Confinement controlled dynamical structural rearrangement in a quasi-2D dusty plasma crystal

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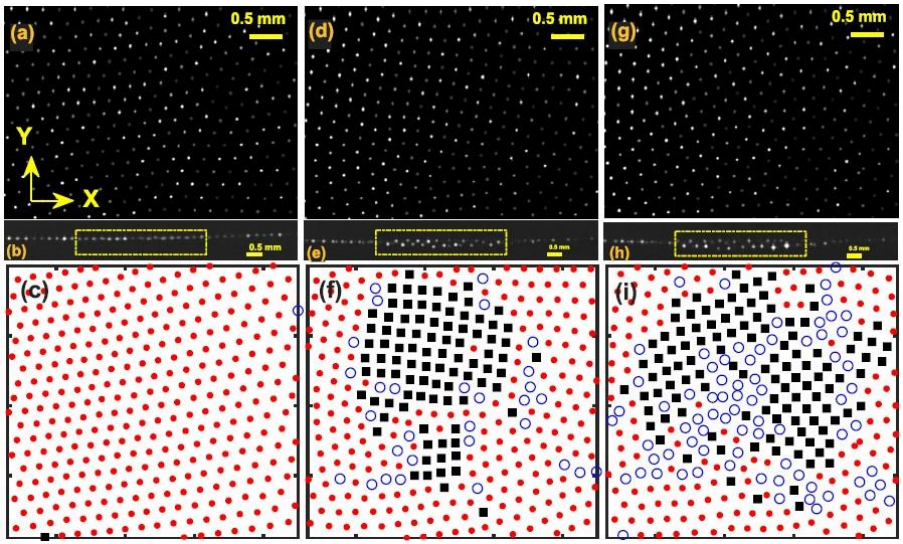

Fig: Top (a), (d), and (g) and side (b), (e), and (h) views of camera images of dusty plasma system for different values of ring potential, Vring=0 [(a) and (b)], 4.5 [(d) and (e)], and 23 V [(g) and (h)]. (c), (f), and (i) The local bond order of the individual dust particle corresponding to (a), (d), and (g), respectively. The closed-circles (red circle), closed-square, and opened-circles represent dust particles with hexagonal, square, and defect arrangement, respectively. (a)–(c) The formation of typical monolayer crystal structures, whereas (d)–(i) depict the instance of square lattice formation with some defects.

In this work, we present experimental results on the structural transition of a two-dimensional dust crystal through controlled adjustment of its radial confinement while keeping all other discharge parameters constant. Initially, a purely 2D dust crystal is formed inside a circular confining ring at the interface of the plasma-cathode sheath region. This monolayer with a hexagonal lattice configuration of the dust particles gets buckled when the sheath thickness around the radial confinement ring is reduced. A bilayer with a square lattice configuration emerges in the dust system due to the onset of a transverse instability. The multiple crystalline domains at this lower confinement show signatures of a constant structural rearrangement in the system.

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