Renormalized Energy Equidistribution and Local Charge Balance in Coulomb Systems

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We consider a classical system of n charged particles confined by an external potential in any dimension d bigger than 2. The particles interact via pairwise repulsive Coulomb forces and the pair-interaction strength scales as the inverse of n (mean-field regime). The goal is to investigate the microscopic structure of the minimizers.
It has been proved by Sandier-Serfaty (d=2) and Rougerie-Serfaty (d>2) that the distribution of particles at the microscopic scale, i.e. after blow-up at the scale corresponding to the interparticle distance, is governed by a renormalized energy which corresponds to the total Coulomb interaction of point charges in a uniform neutralizing background.
In this talk, I will present some results which show that, for minimizers and in any large enough microscopic set, the renormalized energy concentration and the number of points are completely determined by the macroscopic density of points. In other words, points and energy are "equidistributed".

Works in collaboration with S. Serfaty and M. Petrache.