Contribution ID: **348** Type: **Invited talk in the parallel session**

Entanglement production in Einstein-Cartan theory

Wednesday, 7 July 2021 09:30 (20 minutes)

We study the entanglement production for Dirac and Klein-Gordon fields in an expanding spacetime characterized by the presence of torsion. Torsion is here considered according to the Einstein-Cartan theory with a conformally flat Friedmann-Robertson-Walker spacetime. In this framework, torsion is seen as an external field, fulfilling precise constraints directly got from the cosmological
constant principle. For Dirac field, we find that torsion increases the amount of entanglement. This turns out to be particularly evident for small values of particle momentum. We discuss the roles of Pauli exclusion principle in view of our results, and, in particular, we propose an interpretation of the two maxima that occur for the entanglement entropy in presence of torsion. For Klein-Gordon
field, and differently from the Dirac case, the model can be exactly solved by adopting the same scale factor as in the Dirac case. Again, we show how torsion affects the amount of entanglement, providing a robust physical motivation behind the increase or decrease of entanglement entropy. A direct comparison of our findings is also discussed in view of previous results derived in absence of
torsion. To this end, we give prominence on how our expectations would change in terms of the coupling between torsion and the scale factor for both Dirac and Klein-Gordon fields.

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Session Classification: Theories of Gravity: Alternatives to the Cosmological and Particle Standard Models

Track Classification: Alternative Theories: Theories of gravity: alternatives to the cosmological and particle standard models