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Innovating quantum technologies

Nonlinear Quantum Electrodynamics in Dirac materials

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Classical electromagnetism is linear. However, due to quantum mechanics sufficiently strong fields polarize the Dirac sea and this gives rise to the nonlinear electromagnetism. In quantum electrodynamics these effects become relevant in very strong electric and magnetic fields that exist only in exotic environments like neutron stars. We show that similar nonlinear effects arise in Dirac materials at much lower fields, the magnitude of the effects is significant, and they can be observed in laboratory experiments. We predict and calculate the nonlinear electromagnetic effects and discuss compounds where the nonlinear electromagnetism can be observed.



Prof. Yuli Lyanda-Geller's research group focuses on condensed matter theory and atomic and molecular physics. Current group interests include Quantum Computing, particularly decoherence, Spin phenomena, Topological effects in Physics, Quantum Hall effect, and Physics of Nanostructures.