



CRC 1227
Designed Quantum States of Matter



GUEST LECTURE

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DQ-mat Colloquium

Thursday, 21 November 2024, 4.00 pm

Room D326, Welfengarten 1, building 1101

"The time-modulated quantum pendulum under control"

In classical mechanics, a pendulum whose parameters are modulated in time provides a standard example for introducing classical chaos, with the emergence of mixed or fully chaotic stroboscopic phase spaces. In quantum physics, such Hamiltonians offer the possibility of studying chaos-assisted tunneling [1] and the different regimes of matter wave localization. Experiments along these lines require an exquisite control of the initial wave function, we will first explain how we can solve this issue using quantum control techniques [2,3]. We will subsequently present our recent results about quantum chaos with a focus on multiple matter wave interference effects, encapsulated in Coherent Backward and Forward Scattering peaks, respectively related to weak and strong (Anderson) localization.

[1] Chaos-assisted tunneling resonances in a synthetic Floquet superlattice
M. Arnal, G. Chatelain, M. Martinez, N. Dupont, O. Giraud, D. Ullmo, B. Georgeot, G. Lemarié, J. Billy and D. Guéry-Odelin, *Science Advances* 6, eabc4886 (2020).

[2] Quantum state control of a Bose-Einstein condensate in an optical lattice
N. Dupont, G. Chatelain, L. Gabardos, M. Arnal, J. Billy, B. Peaudecerf, D. Sugny, D. Guéry-Odelin, *PRX Quantum* 2, 040303 (2021).

[3] A regular Hamiltonian halting ratchet for matter wave transport
N. Dupont, L. Gabardos, F. Arrouas, N. Ombredane, J. Billy, B. Peaudecerf, D. Guéry-Odelin
Phys. Rev. Lett. 131, 133401 (2023).

All DQ-mat members and all interested are cordially invited to attend.