CO.CO.MAT

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Modelling relativistic quantum mechanics in optical waveguiding structures

Simulating the evolution of a non-relativistic quantum mechanical particle in a periodic potential by propagating an optical wave packet in arrays of evanescently coupled waveguides has received continuous and increasing attention in recent years. Only recently it has been realized that, by carefully designing the underlying periodic potential, paraxial light propagation is capable of simulating the evolution of a relativistic quantum particle, as described by the spinor-type Dirac equation. Thus, optical analogues of such important phenomena as Klein tunneling and Zitterbewegung – the trembling motion of a free relativistic electron – can be realized in the framework of paraxial optics in periodic media, without requiring specially synthesized media with sub-wavelength controlled properties. In my presentation I will give an overview on the recent progress of simulating the evolution of relativistic wave packets in a classical optical system. Specific focus is thereby given on (1) planar superlattice waveguide arrays and (2) honeycomb photonic lattices – also called photonic graphene, that allow the classical simulation of the relativistic Dirac equation.

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