initial singularity, and measured-time begins at the instant that the Big-Bang initiates. The initial singularity therefore contains the precursors of matter as well as the precursor of time (Figure 1).

Because time has both orientation and direction, multiple non-overlapping *partitions of time* can coexist wherein “collections” of matter expanding outwards from the initial singularity rotate independently about different axes in space. In particular, opposing partitions of time oriented about the same axis but separated from one another by a perpendicular plane passing through the

initial singularity can coexist wherein the matter within each partition is both rotating and expanding in opposite directions.

The year and the day are obvious examples of how this definition of time overlaps with our conventional measures of time; the year being an orbital-angular velocity with the units of revolutions per year, and the day being a spin-angular velocity with units of revolutions per day. It is important to note however that the year and the day are both rotational motions of matter occurring *within* a partition of time. It is also important to note that this new definition overlaps with the concept of spacetime in that a partition of time, like spacetime, can rotate and expand at velocities greater than the speed of light. Within a partition of time, however, information cannot travel in excess of the speed of light, in agreement with the principles of special relativity.

The birth of our universe at measured-time=zero is defined as the instant that Big-Bang expansion initiates, fractionating the precursors of mass into three dimensions of space, and three dimensions (three orientations and directions) of time. The first dimension of time is attributed to stir, the unidirectional *spin angular velocity of all mass in the universe*, and the remaining two dimensions of time are bidirectional *orbital angular velocities* induced by the Coriolis force, defined as *counterclockwise twist* and *clockwise twist* (Figure 2). The combined and complex rotational motions of matter, with uni-directional stir and bi-directional twist, is analogous to the relationship between the unidirectional rotation of the earth's atmosphere due to the spin of the earth on its axis, and the bidirectional rotation of the earth's atmosphere in the north and south hemispheres due to the Coriolis force.

Time in the TP Model therefore moves in three dimensions and is distinct from the *measured-time* that we read from a clock, that varies as a function of velocity of the observer, as called for by special relativity [4], and that is indexed to the ground-state hyperfine transition frequency of the Caesium-133 atom [5]. It is interesting to note that frequency, like rotational velocity, has the same units of inverse-time (T^{-1}). The primary difference between time as defined in the TP Model and our conventional measure of time therefore is in the addition of *orientation* and *direction*. Unless otherwise noted as measured-time, time in this communication refers to the rotational motion of matter.

The arrow-of-time derives from the unidirectional orientation and direction of stir and is invariant, in agreement with our everyday experience that the sequence of events from past to present to future is invariant. The time symmetry of CPT (charge, parity, time) symmetry derives from the bidirectional clockwise and counterclockwise directions of twist, and may take on any spacial orientation. The physical reality of time-reversal then is a reversal in the direction of twist, independent of the magnitude and direction of stir. The TP Model therefore provides an intuitive explanation for how time-reversal and time-reversal violation [6] can occur without perturbation in the arrow-of-time.

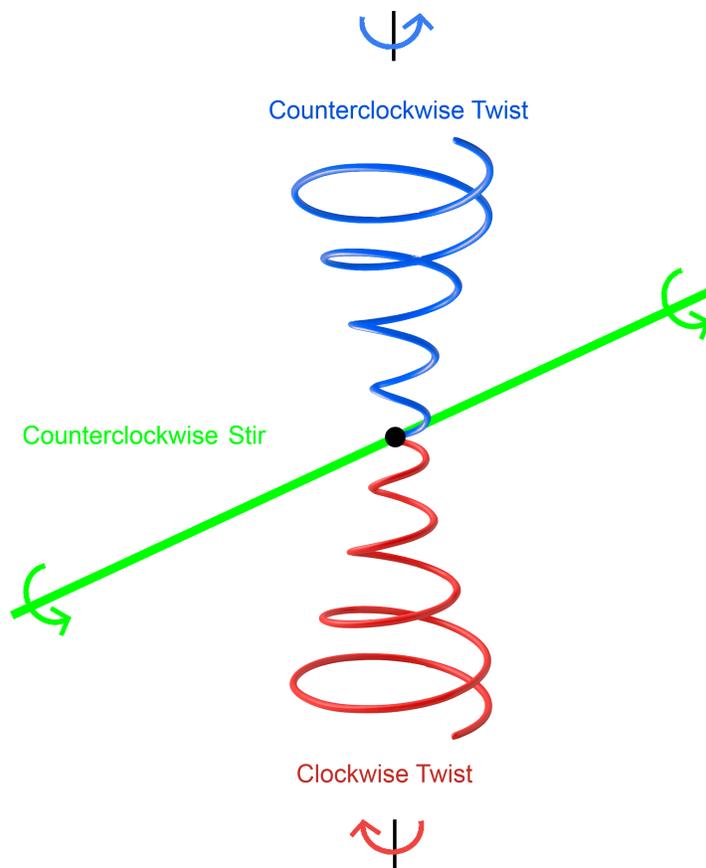


Figure 2 Big-Bang Expansion and the Coriolis Force Fractionate Time into Three Dimensions

