

Thursday, January 27th, 2022

4:00 PM – 5:00 PM, Virtual

<https://asu.zoom.us/j/86960690591>

The Quantum Mechanics of Cosmology

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Abstract:

Cosmology studies the entire Universe as a physical system. Somewhat counterintuitively, the discipline strongly overlaps with the exploration of the extremely small, high-energy particle physics. We have the expansion of the Cosmos to thank for this. Run backward in time, the entire Universe was contained within length scales much smaller than those of nuclei and beyond. This places its early dynamics firmly in the quantum mechanical regime. Furthermore, in its “small” past, it was significantly hotter than the corresponding energies at our highest-energy experiment, the Large Hadron Collider. Thus, cosmological data gives us unique access to the deep structures of Nature, even probing the Holy Grail of fundamental physics, Quantum Gravity. I will describe how the quantum gravitational analog of the Cosmic Microwave Background allows us to take a census of the particle spectrum of the entire universe. In the next decade, this and other important experimental tests of early-Universe cosmology will take place, as I will detail. Lastly, for all its attractiveness, the Inflationary picture of both the Big Bang era and our current era of Dark Energy sits uneasily with Quantum Gravity. I will explain this challenge and my current program to disentangle it.

Biography:

Matthew Baumgart is a theoretical high-energy physicist who studies nuclear & particle physics, cosmology, and quantum gravity. He received his PhD in 2009 from Harvard University. He was additionally a two-year visitor at the Institute for Advanced Study in Princeton, and held postdoctoral positions at Johns Hopkins, Carnegie Mellon, and Rutgers. Since 2017, he has been an Assistant Professor at Arizona State. In much of his research he uses the potent formalism of Effective Field Theory, which systematizes our ability to separate the physics occurring at vastly different energy scales. A major component of his work involves calculations for dark matter. He is additionally an Associate Member of the VERITAS gamma ray telescope, where he collaborates on dark matter searches.

Host: Prof. Cynthia Keeler

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