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New theoretical tools for quantum glasses, with and without quenched disorder

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Even though most solid materials are disordered or glasslike, our understanding of such non-equilibrium phases of matter is meager. Our task is thus to develop new tools to understand the nature of quantum glasses. These can be characterized into two classes: with or without quenched disorder. Interacting spin or electron models with quenched disorder are known to exhibit many-body localization (MBL). We discuss a new method based on a Hilbert-space preserving RG scheme to find the integrals of motion for an interacting system. We used this approach to numerically study MBL phases and the corresponding transition.

On the other hand, we discuss the possibility of self-generated electron glassiness in the absence of quenched disorder. Such structural quantum glasses, requiring geometric frustration and long-range interactions, are in many ways similar to the quenched disorder glasses. We will discuss the soft gap in the density of states, which is now related to short-range frozen density correlations. Using both numerical and analytic arguments we find Arrhenius-type slow relaxation and stretched exponential behavior.

References:

- L. Rademaker, A. Ralko, S. Fratini and V. Dobrosavljevic, Avoiding Stripe Order: Emergence of the Supercooled Electron Liquid, arXiv:1508.03065 (2015).
- L. Rademaker, M. Ortuno, Explicit Local Integrals of Motion for the Many-Body Localized State, arXiv:1507.07276 (2015).
- S. Mahmoudian, L. Rademaker, A. Ralko, S. Fratini and V. Dobrosavljevic, Glassy dynamics in geometrically frustrated Coulomb liquids without disorder, Phys. Rev. Lett. 115, 025701 (2015); arXiv:1412.4441.
- L. Rademaker, Y. Pramudya, J. Zaanen and V. Dobrosavljevic, Influence of long-range interactions on charge ordering phenomena on a square lattice, Phys. Rev. E 88, 032121 (2013); arXiv:1306.4765.