Time is defined as the rotational motion of matter, and the three dimensions of time are counterclockwise stir (green arrows), counterclockwise twist (blue arrow), and clockwise twist (red arrow). From our complex, non-inertial (spiraling) frame of reference coincident with both counterclockwise stir and counterclockwise twist, Big-Bang expansion appears linear and only matter is visible. This simplified view of the early universe is coincident with the rotational axis of stir (green line), where that the effects of the Coriolis force can be visualized, and only one of the three axes of twist is shown. Matter expands outwards from the initial singularity (black dot) with counterclockwise twist (blue helix) and antimatter (intrinsic dark matter) expands outwards with clockwise twist (red helix). The arrow-of-time derives from stir, time-symmetry derives from twist and time-reversal occurs through a flip in the direction of twist, with no perturbation in the magnitude or direction of stir.

The Nature of Matter and Antimatter

Antimatter as we know it is defined as the mirror image of regular matter, with mirror image symmetry of charge, parity, and time [7]. Although the charge and parity are opposites for matter and antimatter pairs, knowing only the charge or knowing only the parity or the handedness of a particle, atom, or molecule alone is insufficient to uniquely classify it as either matter or antimatter. For example, protons and positrons both have positive charges, and yet one is matter and the other is antimatter. Similarly, enantiomeric pairs of chiral entities hypothetically can be made up entirely from either matter or antimatter components, and therefore, knowing only the handedness or the parity of something cannot uniquely distinguish it as either matter or antimatter.

The TP model postulates, however, that matter only twists in the counterclockwise direction, and antimatter only twists in the clockwise direction. Therefore, the sine qua non of matter is a counterclockwise direction of twist, the sine qua non of antimatter is a clockwise direction of twist, and matter and antimatter in the TP Model are defined solely on the basis of their time-symmetry. Due to the strong preference of right-handed spirals in nature [8], matter is presumed to be twisting only in the counterclockwise (right-handed) direction, and antimatter is presumed to be twisting only in the clockwise (left-handed) direction (Figure 2).

That visible matter has right-handed angular momentum reveals a simple mechanism as the basis for the preferred handedness of spiral galaxies observed in the Sloan Digital Sky Survey data [9,10], the predominantly right handed chiral current in atoms of matter, and the predominantly right handed homochirality observed in biology. The unidirectional momentum due to stir is also postulated to account for the handedness and parity violation seen in the weak interaction [11]. The TP model is therefore able to account for chiral asymmetry in the universe as manifestations of stir and twist, or in the language of the TP model, as manifestations of the direction of time.

Matter and antimatter precursors radiate outwards from the initial singularity (the origin of rotation) in equal proportions, according to the TP model, in pairs of opposing time-partitions that twist with orbital angular velocity in opposite directions. Each time-partition expands in the shape of a conical helix, and scale invariance is maintained so long as the shape of each helix grows in size proportional to the golden ratio. The model therefore predicts that all mass in the universe expands outwards from the initial singularity in the shape of golden helices.

Big-Bang expansion is postulated to have created a total of three pairs of matter/antimatter time-partitions aligned along *three orthogonal axes of twist*, the distribution of which corresponds to the three orthogonal axes of three dimensional Cartesian space. Thus Big-Bang expansion creates a total of 6 independent partitions of time distributed into one hemisphere of matter and one hemisphere of antimatter, each hemisphere consists of three mutually orthogonal time-partitions, and the hemispheres rotate together in synchrony around the axis-of-stir (Figure 3).

