

APR14-2014-000263

Abstract for an Invited Paper
for the APR14 Meeting of
the American Physical Society

Singularity Resolution in Quantum Gravity

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In recent years, progress in understanding of the quantization of cosmological spacetimes using techniques of loop quantum gravity, has led to important insights on the resolution of singularities. With a rigorous loop quantization of isotropic and anisotropic spacetimes and development of sophisticated numerical techniques, it is now possible to explore in detail the structure of spacetime in the Planck regime and extract new physics of the very early universe. Investigations of quantization of various spacetimes indicates that classical singularities such as the big bang are avoided, and quantum evolution results in a bounce of the scale factor. The resolution of singularities seems to occur without any assumption on the initial state for quantum evolution or the equation of state of matter. In this talk, we will review some of the main developments in this direction and provide an up to date summary of the novel results obtained on the resolution of singularities in various models in loop quantum gravity.