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ABSTRACT

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Irregularity of free convolution and perturbation of unitary random matrix ensembles

Abstract: Taking free convolution with semicircular law can turn a smooth or even analytic probability density into a non-differentiable density with cusps. This phenomenon was first noticed by Biane and later made precise by Claeys, Kuijlaars, Liechty, and D. Wang in their study of GUE perturbation of singular unitary random matrix ensembles [1]. We show that this irregularity of free convolution happens for freely infinitely divisible laws as well. In particular, the singularity propagation behavior in [1] also holds for Wishart perturbation. Our results are included in a joint work with Hari Bercovici and Ping Zhong [2].

[1] T. Claeys, A. B. J. Kuijlaars, K. Liechty, D. Wang, *Propagation of singular behavior for Gaussian perturbations of random matrices*, Commun. Math. Phys. **362** (2018), 1-54.

[2] H. Bercovici, J.-C. Wang, P. Zhong, *Superconvergence and regularity of densities in free probability*, preprint, 2021. arXiv:2010.01248v3