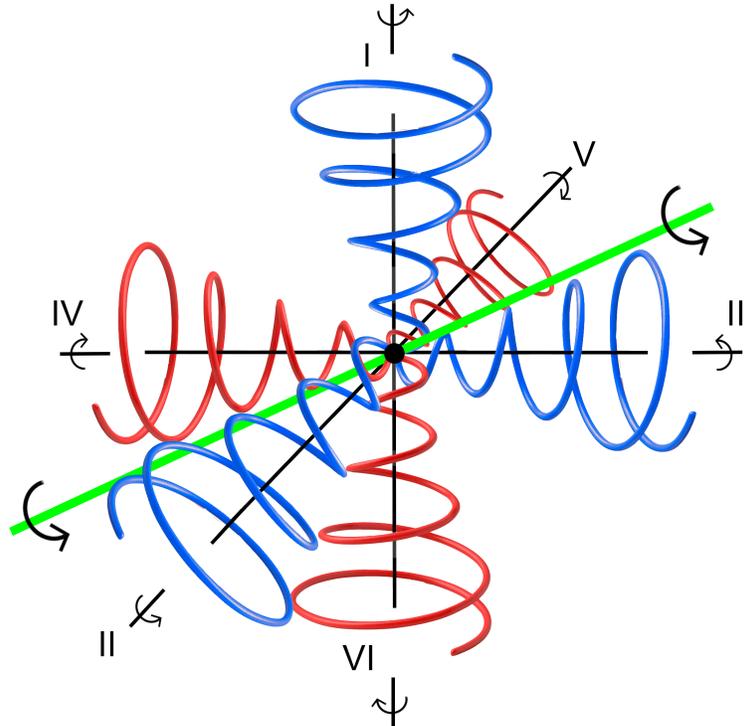


Figure 3 Expansion of Initial Singularity into Three Axes of Twist and Six Partitions of Time

The TP Model posits that Big-Bang expansion created three symmetrical pairs of matter and antimatter radiating outwards in six conical helices aligned along three mutually orthogonal axes of twist (black lines). Time-partitions are labeled with Roman Numerals that correspond to the faces of a playing dice, with our Milky Way Galaxy arbitrarily assigned to partition I. The Big-Bang therefore segregates the universe into one hemisphere of matter twisting counterclockwise (blue helices) and one hemisphere of dark antimatter twisting clockwise (red helices), and each hemisphere is made up of three mutually orthogonal partitions of time. With expansion the 6 helices progressively flatten into rings or tori that geometrically correspond to the 6 faces of a cube, which intersect along lines that correspond to the 12 cube edges. The axis-of-stir (green line) is independent of and oblique to the axes of twist (black lines), and passes from the cube vertex between partitions I-II-III to the vertex between partitions IV-V-VI, making it a body-diagonal (green line). For simplicity of illustration, this view of the early universe is a non-inertial frame coincident with the axis of stir, and the complex pathways of matter and antimatter helices rotating around the axis-of-stir, observed from the proper stationary inertial frame, are not shown. Black arrows indicated the direction of rotation around the axes of twist.

A hypothetical observer in the stationary inertial frame of reference, capable of seeing both matter and antimatter, would see all of the mass in our universe in a constant state of rotational motion, as if it were being stirred. All antimatter formed by Big-Bang expansion is postulated to be dark matter, as explained below, revealing a simple solution to the baryon asymmetry problem.

Because matter and antimatter twist in opposite directions, their momentum is oriented in opposite directions, and phenomena that demonstrate matter / antimatter symmetry such as beta minus and beta plus radioactive decay can be interpreted as conforming to the principle of the conservation of angular momentum. Lepton number therefore can be considered to be a proxy for the direction of twist, with +1 indicating counterclockwise twist and -1 indicating clockwise twist, and the conservation of lepton number is a manifestation of the principle of the conservation of angular momentum. In this manner the TP Model predicts that the neutrino and antineutrino differ from one another solely in their directions of twist. Similar arguments can be applied to the conserved flavor quantum numbers of quarks and support the prediction of the TP model that quarks and antiquarks twist in opposite directions.

The Nature of Dark Matter

Dark matter in the TP model is matter spiraling with relative tangential velocity in excess of the measured speed of light. Dark matter consists of *intrinsic dark matter*, defined as antimatter formed by the Big-Bang, and *extrinsic dark matter*, which is dark matter formed by other means. Examples of processes that can transform visible matter into extrinsic dark matter are vortices that create black holes, as explained below, and intergalactic collisions between matter in adjacent time-partitions that substantially reorients their axes of twist. This implies that the tangential velocities of time-partitions are currently on the order of magnitude of c .

