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Topological Phonon-Plasmon Modes in Two-Dimensional Ferromagnetic Wigner Crystal of Electrons WENCHENG JI, JUNREN SHI, Peking Univ — We show that a two-dimensional ferromagnetic Wigner crystal of electrons confined in a semiconductor quantum well/heterostructure with spin-orbit coupling and an appropriate sign of g-factor could be transformed to a topological phonon-plasmon system by applying a weak perpendicular magnetic field. The competition between the magnetic field and the spin-orbit coupling will drive a topological phase transition, resulting in a topologically trivial phonon-plasmon system in the high magnetic field. We demonstrate the existence of chiral edge phonon-plasmon modes in finite size samples for both phases, and the robustness of the chiral edge modes in the topological phase. We estimate parameters for a few commonly used semiconductors,such as GaAs, GaAl, InAs and InSb. Moreover, we rule out the possibility of Wigner crystal of holes as a topological phonon-plasmon system, due to the unfavorable form of spin-orbit coupling in hole bands dictated by symmetry.

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