iTHEMS Colloquium

Interaction Models in Quantum Optics, Representation Theory and Number Theory

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2020 4/10 15:30 - 17:00

Large Meeting Room,
2F Welfare and Conference Building
RIKEN Wako Campus Bldg. C61

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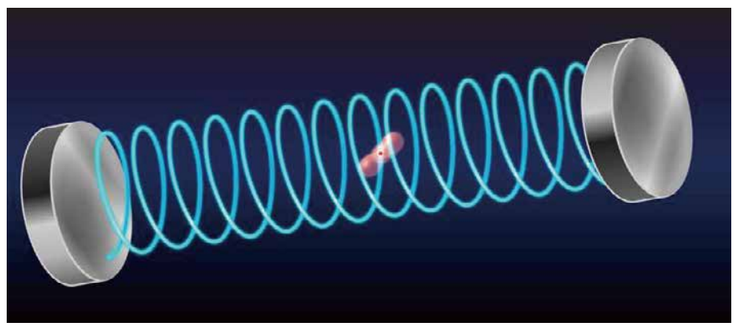
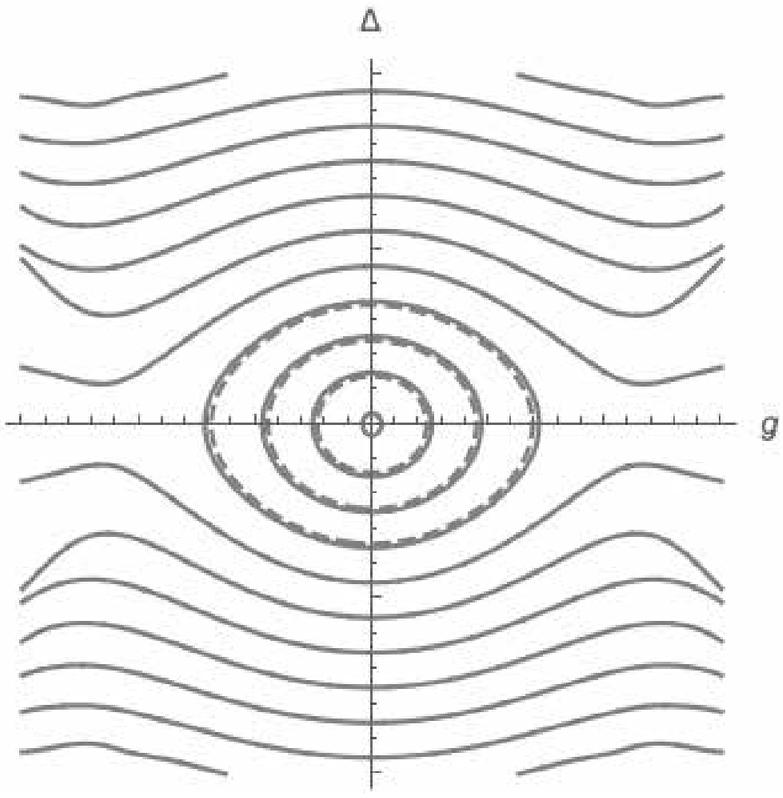
Recently, interaction models originated in quantum optics, with the quantum Rabi model (QRM) as a distinguished representative, are appearing ubiquitously in various quantum systems including cavity and circuit quantum electrodynamics, quantum dots and artificial atoms, with potential applications to quantum information technologies such as quantum computing. Together with the integrability of QRM, demonstrated by Daniel Braak in 2011, this has led to wide discussion and development of various aspect of the QRM and its generalizations from the point of view of theoretical physics and mathematics.



[Fig.1]
Courtesy of APS/Alan Stonebraker
in E. Solano Physics 4, 68 (2011)



In this talk, firstly, we characterize the structure of the spectra of QRM and its asymmetric version via $s\ell_2$-representations. Secondly, we introduce the non-commutative harmonic oscillator, which may be considered to be a "cover" of the QRM in the Heun ODE picture, and describe certain number theoretical aspects arising from its spectral zeta function. Further, we discuss the heat kernel and partition function of the QRM toward the number theoretical investigation of the model. In addition, a number of related open problems will be presented.

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