By way of example, if the tangential velocity of a counterclockwise rotating matter time-partition is greater than $0.5 \times c$, and the tangential velocity of its directly opposing antimatter time-partition is also greater than $0.5 \times c$, but in the opposite clockwise direction, the relative velocity of the time partitions is in excess of c , and photons of light released from within one time-partition cannot move fast enough to “catch up” with matter in the opposing time-partition. Dark matter defined in this manner interacts with visible matter through the gravitational force, but not through the electromagnetic force. Dark matter therefore is postulated to be made up of both regular matter and “regular” antimatter that cannot be seen due to it having a high relative velocity of motion. In the language of the TP model, electromagnetic radiation emitted by dark matter cannot be measured because it is *sequestered in time*.

Universal Helical Momentum

Big-Bang expansion creates equal proportions of matter and intrinsic dark antimatter, and converts the extraordinarily high angular momentum of the initial singularity into helical momentum, defined as Universal Helical Momentum or UHM. The helical nature of UHM derives from 4 components of motion acting in combination: (1) spinning of the initial singularity on the axis-of-stir, (2) radial Big-Bang expansion along three axes of twist, in six directions, creating six independent time-partitions with equal mass and equal momentum, (3) induced counterclockwise and clockwise orbital angular velocity (counterclockwise and clockwise twist) of opposing time-partitions due to the Coriolis force, and (4) the oblique orientation of the axis-of-stir relative to the axes-of-twist (Figure 3). The universe is therefore divided into one hemisphere of matter and one hemisphere of antimatter rotating together around the axis-of-stir, each hemisphere is composed of three orthogonal and independently rotating time-partitions, and both stir and twist contribute independently to the total magnitude of UHM.

As UHM represents the momentum of the entire mass of the universe moving at velocities close to the speed of light, its magnitude is extremely large, making UHM the logical source of zero-point energy and driver of spontaneous quantum fluctuations [12]. UHM acts upon any body or particle with mass, and is revealed to be the “missing” fifth fundamental force. Although fifth in order of discovery, chronologically, angular momentum is proposed to be an intrinsic property of the initial singularity, and UHM is likely to be the first fundamental force to emerge after the Big-Bang.

The Nature of Dark Energy

Dark energy is thought to make up roughly 70% of the total mass-energy in the universe, and is the force responsible for pushing or pulling matter apart. The TP model provides a simple explanation for the physical basis of dark energy as the centrifugal force resulting from UHM. Because we are in a non-inertial rotating/spiraling frame of reference, we cannot directly measure the effects of UHM, however, we indirectly perceive UHM as a fictitious, centrifugal force. Using the analogy of a car moving at constant velocity, the bulk of the vehicle's potential energy is represented by its momentum, the product of its mass and constant velocity, however the speed at which the car is traveling can only be perceived by the non-inertial occupants as a fictitious centrifugal force if the vehicle turns, or as a fictitious Euler force if the vehicle accelerates or decelerates. Because the radius of the universe is very large, the curvature of the path that matter within our time-partition travels is minimal, resulting in a relatively low magnitude of centrifugal force. This is the manner in which the TP model accounts for the relatively low observed density of dark energy [13], despite there being a tremendously high quantity of helical momentum and quantum mechanically calculated zero-point energy.

It is sometimes said that dark energy can alternatively be interpreted as a static field that is uniform across all space, or a dynamical field, defined as quintessence [14], that varies across

space [15]. It is interesting to note that a body in rotational motion embodies the properties of both a scalar field and a dynamical field with respect to the velocity of motion. The angular velocities of rotational motions, stir and twist, are dimensionless scalar quantities with units of inverse (reciprocal) time that are uniform across space. However, the tangential velocity of motion in a rotating body has units of distance times reciprocal-time and varies across space in proportion to the radius from the origin of rotation. The complexities of rotational motion illuminate the mechanism by which dark energy simultaneously appears to us with the kinetic properties of both a scalar field and a dynamical field.

Dark Energy Time-Dependence

Dark energy time-dependence [1] (measured-time-dependence) observed in the DESI data is readily supported by the TP model as a manifestation of the conservation of angular momentum. UHM is the product of the rotational velocities stir and twist and the moment of inertia [16] of the universe. Because angular momentum is both extensive and conserved, the magnitude of UHM is equal to the sum of helical momenta of every component of mass in the universe, and assuming there is no universal aether causing frictional loss, its value today is the same as it was at the instant of the Big-Bang, at measured-time=zero. The magnitudes of stir and twist therefore will have decreased as the radius and moment of inertia of the universe has increased.

