



Tuesday, September 18, 2007

VOICES: A New Year for the Universe: 13.73 Billion

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Guest Columnist

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Today, for the first time in history, we can say with relative certainty when the universe was born: about 13.73 billion years ago. Jewish tradition commemorates the creation every Rosh Hashanah and recalls it in the liturgy (T.B. Rosh Hashanah 32b). Modern knowledge, however, should do more than impress us with the wonder of the cosmos and our intellectual abilities to decipher its mysteries. The rabbis taught that cosmology conveys ethical implications, and during this holiday season of introspection and creation it behooves us to consider the meaning of our newfound cosmic insights.

The medieval commentator Rashi famously asked why the Torah, nominally a book of laws, begins with the seemingly incidental story of creation. He answered, citing a midrash: to demonstrate a moral - that God created the earth; land does not belong to us, but to the Lord.

Four hundred years after Rashi, the kabbalists of Safed offered their own perspective on the creation. They taught their tradition that the universe was born and expanded from an infinitesimally tiny point they called the Resheit. "Beyond this point," the Zohar says, "nothing is known, and so it is called the Resheit, the first word of all."

The Torah's literal opening is thus, "With the Resheit [B'Resheit] God created the heavens and the earth."

The kabbalists' evolving cosmology was radically different from that of their contemporaries, scientists and theologians alike, which held that the universe was eternal and static - an erroneous concept that even Rashi shared and that persisted into the late 20th century. The kabbalists learn an ethical imperative from their vision: We can make a difference. Humanity's task, *tikkun olam*, is to heal the injustices and imperfections that were embedded in the fabric of the newly formed cosmos. An eternal and static universe has no such moral directive.

Atheism prompts a cosmological ethic as well. Last year Richard Dawkins, in *The God Delusion*, argued for replacing righteousness with a blend of Darwinian personal ethos and rational calculation. Unfortunately, he made his case while chastising the faithful with boundless hubris. His indifferent reductionist philosophy peremptorily discarded the morality of religion, leaving the creation without an ethical context and thoughtful religious believers dismayed if not bewildered.

Astronomers studying the creation have had remarkable recent successes investigating how and when the universe was born. They find that the universe as we know it exploded from an infinitesimally tiny point, much smaller than even an atomic nucleus, in a creative event dubbed "the big bang."

The universe has been expanding ever since, and currently its dimension is approximately 46 billion light-years.

The original big bang description of creation was the result of decades of mathematical thinking and meticulous observations that culminated with Edwin Hubble's 1929 observation that other galaxies were systematically moving away from us, in accord with Einstein's theory of relativity. Hubble's results shocked people who only a few years earlier thought that our galaxy was the entire universe and that (as Einstein originally thought) the universe was eternal and static.

Hubble's data came from 46 nearby galaxies; today astronomers have measured the recession of hundreds of thousands of galaxies, some of them a thousand times farther away.

The newborn cosmos was tiny and fantastically hot, and its light was scattered by charged particles like headlights in a fog. After 380,000 years, however, once the universe had cooled down enough for neutral atoms to assemble, the light was finally able to travel through space freely.

That light - the faint remnant of "Let there be light" - is seen today, everywhere. Discovered in 1960, it has become (like the recession of galaxies) one of the essential diagnostics used to refine the details of exactly what happened way back then. Last year astronomers studying this background light announced their results: The universe is 13.73 billion years old, in agreement with the data from galaxies, and with an astonishingly small formal uncertainty of about 150 million years, less than the time than it took for the dinosaurs to come and go.

In this High Holiday period of introspection and renewal, we can, like Rashi and the kabbalists, derive a moral imperative from our cosmic worldview. I offer the following suggestions from my own world of research astrophysics.

First, we should be honest in our inquiries, spiritual or otherwise - we must be if we are to trust our conclusions. This entails respectful learning from all seekers, be they scientists or theologians. Many scientific particulars of creation - the age of the universe, for example - are certain to be correct, but our understanding is equally certain to evolve and improve; part of the power of science comes from recognizing its ignorance and admitting its limitations.

But science cannot provide us with moral imperatives. For this we look to religion, and as we gain in wisdom, our understanding of Scriptures is equally certain to change. If we are honest spiritual seekers, we should, like our scientific counterparts, search to find the truth, not to defend our interpretation of a tradition. Today's political debates embroiling science and religion - evolution, intelligent design, stem-cell research and global warming (to name a few) - often devolve from open inquiry into defensive rhetoric. Remember that in an evolving universe, we can make a difference.

During this Rosh Hashanah season, I remind myself that although the creation was a long time ago, its hallmark, the cosmic background light, still permeates the world. That thought helps keep me honest.

Howard Smith's new book is [Let There Be Light: Modern Cosmology and Kabbalah, a New Conversation Between Science and Religion](http://lettherebelightbook.com). He is a senior astrophysicist at the Harvard-Smithsonian Center for Astrophysics and was the astronomy chairman at the Smithsonian's National Air and Space Museum. He can be reached at howardsmith@lettherebelightbook.com.

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