



Going Back to the Beginning

While most people are “going forward,” many physicists calculate backward to try to understand how the universe has evolved. A lack of eyewitnesses means that the best way to achieve that understanding is essentially to run the equations of general relativity and quantum mechanics in reverse. Mathematical models and numerical methods applied to these equations have allowed researchers to reconstruct what happened billions of years ago. The first few instants of the universe, however, will remain a mystery, at least until someone creates a unified theory that incorporates the most important aspects of two of the foundations of modern physics: general relativity and quantum mechanics.

Although general relativity (which describes gravity) and quantum mechanics (which describes the behavior of the very small) conflict, there are theories that attempt to unify the two fields. One is superstring theory, which posits a universe of eleven dimensions. An important part of this theory comes from complex analysis and modular forms. The verification of superstring theory is probably a long way off, but could be found here on Earth, using particle accelerators (possibly much more powerful than those of today), or light years away in gravitationally massive black holes, or even in the afterglow from the first moments of the Big Bang.

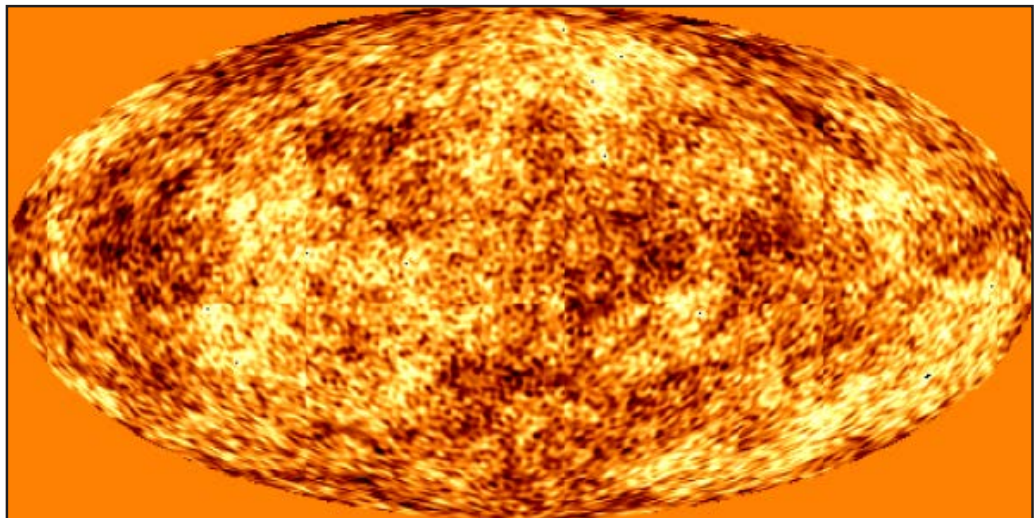


Image: Simulation of the cosmic microwave background, © ESA.

For More Information: “The Black Hole at the Beginning of Time,” Niayesh Afshordi, Robert B. Mann and Razieh Pourhasan, *Scientific American*, August 2014.

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