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Spectral Phase Transitions in Non-Linear Wigner Spiked Models

In this talk, we discuss the asymptotic behavior of the spectrum of a random matrix where a non-linearity is applied entry-wise to a Wigner matrix perturbed by a rank-one spike with independent and identically distributed entries. In this setting, we show that when the signal-to-noise ratio scale as $N^{\frac{1}{2}(1-1/k_\star)}$, where $k_\star$ is the first non-zero generalized information coefficient of the function, the non-linear spike model effectively behaves as an equivalent spiked Wigner matrix, where the former spike before the non-linearity is now raised to a power $k_\star$. This allows us to study the phase transition of the leading eigenvalues, generalizing part of the work of Baik, Ben Arous and Péché to these non-linear models. We also will explain an application of this result to estimate a low-rank matrix from non-linear and possibly noisy observations. This talk is based on recent and upcoming work with Alice Guionnet, Florent Krzakala, Pierre Mergny, and Lenka Zdeborová.