2007 Conant Prize

The 2007 Levi L. Conant Prize was awarded at the 113th Annual Meeting of the AMS in New Orleans in January 2007.

The Conant Prize is awarded annually to recognize an outstanding expository paper published in either the *Notices of the AMS* or the *Bulletin of the AMS* in the preceding five years. Established in 2001, the prize honors the memory of Levi L. Conant (1857–1916), who was a mathematician at Worcester Polytechnic University. The prize carries a cash award of US$1,000.

The Conant Prize is awarded by the AMS Council acting on the recommendation of a selection committee. For the 2007 prize, the members of the selection committee were: Noam D. Elkies, Carl R. Riehm, and Mary Beth Ruskai.

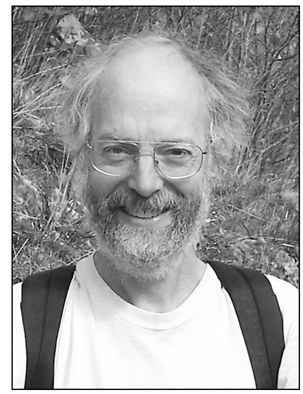
Previous recipients of the Conant Prize are: Carl Pomerance (2001), Elliott Lieb and Jakob Yngvason (2002), Nicholas Katz and Peter Sarnak (2003), Noam D. Elkies (2004), Allen Knutson and Terence Tao (2005), and Ronald M. Solomon (2006).

The 2007 Conant Prize was awarded to Jeffrey Weeks. The text that follows presents the committee's citation, a brief biographical sketch, and the awardee's response upon receiving the prize.

Citation

The Conant prize in 2007 is awarded to Jeffrey Weeks for his article "The Poincaré Dodecahedral Space and the Mystery of the Missing Fluctuations" [*Notices*, June/July 2004]. In this article, together with an earlier one "Measuring the Shape of the Universe" [*Notices*, December 1998], co-authored with Neil Cornish, Weeks explains how extremely sensitive measurements of microwave radiation across the sky provide information about the origins and shape of the universe.

After giving some physical background, Weeks summarizes the evidence for and against a universe that locally looks like a spherical, Euclidean, or hyperbolic 3-manifold. He then considers spherical universes in more detail, emphasizing the role of symmetry groups and making a case for a model based on the Poincaré dodecahedral space. Throughout the paper, he makes this material accessible by using analogies with more familiar structures in one and two dimensions. He gives a particularly elegant exposition of the free symmetry groups of the 3-sphere via an extension of rotation groups of the 2-sphere.



Jeffrey Weeks

Most accounts of the development of physical theories are presented after the dust has settled and the experimental evidence has convinced most scientists. Weeks has explained the mathematics behind models whose validity cosmologists debate while waiting for more experimental evidence. Whether or not the dodecahedral model turns out to be consistent with future observations remains to be seen. In either case, Weeks has given a rare glimpse into the role of mathematics in the development and testing of physical theories.

Biographical Sketch

Jeff Weeks fell in love with geometry in the 12th grade when he read *Flatland*. While an undergraduate at Dartmouth College he bounced back and forth between math and physics, eventually settling on math. He went on to study 3-manifolds under Bill Thurston at Princeton but maintained his interest in physics on the sly. After a few years teaching at Stockton State College and Ithaca College, Weeks resigned to be a full-time dad for a few years. From there he fell into the life of a freelance mathematician, at first part-time, then full-time. He has enjoyed extensive work with the Geometry Center and the National Science Foundation as well as smaller gigs for science museums and teaching at Middlebury College. In 1999 a telephone call from the MacArthur Foundation brought five years of work with zero administrative overhead. The timing could not have been better: 1999–2004 was an intense period for cosmic topology, as well as the time to finish the unit Exploring the Shape of Space for middle schools and high schools. Weeks currently splits his time between puzzling over the microwave background and writing Macintosh versions of his geometry and topology software.

Response

Mathematics, physics, and astronomy share a deep common history. It's been a pleasure working in this tradition, and I'm particularly pleased that *Notices* readers enjoyed hearing one small piece of the ongoing story.

As for the cosmic microwave background, new satellite data (WMAP 2006) and more detailed analysis (carefully excluding a neighborhood of the galactic plane) find the large-scale fluctuations to be even weaker than previously thought, implying that we're seeing something real and not just a statistical fluke. Nontrivial cosmic topology could account for the weakness, but so far no rigorous evidence exists for this or any other explanation. Mother Nature is keeping us guessing.