



THE FIELDS INSTITUTE

COXETER LECTURE SERIES

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FIELDS INSTITUTE

*Systems with Coulomb interaction:
from variational study to statistical mechanics*

Systems of particles with Coulomb and logarithmic interactions arise in various settings: an instance is the classical Coulomb gas which in some cases happens to be a random matrix ensemble, another is vortices in the Ginzburg-Landau model of superconductivity, where one observes in certain regimes the emergence of densely packed point vortices forming perfect triangular lattice patterns, named Abrikosov lattices in physics, a third is the study of Fekete points which arise in approximation theory. I will describe tools to study such systems and derive a next order (beyond mean field limit) “renormalized energy” that governs microscopic patterns of points. I will present the derivation of this limiting problem, and discuss the question of its minimization and its link with the Abrikosov lattice and crystallization questions. I will also discuss generalizations to Riesz interaction energies, and the statistical mechanics of such systems.

This is based on joint works with Etienne Sandier, Nicolas Rougerie, Simona Rota Nodari, Mircea Petrache, and Thomas Leblé.



About Sylvia Serfaty

Sylvia Serfaty is a French Mathematician and is a recipient of the Henri Poincaré Prize in 2012, and the EMS Prize in 2004. Her themes of research include nonlinear partial differential equations, calculus of variations and mathematical physics, in particular the Ginzburg-Landau model of superconductivity.

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