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Asymmetric phase transitions in random noncommutative geometries

In this talk we will outline study the asymmetric phases of the quartic type $(0,1)$ and $(1,0)$ Dirac ensembles. The focus of this work is on asymmetric solutions to the Schwinger-Dyson and saddle point equations of these models, whose solution spaces prove deeply intricate. Via the Riemann-Hilbert approach, we are able to give explicit formulae for the eigenvalue distributions and free energy of various solutions. Using Hamiltonian Monte Carlo simulations, we are able to reconstruct the phase structure. Lastly, using bootstrapping with positivity, we are able to reconstruct the eigenvalue distribution of these models from their bootstrapped moments. All three methods show excellent agreement for large matrix size. This talk is based on upcoming joint work with Benedek Bukor, Masoud Khalkhali, Samuel Kováčik, Katarína Magdolenová, and Juraj Tekel.