The centrifugal force of a rigid body in rotational motion (F_c) is given by the relationship:

$$F_c = mr(w)^2$$

where m is mass, r is radius, and w is angular velocity. In simplified terms then, dark energy is proportional to the radius of the universe and the squares of the magnitudes of stir and twist, and conservation of angular momentum dictates that there is a reciprocal relationship between radius and rotational velocity. Rigorously adapting these relationships to the helical motions of matter and antimatter that make up dark energy requires that we account for the complexities of a non-rigid body made up of six independently rotating partitions of mass expanding under the influence of the Big-Bang, with multiple degrees of freedom of movement. Even without taking these many factors into account, however, it is clear that the TP model readily supports time-dependence to the magnitude and density of dark energy as the universe evolves.

The Direction of Stir

As the axes of stir and twist are not coincident, both stir and twist independently contribute to the overall magnitude of UHM, as stated above. However stir is unidirectional, and twist is bidirectional, being counterclockwise for matter and clockwise for antimatter. Therefore the net direction of UHM and the net direction of dark energy must be “weighted” in favor of the direction of rotation of stir.

The weak interaction is considered to be a manifestation of centrifugal force (see below). The handedness of chirality demonstrated by the weak interaction therefore forms the basis for determining the direction of stir. That matter has counterclockwise twist was inferred because matter, particularly that found in living systems, shows a strong preference for right-handedness. Stated in another way, it can be inferred that “right-handedness” in the universe is energetically favorable.

The primary function of the weak interaction is in “facilitating” the nuclear flavor changes characteristic of beta radioactive decay. Both the neutral and charged weak interactions are known to preferentially interact with left-handed particles and right-handed antiparticles [17]. That the weak interaction preferentially acts upon left handed particles implies that left handed particles are more vulnerable to beta decay, and right-handed particles of matter are relatively more stable. Right-handedness is, again, seen to be energetically favored, and on that basis, the direction of stir is postulated to be counterclockwise. UHM therefore has a net counterclockwise direction, matter twists in the same direction of stir, antimatter twists in the opposite direction of stir, and right-handedness is energetically favored for chiral entities and chiral processes at all scales of mass.

The TP Model holds that the fundamental forces act equivalently upon matter and antimatter, however, as the weak interaction is considered to be a manifestation of the centrifugal force of UHM, and UHM is weighted in the direction of stir, the model predicts that matter and antimatter should respond differently to the weak interaction. Considering a pair of otherwise identical unstable isotopes of matter and antimatter, atoms twisting “against” the momentum of stir should decay faster, and their corresponding half-lives should be shorter than atoms that twist “with” the momentum of stir. As the half-lives of antimatter radioisotopes are largely unknown, this prediction also forms one means to test the validity of the TP model. Employing a similar line of reasoning, the chiral currents of antimatter atoms is predicted to be left-handed; opposite to the right handed chiral currents observed in atoms of matter.

The Nature of Black Holes

Localized vortices within time-partitions are an important source of extrinsic dark matter, and spontaneous formation of a vortex of matter, due to the combined effects of gravity and UHM, is the mechanism by which the TP Model accounts for black holes. Due to conservation of angular momentum, the angular velocity at the center of the vortex increases as mass is concentrated by gravitational attraction, and once the relative tangential velocity exceeds some multiple of c (depending upon orientation), matter within the vortex becomes dark, thereby creating a black hole.

Should mass within a black hole reach some critical value of density and angular velocity, the black hole could potentially condense into a new initial singularity, and subsequently expand into

a new universe. As the orientation of the axis-of-stir of the newly formed universe would most likely be different from the orientation of the axis-of-stir of our universe, the new universe would almost certainly be oriented along three unique dimensions of time. Both the antimatter and the matter formed in the second universe would then all be dark to an observer in our universe. In this manner the TP Model allows for the simultaneous existence of multiple independent universes that interact with our universe primarily through the gravitational force.

The Universe in Equilibrium

One of the most profound predictions of the TP model is that the universe enters into a dynamic equilibrium state. Gravity, the force of attraction between masses, counteracts dark energy centrifugal force and gradually overcomes helical expansion, causing the magnitudes of stir and twist to reach minimum values and the size of the universe to reach a maximum in size. Given sufficient time then, the TP model predicts that the universe would eventually stop its outward spiral expansion and begin to contract. But because angular momentum is conserved, once contraction begins, the magnitudes of stir and twist would increase from their minimums, with an accompanying increase in centrifugal force propelling matter and antimatter in the outwards direction once again. The TP model therefore predicts that the universe eventually enters into an equilibrium state wherein the relative distances between celestial objects and the radial distances between celestial objects and the origin of rotation are approximately constant. Localized movements in the relative positions of adjacent “smaller” objects, such as the gravitational drift of the Milky Way Galaxy towards the Andromeda Galaxy, would still be expected to occur [18], and would still be readily apparent and measurable from within our spiraling reference frame.

