Abstract Submitted
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WHY A MAGNETIZED QUANTUM WIRE CAN ACT AS AN OPTICAL AMPLIFIER MANVIR KUSHWAHA, Rice University — We discuss the fundamental issues associated with the magnetoplasmon excitations in a semiconducting quantum wire characterized by a harmonic confining potential and subjected to an applied (perpendicular) magnetic field. The problem involves two length scales: $l_0 = \sqrt{\hbar/m^*\omega_0}$ and $l_c = \sqrt{\hbar/m^*\omega_c}$, which characterize the strengths of the confinement and the magnetic field (B). Essentially, we focus on the device aspects of the intersubband collective (magnetoroton) excitation, which observes a negative group velocity between maxon and roton. Existence of the negative group velocity is a clear manifestation of a medium with population inversion brought about due to a metastable state caused by the magnetic field that satisfies the condition $B > B_{th}$; B_{th} being the threshold value below which the magnetoroton does not exist. A medium with an inverted population has the remarkable ability of amplifying a small optical signal of definite wavelength. An extensive scrutiny of the gain coefficient suggests an interesting and important application: the electronic device designed on the basis of such magnetoroton modes can act as an optical amplifier[1]. 1. M.S. Kushwaha, J. Appl. Phys.**109**, 106102 (2011).

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