Contribution ID: **821** Type: **Talk in the parallel session**

Semiclassical and quantum polymer dynamics of the Bianchi I cosmology in Ashtekar and volume-like variables

Friday, 9 July 2021 07:30 (20 minutes)

We analyze the Bianchi I cosmology in the presence of a massless scalar field and describe its dynamics via a semiclassical and quantum polymer approach. We investigate the morphology of the emerging Big Bounce by adopting three different sets of configurational variables: the natural Ashtekar connections, the Universe volume plus two anisotropy coordinates and a set of anisotropic volume-like coordinates (the latter two sets of variables would coincide in the case of an isotropic Universe). In the semiclassical analysis we demonstrate that the Big Bounce has a universal nature in both the two sets of volume-like variables, i.e. its critical energy density has a maximum value fixed by fundamental constants and the Immirzi parameter only. On the contrary, when adopting the Ashtekar connections (the privileged variables as dictated by Loop Quantum Gravity) the value of the critical Big Bounce density depends on the Cauchy problem for the dynamics and specifically on the conjugate momentum to the scalar field, which is a constant of motion in the present analysis. Also, a cosmological constant is included in the Ashtekar connections' formulation and some interesting results are mentioned making a comparison between the synchronous dynamics and that one when the scalar field is taken as a relational time. From a pure quantum point of view, we investigate the Bianchi I dynamics only in terms of the Ashtekar connections. In particular, we apply the Arnowitt-Deser-Misner (ADM) reduction of the variational principle and then we quantize the system. We study the resulting Schr\"{o}dinger dynamics, stressing that the wave packet peak behavior over time singles out common features with the semiclassical trajectory, confirming the non-universal character of the emerging Big Bounce also on a quantum level.

Primary author: GIOVANNETTI, Eleonora (Sapienza)

Co-authors: Prof. MONTANI, Giovanni (Università di Roma "La Sapienza"); Mrs SCHIATTARELLA, Silvia (Università di Roma "La Sapienza")

Presenter: GIOVANNETTI, Eleonora (Sapienza)

Session Classification: Extended Theories of Gravity and Quantum Cosmology

Track Classification: Alternative Theories: Extended Theories of Gravity and Quantum Cosmology