The resulting balancing of gravity and dark energy prevents the universe from collapsing in a “Big-Crunch” [19] and ultimately leads to a continuous oscillation in the size of the universe around a finite mean radius and volume. As long as no momentum is lost to friction with an aether [20], oscillations around the mean volume would continue indefinitely. As a corollary to this prediction, if the total magnitude of dark energy in the universe is seen to be continually decreasing after the equilibrium state is reached, frictional loss of rotational momentum to a universal aether, or “drag” resulting from gravitational attraction to dark matter located outside of our universe could be inferred.

Data obtained from the Dark Energy Spectroscopic Instrument (DESI) [21, 22] indicate that the magnitude of dark energy reached a maximum about 4 billion years ago and then began decreasing by about 10%. Interpreted within the context of the TP model, these data indicate that the equilibrium state in our universe was attained four billion years ago, about the time life first appeared on our planet, with the universe now in a gradual state of contraction consistent with the first oscillation in volume about the mean.

Assuming that matter in the universe now moves at a near constant angular velocity, which is to say that the current rate of change in stir and twist is low (zero or near zero impulse) the direct

effects of UHM are imperceptible to us in our non-inertial, spiraling frame of reference. The potential energy measurable within a vacuum (vacuum energy), therefore, is very low despite the magnitude of UHM being very high, just as we have no perception of motion while riding in a vehicle traveling at constant velocity even though the momentum of the vehicle may be very high, and we have no perception of the rotational motions of the earth. In this manner, UHM presents an intuitive solution to the cosmological constant problem or “vacuum catastrophe,” the extraordinarily large discrepancy between quantum mechanical calculated zero-point energy and experimentally measured vacuum energy. As a corollary, the observation that measured vacuum energy is exceedingly low compared to predicted zero-point energy supports the conclusion that the current rate of change in stir and twist is low.

Reframing Experimental Data

Assuming that the universe has reached equilibrium, this implies that the radial distances between celestial objects and the origin of rotation are now all approximately constant, and the relative (true) distances of separation between celestial objects are also now all approximately constant. This prediction starkly contrasts with the generally accepted belief that our universe is in a state of accelerating expansion. Characterized as Hubble flow, the conclusion of accelerating expansion is based upon experimental redshift data [23, 24] and is supported by type I supernova luminosity data [25]. Despite this unorthodox prediction, the TP model is fully compatible with Hubble flow experimental data when one considers that, for a body in rotational (helical) motion, tangential velocity increases proportional to radius.

Considering a simplified, hypothetical non-inertial example where the earth is at the center of constant circular rotation and the radial (true) distances between the earth and all external sources of light are constant, the tangential velocity v of each light source is proportional to its distance (radius) from earth, and is given by the simple relationship:

$$v = \omega r$$

where w is the rotational velocity, and r is the radius. When observed from within this hypothetical rotating frame of reference, light will appear to be traveling towards the earth in straight lines. However, when the rotating system is observed as a whole, from the preferred stationary inertial frame of reference, light will be seen to travel towards the earth along coiled, spiral pathways.

Because they have proportionally higher tangential velocities, distant light sources must travel proportionally further than proximal light sources over any given interval of time, and light traveling towards the earth from distant sources will redshift and reduce in intensity more than anticipated by an observer in the non-inertial frame of reference who assumes that light is traveling towards them in straight lines. Due to rotational motion, distant light sources move faster through absolute space than proximal light sources, but once equilibrium has been reached,

they aren't moving any further away. In short, the failure to recognize that our experimental observations have been made from within a spiraling frame of reference leads us to incorrectly conclude that the universe is expanding at an accelerating rate.

Resolving Hubble Tension

The precise value of the Hubble constant (H_0) is in question, and two general methods for measuring its value have emerged. "Early" universe methods based upon the Cosmic Microwave Background (CMB) radiation, emitted 380,000 years after the Big-Bang, produce a value of H_0 of approximately 67 km/sec per megaparsec, whereas "late" universe methods based upon measures of light emitted from sources formed after the evolution of stars cluster around 73 km/sec per megaparsec [26]. As astronomical measurement techniques have improved, determinations of H_0 obtained by different methods have not converged as expected. Instead, they have diverged, and the statistical significance of their discrepancy has grown, now reaching the 5σ level.

