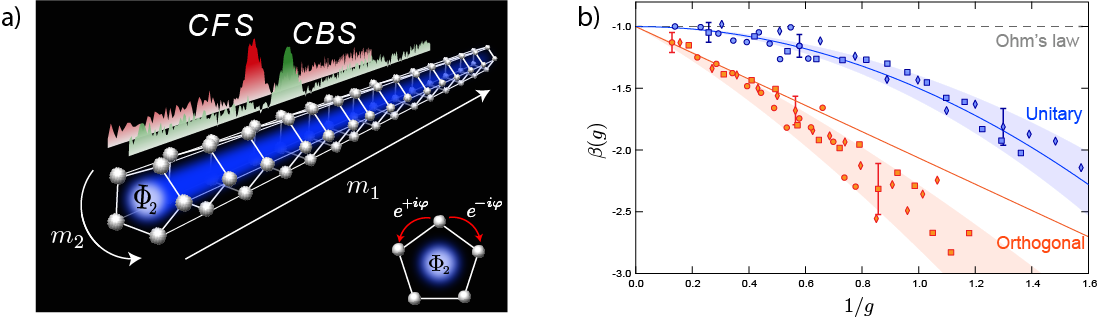
Observation of Coherent Forward Scattering in a disordered quantum system

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Anderson localization is the absence of diffusion in certain disordered media. The transport and localization properties of disordered quantum systems are greatly affected by symmetries. Here, we present a novel technique [1,2] which allows the realization an artificial gauge field in a synthetic (temporal) dimension of a disordered, periodically driven (Floquet) quantum system. Our technique is used experimentally to control the Time-Reversal Symmetry properties of the Kicked Rotor – a paradigmatic model of classical and quantum chaos.

Using this system, we were recently able to provide the first observation and characterization of a direct ‘microscopic’ interference smoking gun of the Anderson Localization, the so-called “Coherent Forward Scattering” (CFS) phenomenon – thus confirming its very recent theoretical prediction [3]. This result is complemented by an accurate measurement of the universal scaling function β(g) [4] in two different universality classes. The Coherent Forward Scattering, in conjunction with its weak-localization counterpart, the “Coherent Backscattering” (CBS) [2], can be extremely valuable tools for future probing novel phenomena, emerging from the interplay of many-body effects or symmetry properties with the Anderson physics.



**Fig. 1** (a) Experimental observation of both CFS and CBS interference peaks, using the time-reversal properties of the Phase-Shifted Quantum Kicked Rotor (see [1] for details). (b) Measurement of the universal scaling function β(g) for two universality classes (Orthogonal and Unitary), with different Time-Reversal properties.

**References:**

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