Contribution ID: **452** Type: **Poster**

Barut-Girardello coherent states in magnetized 2D-Dirac-Weyl materials under uniform uniaxial strain

Monday 15 July 2019 18:30 (1h 30m)

We construct the Barut-Girardello coherent states for charge carriers in 2D-Dirac-Weyl materials immersed in a constant homogeneous magnetic field which is orthogonal to the sample surface. We consider the situation in which the membrane is deformed uniformily and uniaxially, avoiding the generation of pseudo-magnetic fields. For that purpose, we solve the Dirac-Weyl equation with an anisotropic Fermi velocity and identify the appropriate arising and lowering operators. Working in a Landau-like gauge, we explicitly construct nonlinear coherent states as eigenstates of a generalized annihilation operator with complex eigenvalues which depends on an arbitrary function f of the number operator. In order to describe the anisotropy effects on these states, we obtain the Heisenberg uncertainty relation, the probability density and mean energy value for three different functions f. In particular, for strained graphene we obtain that, when a stress is applied along the x-axis of the material surface, the probability density for the nonlinear coherent states is smaller compared to when the material is compressed along the same axis.

Keywords: nonlinear coherent states, Dirac-Weyl fermions, graphene, magnetic field

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Session Classification: Wine & Cheese Poster Session

Track Classification: Quantum Field and String Theory