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Melting Scenario for Coulomb-interacting Classical Particles in Two-dimensional Irregular Confinements DYUTI BHATTACHARYA, AMIT GHOSAL, Indian Institute of Science Education and Research, Kolkata, India —

We report the thermal "melting" of self-formed rigid structures made of a small number of interacting classical particles in two-dimensional confined geometries. We will focus on the role of irregularities of the confinement on the melting of these Coulomb-interacting particles using Monte Carlo simulations. It will be shown that the interplay of long-range Coulomb repulsions between these particles and the irregular confinement yields a solid-like phase (termed as irregular Wigner molecules) at low temperatures that possesses a bond-orientation order. However, the positional order is depleted even at the lowest temperatures due to the disordered confinement. Upon including thermal fluctuations, this solid-like phase smoothly crosses over to a liquid-like phase by destroying the bond-orientation order. This cross-over will be demonstrated by the temperature dependence of several physical observables. The collapse of the solidity will be shown to be defect mediated, and aided primarily by the proliferation of free disclinations, initiated by intriguing tortuous path of correlated fluctuations. These results will help us quantifying the melting found in experiments on systems with confined geometries.

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