

# Bethe Colloquium

**John Chalker**

University of Oxford

## Chaotic Many-Body Quantum Dynamics, Spectral Correlations and Energy Diffusion

For almost a century, much of the effort studying many-body quantum systems has focussed on behaviour at low temperature, or in solvable models with many conserved quantities. Recently, minimal models have been developed which give a window onto dynamics in generic systems, unrestricted by temperature or conservation laws. These models make it possible to explore the main features expected in chaotic many-body dynamics using quite simple analytical calculations. This is progress that I think goes far beyond what could reasonably have been dreamed of ten years ago, but it is built on foundations laid in the 1950s.

After giving a short introduction to these general developments, I will describe a study of chaotic many-body quantum dynamics in a minimal model with spatial structure and local interactions, which is analytically tractable in a suitable limit. In this limit we show that energy dynamics is described by a classical master equation and is diffusive. We also show that the spectral form factor, which characterises correlations between energy eigenvalues, can be expressed exactly in terms of the solution to this master equation. [Joint work with Dominik Hahn, arXiv2510.02198]

**BCTP, Room W 2.019 - Wegelerstr. 10 - 53115 Bonn**  
**Thursday, June 11, 2026 at 4:15 p.m.**

**Bethe Center for  
Theoretical Physics**

Physikalisches Institut  
Universität Bonn  
Nussallee 12  
53115 Bonn

phone (+49)228/73-3770  
mail theory@physik.uni-bonn.de



For detailed information visit us at: <http://bctp.uni-bonn.de>