
Effects of correlations in disorder on localization and ergodicity breaking in long-range systems

Ivan Khaymovich*¹

¹Nordic Institute for Theoretical Physics – Sweden

Abstract

In this talk, after a brief introduction to the topic of correlated long-range systems and correlation-induced localization (1, 2), I consider a method (3) to calculate both the localization phase diagram and the fractal dimensions D_2 and D_∞ , relevant for physical observables, in the system with correlated on-site disorder. To verify this method, I will show the application of it to the class of long-range (self-)dual models, interpolating between AA and TI RP ones via both power-law dependences of on-site disorder correlations and hopping terms, and, thus, being out of the validity range of the previously developed methods. We show that the interplay of the correlated disorder and the power-law decaying hopping terms leads to the emergence of the two types of fractal phases in an entire range of parameters, even without having any quasiperiodicity of the AA potential. The analytical results of the above method are in full agreement with the extensive numerical calculations. (1) Nosov, Khaymovich, Kravtsov, Correlation-induced localization, PRB **99**, 104203 (2019).

(2) Kutlin, Khaymovich, Renormalization to localization without a small parameter, SciPostPhys. **8**, 049 (2020).

(3) Roy, Basu, Khaymovich, Ergodicity-breaking phase diagram and fractal dimensions in long-range models with generically correlated disorder, PRB **111**, 104203 (2025).

*Speaker