MAGIC

Science of the Cosmos

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On Measuring the Quantum Universe

According to the common understanding of quantum mechanics (QM), everything is a priori quantum, even the Universe itself. Describing the Universe as a quantum object is the realm of quantum cosmology (QC). The Schrödinger equation of the Universe has been derived by Wheeler and DeWitt around half a century ago. After quantizing the classical Friedman theory the wave function of the Universe was found to be timeless, violating our common sense and contradicting our mere existence. This has since been subject of an ongoing debate.

In this talk we first discuss whether and how the cosmic time can be retained by modifying the quantization process for a class of gravity theories. We discover the spatial curvature to assume a prominent role similar to the energy spectrum in conventional QM.

Secondly we analyze the problem of interpreting astronomical observations vs. the postulates of canonical (Copenhagen) QM, and in particular show how the collapse of the universal wave function is circumvented by invoking the so called “weak” or sub-quantum measurements.

Thirdly, we review the de Broglie-Bohm picture of QM enabling the extraction of classical trajectories from a wave function, and address its application in QC.

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