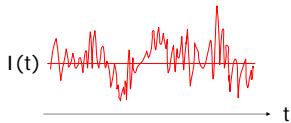
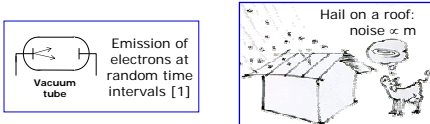


Shot noise in the chaotic-to-regular crossover regime



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Classical shot noise



time-dependent current fluctuations due to granularity of electron charge

$$S_P(\omega) = 2e \langle I(\omega) \rangle$$

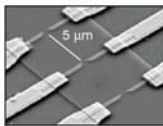
spectral density

no correlation: Poisson statistics

Quantum shot noise



Experiment [3]: Quantum cavities with disorder scattering and tunable dwell time



Fano factor: $F = \frac{S}{S_P}$ noise compared to Poisson value

Shot noise suppression, $F < 1$ (reduction of noise due to correlations)

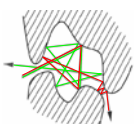
- diffusive wires: $F = 1/3$
- fractional Quantum Hall effect: $F = M/N$ (Laughlin quasiparticles)
- chaotic quantum dots: $F = 1/4$

Time scales:

- Dwell time τ_D : Time the electron spends inside the cavity
- Ehrenfest time τ_E (quantum break time)

$\tau_E \gg \tau_D \rightarrow$ system "classical"
 $\tau_D \gg \tau_E \rightarrow$ system governed by "quantum diffraction"

Quantum-to-classical crossover



"quantum chaos" [4]

$$F = \frac{1}{4} \exp\left(-\frac{\tau_E}{\tau_D}\right)$$



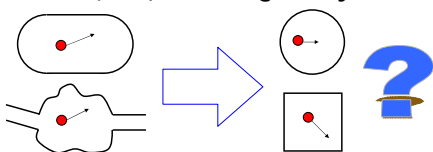
"quantum disorder" [3]

$$F = 1/4 \left(1 + \tau_Q/\tau_D\right)^{-1}$$

Chaotic to regular crossover

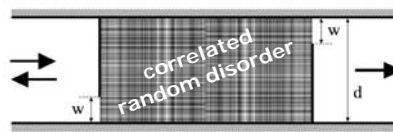
Chaotic (RMT)

regular dynamics

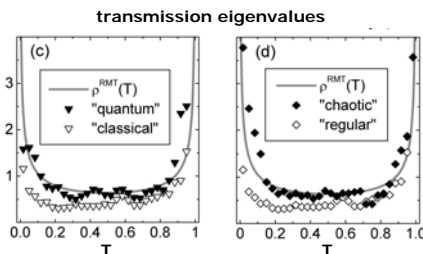
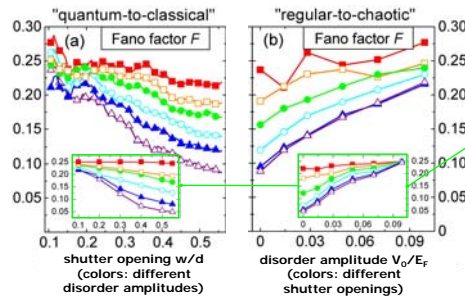


Numerical simulation of quantum transport

Disordered quantum dots
 Similar setting as in the experiment [3]

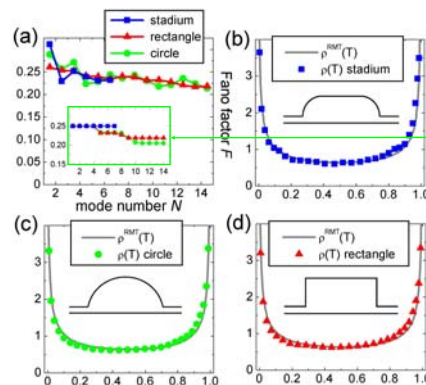


Modular recursive Green's function method [5]: variable shutters and tunable disorder potential



Ballistic quantum dots

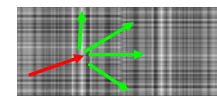
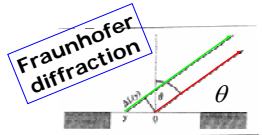
Prototype systems for regular and chaotic classical dynamics



- Semiclassical estimate for F requires diffractive corrections
- Small lead width: Diffraction causes $F=1/4$ for both regular and chaotic dots

Quantum diffraction as source of shot noise

- Diffraction at the cavity opening
- Diffraction by disorder scattering



Quasiclassical description in first Born approximation

Semiclassical estimate

Estimate for Fano factor including diffractive scattering (along Ref. [6]):

$$F = 1/4 \left[1 - \int_0^{\tau_E} P(t) dt \right] = 1/4 \int_{\tau_E}^{\infty} P(t) dt$$

in very good agreement with numerical data

Conclusions

- Dominant sources for shot noise: Diffraction and random scattering
- Diffraction: Regular dots with $F=1/4$
- RMT-limit of shot noise can be realized without chaotic dynamics
- Semiclassical model including diffraction in agreement with data

Future Projects

- Effects of cavity symmetry on shot noise suppression
- Crossover from long to short range disorder potential

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Preprint available [7]

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