Melting Scenario of the Two-Dimensional Core-Softened System: First-Order or Continuous Transition?

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We present a computer simulation study of the phase behavior of two-dimensional classical particles repelling each other through an isotropic core-softened potential [1-4]. As in the analogous three dimensional case [1-4], a reentrant-melting transition occurs upon compression for not too high pressures, along with a spectrum of water-like anomalies in the fluid phase. However, in two dimensions in the low density part of the phase diagram melting is a continuous two-stage transition, with an intermediate hexatic phase. All available evidence supports the Kosterlitz-Thouless-Halperin-Nelson-Young scenario for this melting transition [5-7]. On the other hand, at high density part of the phase diagram one first-order transition takes place. We expect that such a phenomenology can be checked in confined monolayers of charge-stabilized colloids with a softened core and water confined between two hydrophobic plates.

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