Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **2679** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

Dynamical tunnelling in the quantum kicked top

Tuesday, June 4, 2019 4:15 PM (15 minutes)

The quantum kicked top is a fundamental model used to study the emergence of classically chaotic behaviour in periodically driven systems arising from a quantum mechanical origin. Experimentally realized as a many-body ensemble of interacting qubits, the kicked top has allowed insight into how nonlinear features in the classical picture, such as a mixed phase space and bifurcation dynamics, influence underlying quantum characteristics including entanglement generation, tunneling, and thermalization. This work explores the strictly quantum mechanical phenomenon of dynamical tunnelling of spin coherent states between classically stable regions of phase space separated by a chaotic sea. Using analytical and numerical methods we explore the non-trivial relationship between the frequency of dynamical tunneling and the amount of chaos present, even in the deep quantum regime. The connection to thermalization of an isolated system and its relevance for future experimental tests is discussed.

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Session Classification: T4-9 Quantum Theory (DTP) | Théorie quantique (DPT)

Track Classification: Theoretical Physics / Physique théorique (DTP-DPT)