This discrepancy is known as the "Hubble tension", and it is one of the several observations that draw criticism to the validity of the Lambda Cold Dark Matter (Λ CDM) model of the universe, as the standard Λ CDM model cannot adequately account for fluctuations in the value of the Hubble constant over time. The TP model however provides an intuitive solution to the Hubble tension. For early time points in evolution, which is to say, for time points prior to reaching equilibrium 4 billion years ago, the magnitude of the average tangential velocity of matter in the universe, and hence the magnitude of the averaged Hubble constant, would have gradually increased as the average radius of the universe increased.

Summary and Conclusion

The Λ CDM model, the generally accepted standard model of the cosmos, is in crisis. Difficult to comprehend and dependent upon hypothetical forms of cold dark matter and cosmic inflation, DESI data indicating that the magnitude of dark energy has varied over time and tension in the exact value of the Hubble constant strain the model's credibility and utility even further [27]. The Time-Partition Model of the Cosmos summarized in this paper provides an exciting and far more cohesive alternative.

Time in the TP model is defined as the rotational motion of matter, and moves in three dimensions, a refinement of our current operational and circular definition of measured-time as simply "what a clock reads" [28], and the only additional assumption made in formation of the model is that, prior to Big-Bang expansion, the initial singularity was spinning with spin angular velocity defined as stir. Matter and antimatter are defined by their direction of twist, a form of orbital angular velocity induced by the Coriolis force after Big-Bang expansion and the physical

basis of time-symmetry. The Big-Bang is postulated to have created three partitions of matter and three partitions of antimatter, aligned along three axes of twist, which expand outwards independently into six conical helices. The axes of twist also rotate together around the axis of stir and antimatter produced by the Big-Bang is dark. Collisions between orthogonal matter time-partitions stimulates spiral galaxy formation and large-scale structures.

The TP model reveals that we unexpectedly find ourselves in a non-inertial, spiraling frame of reference, and the combined rotational motions of stir and twist produces an enormous quantity of universal helical momentum (UHM) that is the “missing” fifth fundamental force and source of zero-point energy. Dark energy is revealed as a fictitious centrifugal force, and as fictitious forces “disappear” [29] when observed from the proper, stationary inertial frame of reference, our difficulties in elucidating the nature of dark energy stem from the fact that dark energy is not a “real” force.

This new paradigm, that the universe is spinning with helical momentum, also provides a basis for conceptually unifying the fundamental forces as properties of rotational motion. UHM creates an outwards centrifugal force acting at all scales of mass and the weak interaction is a centrifugal effect acting at the nuclear scale, where the mass of atoms is concentrated. The attractive forces of gravity, electromagnetism, and the strong force then are all *centripetal forces* counteracting UHM at different scales of mass. It is interesting to note that unlike centrifugal force, centripetal forces are “real” in non-inertial reference frames, therefore accounting for the “relative ease” in elucidating the nature of gravity, electromagnetism, and the strong force.

The weak interaction mediates beta decay, however, within the context of the TP model, radioactive decay in general is envisioned as a process in which isotopes having unstable combinations of quarks become energetically stabilized when the centrifugal force of UHM “expels” an energetically stable alpha or beta particle from the nucleus, thus providing a unified theory on the mechanism of radioactive decay. Alpha decay is traditionally described as a manifestation of quantum tunneling [30], but the TP Model provides a fresh perspective wherein alpha decay, like beta decay, is a consequence of the centrifugal force of UHM overcoming nuclear binding energies in isotopes with unstable combinations of quarks. This is one illustration of the TP model’s capacity to describe quantum phenomena via classical rotational dynamics; a detailed exposition is forthcoming.

As a centrifugal force preventing matter from collapsing under the force of gravity, UHM is also equivalent to Einstein’s cosmological constant. The idea of a rotating universe with angular momentum as the basis for Einstein’s cosmological constant has been explored in the past, and in a paper from 1949, Godel proposed solutions to Einstein’s field equations based upon a rotating universe. His modeling however was strictly based upon circular, and not helical motion, and he concluded that rotation alone would not allow for redshifts of distant objects and the irregular distribution of galaxy rotation axes [31].

