Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Spinor Slow-Light and unusual midgap states JOHANNES OTTERBACH, RAZMIK G. UNANYAN, MICHAEL FLEISCHHAUER, TU Kaiserslautern, JULIUS RUSECKAS, VIACESLAV KUDRIASOV, GEDIMINAS JUZELIUNAS, ITPA, Vilnius University — Since the discovery of a Dirac-like band structure in graphene there is a constantly growing interest in systems evolving under the influence of an effective Dirac-like Hamiltonian. We here show that the interaction of weak probe fields with a coherently driven atomic ensemble under conditions of electromagnetically induced transparency (EIT) leads to a Dirac-like spectrum for light-matter quasi-particles, with multiple dark-states, called spinor slow-light polaritons (SSP). They posses an "effective speed of light" given by the group-velocity of slow-light, which can be externally controlled and be made many orders of magnitude smaller than the vacuum speed of light. By inducing a small two-photon detuning a mass is created for the SSPs. It has been shown that a 1D model of Dirac particles having a spatially random varying mass exhibits unusual spatial correlations. For a vanishing mean value of the mass there exists a zero energy (mid-gap) state with a power-law decay of correlations. We use the property of a locally adjustable two-photon detuning to create a random varying mass of the SSP and hence to observe the unusual mid-gap state correlations. A possible implementation and its limitations are discussed.

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Date submitted: 27 Jan 2010 Electronic form version 1.4