2023
Emil Grosswald Lectures
Systems of Points with Coulomb Interactions

Large ensembles of points with Coulomb interactions arise in various settings of condensed matter physics, classical and quantum mechanics, statistical mechanics, random matrices and even approximation theory, and they give rise to a variety of questions pertaining to analysis, partial differential equations and probability. In the first lecture, we will review these motivations and describe the main results. In the subsequent lectures, we will present the "mean-field" derivation of effective models and equations describing the system at the macroscopic scale, and then explain how to analyze the next order behavior, giving information on the configurations at the microscopic level and connecting with crystallization questions, as well as describing the effect of temperature.

The first lecture is intended for a general audience.

Sylvia Serfaty
Courant Institute, NYU

Lecture 1:
October 30
4:00 p.m.
Tuttleman LC 103

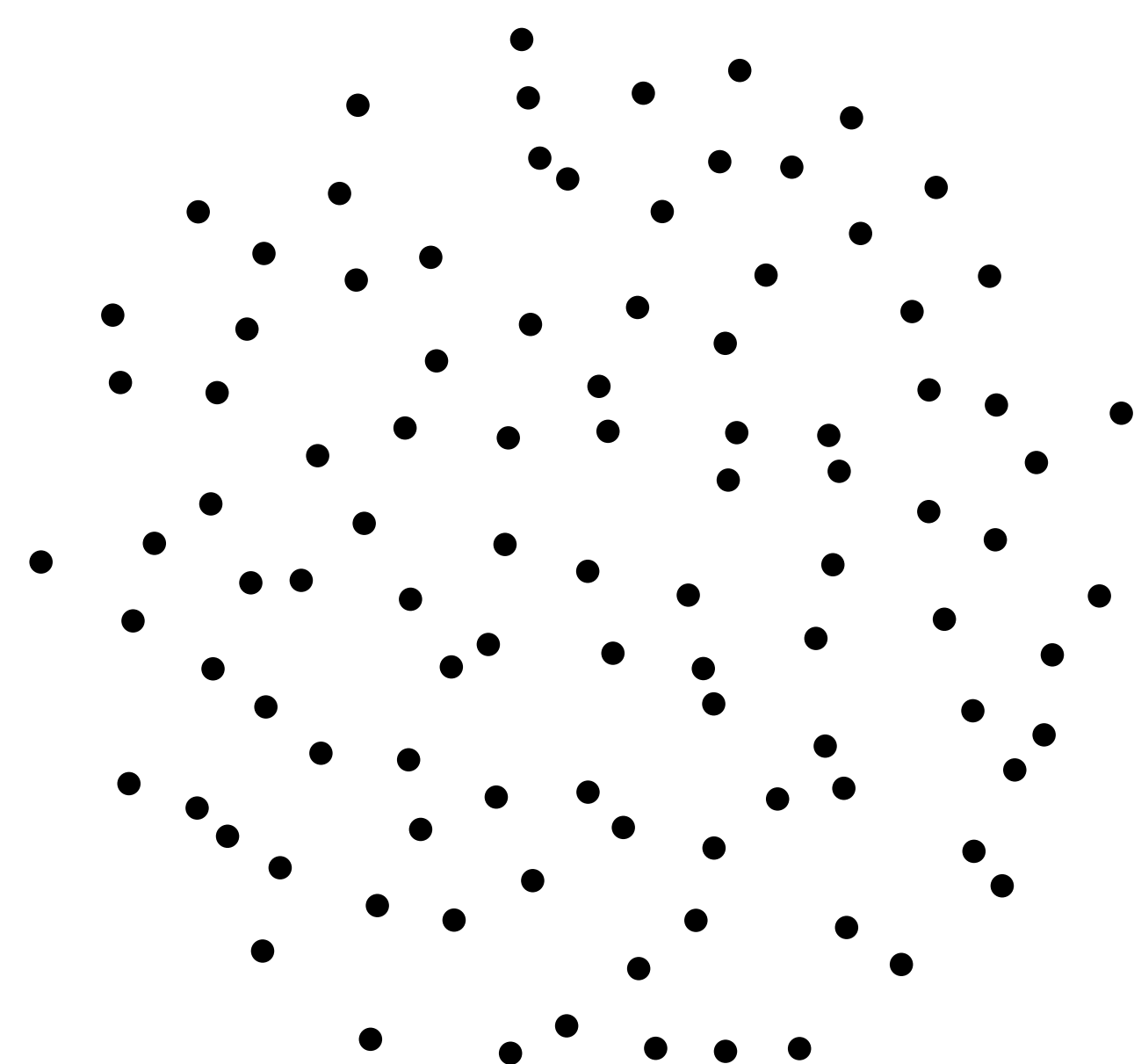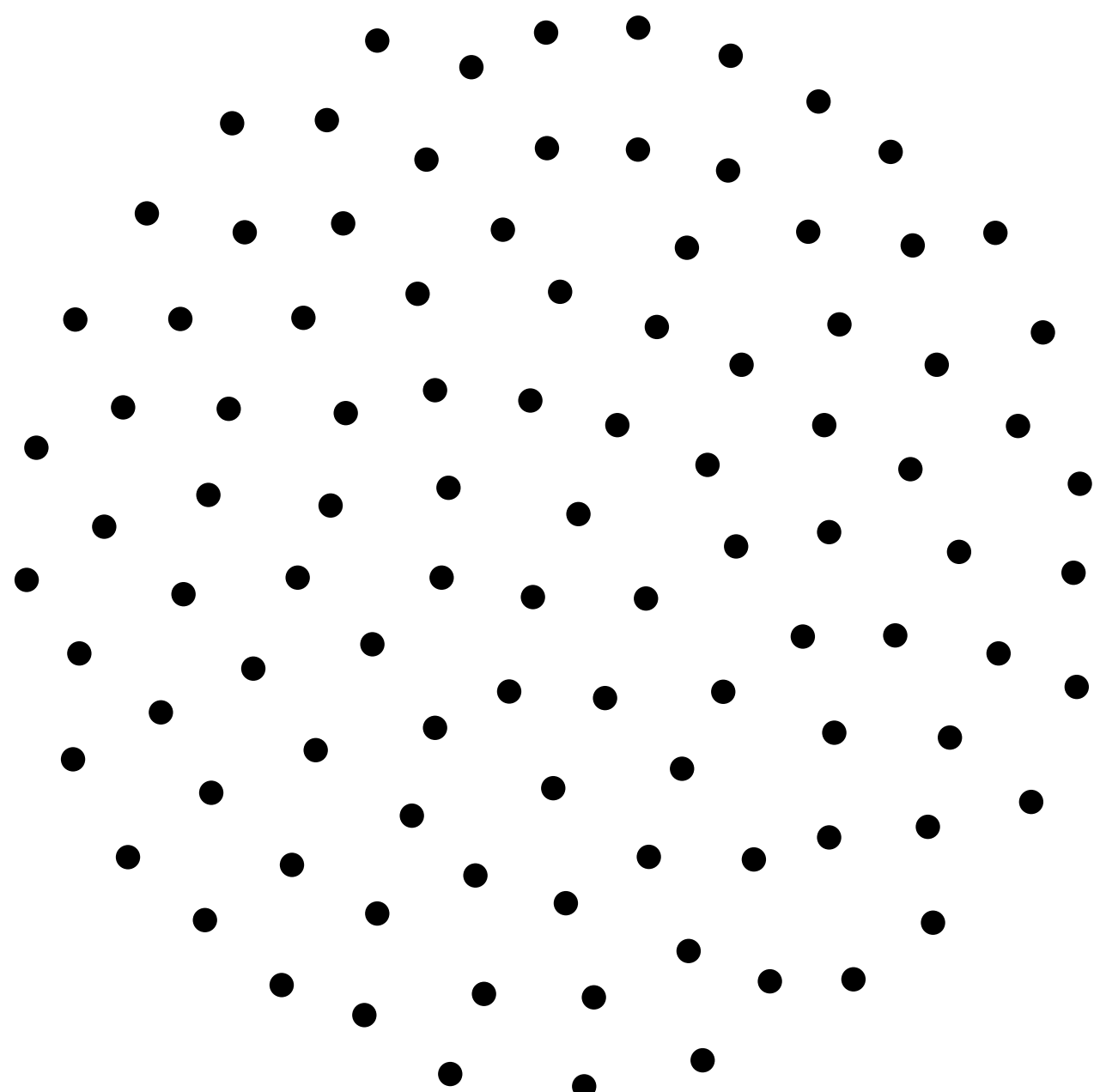**Lecture 2:**
November 1
11:00 a.m.
Wachman Hall 617

Lecture 3:
November 1
2:00 p.m.
Wachman Hall 617

$$\mathcal{H}_N(x_1, \ldots, x_N) = -\frac{1}{2} \sum_{i \neq j} \log |x_i - x_j| + N \sum_i |x_i|^2$$

$$d\mathbb{P}_{N,\beta}(x_1, \ldots, x_N) = \frac{1}{Z_{N,\beta}} e^{-\beta \mathcal{H}_N(x_1, \ldots, x_N)} dx_1 \cdots dx_N$$