复旦大学物理系 Special Colloquium

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Graphene Wormholes:

From General Relativity to Nano-technologies

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Abstract: We propose a model describing the evolution of free electron current density in graphene giving rise to bidimensional wormhole solutions. Based on analogue concepts of General Relativity, we perform the analysis using the difference between curvatures of parallel and antiparallel spins. In such a framework, effective “gravitons” emerges in the form of gauge fields exchanged between electrons. In a plain graphene system, the curvatures produced by both kinds of spins neutralize each other giving rise to no conduction. However, in the presence of geometrical defects of the graphene sheets, the inequality between curvatures leads to the emergence of current densities and conductivity in a wormhole solution. Depending on the type of defects, the resulting current density can be negative or positive. Possible applications are discussed.

Biography: Full Professor at the “Ettore Pancini” Department of Physics, University of Naples “Federico II”. Master Degree (Laurea) in Physics at the University of Rome "La Sapienza" (Academic year 1988/89). PhD in Theoretical Physics at the University of Naples "Federico II" (Academic year 1992/93). Specialization in General Relativity, Cosmology and Particle Physics at the University of Naples "Federico II" (Academic year 1993/94). In 1993, he was awarded the Astrophysical Science Award from the National Society of Sciences, Letters and Arts (Academy of Physical and Mathematical Sciences). In 2014, he received the “Rosone d’Argento Award” (Apulia) for scientific merits. In 2020, he was awarded the Silver Medal for Education and Science of the Russian Federation.