A Law-abiding Cosmology Model

2 March 2015 **Simsbury CT 06070**

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Abstract: Suppose the laws of physics are truly invariant: they were, are, and always will be as they are here and now. Suppose further that there were no physical things before the Big Bang, just endless void. At some point, the laws of physics came into being, including conservation of mass-energy: this was the true creation event; the Big Bang was simply an allowed event. We speculate on the resulting cosmology. The three fundamental equations for mass ($F = ma$; $F = Gm_1m_2/r^2$; and $E = mc^2$) are symmetric for positive and negative values of m, suggesting a family of negative mass particles ("unmatter"), with zero net mass-energy for the universe overall. The Big Bang would have produced two precisely concentric, inter-meshed, expanding spheres, one of positive m matter, the other of negative m unmatter. After 7.2 years, the spheres would have had sufficient volume for 10^81 hydrogen atoms. They would have repelled and segregated at myriad local sites, providing the birth areas for an immense number of large, short-lived stars, which in turn provided the evidently immense number of black holes in the universe today, and then early cosmic anisotropy and galactic spins. As the spheres expanded to their current, roughly 28 billion light-year diameters, they became progressively more segregated, leading to apparently huge voids if only one sphere is considered. As segregation further increased, the unbalanced local forces increased, leading to the observed and heretofore exceedingly puzzling accelerating expansion.

Suppose the laws of physics are truly invariant: the same at every time and place; before, during, and after the Big Bang; inside, outside, and on the boundaries of black holes; etc. No clever contrivances like "Cosmic Inflation" to get the universe expanding. No physics magic like "Dark Energy" to accelerate expansion. The laws of physics were, are, and always will be as they are here and now.

Now a further simplification: there were no physical things before the Big Bang – no mass, no energy, just endless void. But at some point, the laws of physics came into being, including conservation of mass-energy. That is to say, the true creation event was the creation of the laws of physics: the Big Bang was simply an allowed event. John 1:1 in the King James Version of the Bible provides an elegant summary:

"In the beginning was the Word, and the Word was with God, and the Word was God."

Or in the notation of modern mathematical physics:

$$\Sigma_{\text{universe}}(m) = 0$$

What cosmology would result? What follows is the authors' speculation about such a law-abiding universe. We believe that the model proposed here can be described in finite-element analysis computer code, and then run to explore aspects of cosmology never before susceptible to computer analysis. We hope others will agree and do that.

We begin by noting that three fundamental equations for mass,

$F = ma$	Inertia
$F = Gm_1m_2/r^2$	Gravity
$E = mc^2$	Relativity

are symmetric for positive and negative values of m. This suggests a family of negative mass particles ("unmatter" hereafter), with zero net mass-energy for the universe overall. The positive m matter gravitationally attracts other positive m matter; negative m unmatter gravitationally attracts other unmatter; but positive m matter gravitationally repels negative m unmatter. (The parallel to British physicist P.A.M. Dirac in 1930 is clear and compelling. Dirac made a similar observation about the electromagnetic equations. The discovery of the positron followed quickly, followed by the whole anti-matter family.)

The Big Bang would therefore have required zero net mass-energy, and would have produced two precisely concentric, inter-meshed, expanding spheres, one of positive m matter, the other of negative m unmatter. After expanding at light speed for an hour, each sphere could hold 10^81 nucleons, which is one estimate of the number of atoms in the visible universe.

Note that the universe was at this stage, and had always been, zero net mass-energy, zero net magnetic poles, zero net rotation, etc. To this instant it would therefore have had zero net gravitational force and zero net electromagnetic force, just short-range nuclear forces. In consequence, the universe would have seemed identical everywhere except at the outermost layer. As expansion continued, however, the structure would have begun to disassemble at virtually every nucleon diameter.

After 7.2 years, the spheres would have had sufficient volume for 10^81 hydrogen atoms. They would have repelled and segregated at myriad local sites, providing the birth areas for an immense number of large, short-lived stars, which in turn provided the evidently immense number of black holes in the universe today. As expansion and matter/unmatter segregation progressed, the heretofore puzzling early cosmic anisotropy and galactic spins appeared.

As the spheres expanded to their current, roughly 28 billion light-year diameters, they became progressively more segregated, leading to apparently huge voids if only one sphere is considered. As segregation further increased, the unbalanced local forces increased, leading to the observed and heretofore exceedingly puzzling accelerating expansion.

Two verification experiments: Looking for locations in a sky map where unphotons from an ungalaxy have “cancelled” the positive energy photon "mist" should work. Such locations would appear as small black dots in the sky map, stable in both time and position.

A direct imaging camera may also work. The detector pixel could be supplied electrons at elevated energy. Any transitions to ground state without photon emission would hopefully be mostly from unphoton absorption. The lens would be just a drilled block of the same material held at the elevated energy.

Conclusion: We note with immense pleasure that extremely clever, but painfully inelegant, special rules like cosmic inflation and dark energy, are simply unnecessary, replaced by a single, invariant set of laws. Like any beautiful lady, Mother Nature values elegance far above cleverness.

About the authors: Both authors are graduates of the Cornell University College of Engineering: Robert in Engineering Physics in 1966, and Scott in Electrical and Computer Engineering in 2001. Robert is Scott’s father. This work was made possible by the tireless support of Dr. Martha Hartranft (Robert’s wife, Scott’s mother).