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Free Stein kernels and an improvement of the free logarithmic Sobolev inequality

In their 2015 paper, Ledoux, Nourdin, and Peccati used Stein kernels and Stein discrepancies to improve the classical logarithmic Sobolev inequality (relative to a Gaussian distribution). Simply put, Stein discrepancy measures how far a probability distribution is from the Gaussian distribution by looking at how badly it violates the integration by parts formula. In free probability, free semicircular operators are known to satisfy a corresponding “integration by parts formula” by way of the free difference quotients. Using this fact, we define in this talk the non-commutative analogues of Stein kernels and Stein discrepancies and use them to produce an improvement of Biane and Speicher’s free logarithmic Sobolev inequality from 2001. This talk is based on joint work with Max Fathi.