Geometrical defects in two-dimensional melting of many-particle Yukawa systems

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We perform Langevin dynamics simulations and use polygon construction method to investigate two-dimensional (2D) melting and freezing transitions in many-particle Yukawa systems. 2D melting transitions can be characterized as proliferation of geometrical defects - non-triangular polygons, obtained by removing unusually long bonds in the triangulation of particle positions. A 2D liquid is characterized by the temperature-independent number of quadrilaterals and linearly increasing number of pentagons. We analyze specific types of vertices, classified by the type and distribution of polygons surrounding them, and determine temperature dependencies of their concentrations. Critical points in a solid-liquid transition are followed by the peaks in the abundances of certain types of vertices.

Comments:	8 pages, 9 figures: The geometry of a simulation box was changed, to start the experiment from a perfect hexagonal lattice. Some comments on the nature of the hysteresis were added. The list of references was expanded and larger versions of figures 5 and 7 were added
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