Contribution ID: **82**   Type: **Poster**

Nonergodic dynamics in strongly interacting 1D systems.

Monday, 11 September 2023 22:40 (20 minutes)

I will present several examples of nonergodic dynamics in strongly interacting systems in the presence of the disorder. Those will include (1D) dipolar models, tilted lattices as well as disordered cases.

The first model considered are dipolar bosons in a 1D lattice. By tailoring the transversal confinement one may modify the tail of interactions that profoundly affects the dynamics for hard-core bosons [1]. The situation is even more interesting for soft bosons where interaction induced tunnelings may be shown to deeply affect the dynamics. They may lead to boson delocalization for strong interactions. Interestingly, the interference between kinetic and interaction induced tunneling may, for a specific interaction values lead to a decoupling of the subspace of the Hilbert space containing single occupations only (hard-core subspace) which reveals ergodic dynamics and soft-core subspace where transport is inhibited [2].

A second example which we consider is the fate of an impurity immersed in a sea of other type of (noninteracting) bosons in a tilted lattice. Those bosons are Stark localized - we discuss how a single interacting impurity may affect the system depending on the tilt value as well as the interaction strength. We show that the dynamics strongly depends on the initial arrangement of Stark-localized particles [3]. We compare this situation with the similar model in which hard-core bosons are Anderson localized due to the presence of the disorder [4]. We claim that on nthe experimental time scale one cannot conclude on the long-time fate of the system, in particular whether many-body proximity effect occurs.

We hope to present also very fresh results on the ground state properties of strongly interacting dipoles with the interaction tail modified (as in [1]) [5] as well as unusual findings on transport in open tilted lattice [5].

[1] H.Korbmacher, P.Sierant, W.Li, X Deng, J.Zakrzewski, L.Santos, Lattice control of nonergodicity in a polar lattice gas, Phys. Rev. A107 013301 (2023).
[2] A.S.Aramthottil, M.Lacki, L.Santos, J.Zakrzewski,
Role of interaction-induced tunneling in the dynamics of polar lattice bosons, Phys. Rev. B107 104305 (2023).
[3] P.Falcao, J.Zakrzewski, Nonergodic dynamics for an impurity interacting with bosons in tilted lattice arXiv:2306.06705.
[4] P.Sierant, T.Chanda, M.Lewenstein, and J.Zakrzewski,
Slow dynamics of a mobile impurity interacting with an Anderson insulator Phys. Rev. B107 144201 (2023).
[5] H. Korbmacher, G. A. Dominguez-Castro, W. Li, J. Zakrzewski, and L. Santos, Transversal effects on the ground-state of hard-core dipolar bosons in one-dimensional optical lattices
Phys. Rev. A107 063307 (2023) (and the ongoing work).
[6] B. De, G. Wojtowicz, J. Zakrzewski, M. Zwolak, M. M. Rams Transport in a periodically–driven tilted lattice via the extended reservoir approach: Stability criterion for recovering the continuum limit
Phys. Rev. B107 235148 (2023). (and the ongoing work).

Primary author: Prof. JAKUB, Zakrzewski (Jagiellonian University)

Presenter: Prof. JAKUB, Zakrzewski (Jagiellonian University)

Session Classification: Poster Session II

Track Classification: Quantum Gases in Low Dimensions