Title: Free energy and fluctuations in the random normal matrix model with spectral gaps.

Abstract: Consider a plasma consisting of n repelling point charges $\{z_j\}_1^n$ in the complex plane $\mathbb{C}$, subjected to a suitable confining potential Q, which is "large" near infinity and radially symmetric. The particles will tend to occupy a droplet consisting of concentric annuli, possibly with a central disk. There might also be some "spectral outposts", i.e., components of the coincidence set outside of the droplet.

We consider a large n expansion for the free energy $\log Z_n$ (at inverse temperature $\beta = 2$), where

$$Z_n = \frac{1}{\pi^n} \int_{\mathbf{C}^n} \prod_{1 \le i < j \le n} |z_i - z_j|^2 \prod_{i=1}^n e^{-nQ(z_i)}\, d^2 z_i,$$

is the partition function of the gas. The expansion takes the form

$$\log Z_n = C_1 n^2 + C_2 n \log n + C_3 n + C_4 \log n + C_5 + \mathcal{G}_n + o(1),$$

where $C_1, \dots, C_5$ are certain geometric functionals while the bounded n-dependent term $\mathcal{G}_n$ measures the "displacement" of particles from a given component of the coincidence set to another one. The coefficients C_4, C_5 and $\mathcal{G}_n$ are related to fluctuations of linear statistics.

Joint work with Joakim Cronvall and Christophe Charlier.