In contrast to Einstein's original concept of a static universe, and in sharp contrast to current beliefs that the universe is in a state of accelerating expansion, the TP model accounts for Hubble flow red-shift data in a new manner, and recent measures of the magnitude of dark energy over time suggest that the universe is now in a dynamic equilibrium state between the centrifugal force of dark energy and the centripetal force of gravity. The radial distances between celestial objects and the origin of the Big-Bang (the origin of rotation) therefore are now approximately constant, with far reaching implications about measured cosmological distances and the estimated overall size of our universe.

Acceptance of the validity of the TP Model therefore requires a paradigm shift away from our now nearly 100 year old belief in a universe undergoing accelerated expansion, and because the tangential velocity of rotational motion increases proportional to radius, the TP Model predicts that, when observed from the stationary inertial frame of reference, light is seen to travel across the cosmos in helices. In this manner, the TP model compels us to "reframe" visible light redshift data and all other observational data based upon measures of electromagnetic radiation. The diameter of the observable universe is therefore far smaller than 92.6 billion light years, the current estimate calculated using the age of the universe, the measured speed of light, and the rate of perceived spacetime expansion [32]. In fact, the TP model assumes that the true size of the universe has always been small enough such that every point in space was causally connected during the recombination epoch of the Big-Bang, when the CMB radiation first appeared [33], thus "sidestepping" the Homogeneity Problem [34] without the need for cosmic inflation.

Because matter and antimatter are produced in equal proportions distributed along axes of twist, and because all antimatter produced by the Big-Bang is intrinsically dark, ostensibly the TP model would allow for the Big-Bang to have created any number of axes of twist, and any even number of time-partitions. The rationale for choosing three axes of twist and six time-partitions is that it naturally leads to the formation of perpendicular large scale structures, and is the subject of an manuscript in preparation.

In short, a helix that enlarges over billions of years is anticipated to progressively flatten into a torus at its base that approximates the shape of a circle within a plane. In the model presented here, six time-partitions radiate outwards from the initial singularity in helices, equally separated from one another in three dimensional space, and progressively flatten into six ring-shaped planes. Because adjacent planes are mutually orthogonal to one another, the overall shape of the universe therefore approximates the shape of a cube, a geomantic arrangement defined as the *primordial cube*. Matter within each torus rotates around its axis of twist, and the three axes of twist rotate in synchrony around a body-diagonal of the cube that corresponds to the axis-of-stir. As the early universe expands, matter within the three adjacent and mutually orthogonal matter time-partitions intersects causing "head-on" collisions (at right angles) along three of the primordial cube edges. This arrangement of colliding matter naturally stimulates spiral galaxy formation concentrated into perpendicular galaxy filaments. With continued expansion of the three matter tori, filaments spread into perpendicular walls with tubular voids [35].

Another powerful prediction of the TP model is that UHM is the force in nature that accounts for the predominance of the spiral shape. The spiral shape of galaxies, spiral shell shapes in mollusks, the spiral phyllotaxis of plants, the spiral arrangement of chloroplasts in spirogyra, the alpha helix in proteins, the helical structures within starch granules [36], the double helical structures of DNA and the spiral shape of quantum vortices in superfluids are examples of the predominance of the spiral shape in nature at all scales of size. UHM therefore is the force that drives evolution in the direction of spirals of increasing complexity, making it the “missing” force in nature that counteracts entropy.

Despite departing from the current dogma of accelerating expansion, the major strength of the TP model is in its ability to intuitively explain an extremely broad range of unsolved problems in cosmology and physics without deviating from known physical laws. The primary limitations of this paper are the absence of a mathematical formalism and quantitative predictions. However, as the TP model unifies the fundamental forces around the properties of rotational motion, reveals the nature of dark energy, creates a unified theory of radioactive decay and defines the nature of Einstein’s cosmological constant, there are a multitude of means by which more formal mathematical descriptions of UHM can be made, on different scales of mass, and calculated values for stir and twist determined and compared.

Conceptual models are the end product of the scientific method, the culmination of our collective pursuit to understand nature. The beauty of the most impactful models is in their simplicity, reflecting our overwhelming bias that truth in our universe is simple and “natural” [37], once fully uncovered. By redefining time, “reframing” our interpretation of natural phenomena, and revealing a fifth fundamental force, the TP Model pieces together a broad range of unsolved mysteries and provides new insight into virtually every scientific and philosophical discipline. Even so, the most compelling aspect of the Time-Partition Model may well lie in its simplicity, as the philosophical basis for its many predictions and insights can be succinctly summarized and readily understood: the universe is spinning.

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