Non-Hermitian degeneracies in the Lieb-Liniger model and exotic quantum holonomy

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In thermodynamics, adiabatic cycles are trivial as they induce no change. On the contrary, quantum mechanical systems may be changed by adiabatic cycles. A famous example is the geometric phase. Even the adiabatic cycles may induce excitation of quantum mechanical systems. The latter is referred to as the exotic quantum holonomy [1]. It has been shown that the exotic quantum holonomy has an intimate correspondence with the degeneracy points that appear in non-Hermitian quantum theory [2]. We also note that the covering space structure plays a crucial role in the topological formulation of the exotic quantum holonomy [1] as well as the theory for the geometric phase in non-Hermitian systems [3]

In this talk, I will explain an interplay of the exotic quantum holonomy and exceptional points in one-dimensional Bose systems [4,5]. In particular, we examine an adiabatic cycle that starts from the free system and goes through Tonks-Girardeau and super-Tonks-Girardeau regimes and comes back to the free system. In the Hermitian side, it is shown that the exotic holonomy occurs with an arbitrary number of Bose particles, where the role of conserved quantities is emphasized. The analytic continuation of the adiabatic cycles that induces the exotic quantum holonomy in two-body case clarifies the role of non-Hermitian degeneracy points of the Lieb-Liniger model [6].

This is a joint work with Nobuhiro Yonezawa and Taksu Cheon.

References

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