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Free Energy of Spherical Sherrington-Kirkpatrick Model

Spherical Sherrington-Kirkpatrick (SSK) model is an example of disordered systems known as spin glasses. The free energy of 2-spin SSK, which is a random variable, can be considered as a finite temperature version of the largest eigenvalue of a random symmetric matrix. We find the critical temperature and prove the limiting free energy for all non-critical temperature. We also show that the law of the fluctuation of the free energy converges to the Gaussian distribution when the temperature is above the critical temperature, and to the GOE Tracy-Widom distribution when the temperature is below the critical temperature. The result is universal, and the analysis is applicable to various models including SSK with ferromagnetic interaction and bipartite SSK model. This talk is based on joint works with Jinho Baik.