

Judaism and Science Organizational Meeting – Tempe – 8/17/08

Judaism and Cosmology

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My Judaism-and-science thinking is mainly on the implications for us Jews of the new picture of the universe that modern cosmology is giving us. I'm a theoretical physicist. In the early part of my career, my research helped to create what is now called the Standard Model of particle physics. After that, cosmology became my main research interest. The Cold Dark Matter theory that I developed with my colleagues starting in the early 1980s has now become the standard theory of the composition and structure of the universe. Since the early 1990s evidence has been accumulating of the success of this theory, which has led to our first scientific understanding of the evolution of the universe starting just fractions of a second after the Big Bang. Thus we cosmologists are beginning to be able to answer God's challenge in Job: "Where were you when I laid the foundations of the earth?" We are now able, in our scientific imaginations, to see in considerable detail how the universe and the earth were created. Our growing ability to understand the history of the universe in turn encouraged my wife Nancy Ellen Abrams and me to think about the possible larger cultural and religious implications. For more than a decade we have been teaching together a popular course called "Cosmology and Culture" at UCSC, and this led to our book ***The View from the Center of the Universe: Discovering Our Extraordinary Place in the Cosmos*** (2006), which is now appearing in many foreign editions.

The current construction of the foundations of scientific cosmology represents only the third major transition in the history of Western cosmology. A flat earth with a domed sky was the cosmology of ancient Egypt and Mesopotamia, including Genesis/Bereshit. The first great cosmological revolution was from the flat earth to the Greek/Medieval cosmology of a spherical earth at the center of a spherical universe, with God beyond the outermost sphere. The second revolution was the overthrow of the heavenly spheres by

Galileo's telescopic observations, and its replacement by Newton's clockwork mechanical universe – which we now realize amounted to little more than an explanation of the motions of the solar system, but with no explanation of the solar system's origin or cosmic context. The third revolution, happening now, is constructing a scientific cosmology that is being confirmed in striking detail by astronomical observations of steadily increasing power. The new cosmology explains for the first time the evolution of the material content and structure of the universe, including the origin of galaxies and planetary systems.

Especially for us Jews, whose greatest religious text begins with two creation stories and whose liturgy routinely praises God as the creator of the universe, a new picture of the origin and structure of the universe must have religious implications. In addressing this question in our book and in many subsequent invited lectures, Nancy and I have emphasized the surprising ways that human beings (and any other intelligent creatures that may inhabit our universe) are central or special from a cosmic perspective. Here are some examples:

- We now understand that as we look out into space we look back in time, so that we (and any astronomical observers) see ourselves at the center of cosmic spheres of time.
- There is a largest and smallest size in the universe, and our size is right in the middle.
- Almost all of the universe is invisible; atomic matter makes up only about 5% of the total density, and oxygen, carbon, and the other sorts of atoms that were all forged in stars and that we are made of are the rarest sort of stuff in the universe, making up only about 0.01%.
- We live at the center of time from the perspective of the cosmos, of our solar system, and of life on earth.
- We also live at a pivotal time for humanity, the end of the brief period of exponential expansion in our numbers and in our technological impacts on the earth.

The new cosmology thus gives us humans a new perspective on how we fit into the universe. The need for Tikkun Olam has never been greater than at the present moment, and now we can understand this from a cosmic perspective.