



Fig. 1. Colour online. (a) Low energy metastable state of 2000 charges interacting via an inverse potential $\gamma = 1$ (i.e. the Coulomb potential) showing an isolated rosette defect. (b) More typically however are grain boundary scars (of alternating positive and negative disclinations) as can be seen in this low energy metastable state of 5000 charges with $\gamma = 1$. Positive and negative disclinations in (a) and (b) are coloured red and green respectively. (c) A small cluster of 100 charges with $\gamma = 2$; the particles are arranged into two distinct shells, an inner shell of 13 particles and an outer shell with 87 charges. (d) The two outermost shells for a system with 5000 charges and $\gamma = 2$. Positive and negative disclinations on the inner shells in (c) and (d) are coloured yellow and blue, respectively. (e) The two innermost shells in a cluster of 2000 charges with $\gamma = 2$. (f) Outer shell of a low energy state of 1000 charges interacting via an inverse potential with $\gamma = 12$.

throughout the sphere with uniform density (Hardin and Saff, 2004).

Although it is recognised that for $\gamma > 1$ the presence of charges in the interior of the spherical box becomes energetically favourable (Levin and Arenzon, 2003), our simulations demonstrate that these internal charges also condense into spherical crystals (in which most charges have six nearest neighbours) giving rise to a series of concentric shells. Decreasing the range of interaction (by increasing γ) drives

particles into the interior and leads to a higher occupancy of the inner shells. This is in contrast to similar shell like structures observed in spherical dusty plasma crystals (so called Yukawa balls), where decreasing the range of interaction (achieved by decreasing the screening length) drives particles towards the exterior and leads to a higher occupancy of the outer shells (Baumgartner *et al.*, 2009).

For $\gamma \geq 3$ the continuum limit charge density is expected to be uniform. In finite sized clusters the charges