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Electrons in nanostructures - one-by-one

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The charge of quantum dots can be controlled on the level of individual electrons. Using a nearby quantum point contact, the occupation of the dot can be monitored in a minimally invasive way as a function of time. Within the experimental bandwidth (30 kHz) we monitor the flow of individual electrons through the quantum dot.
This way currents as low as atto-Amps (10^{-18} Amperes) can be measured, a regime which is three order of magnitude better than what can be achieved with conventional electronics. Furthermore, the noise of the current and even higher moments of the current fluctuations can be measured and analyzed in the framework of the so-called full counting statistics which has so far been an entirely theoretical endeavor.
These experimental achievements will be useful to measure electronic correlations and entanglement in nanodevices. In addition we demonstrate that charge counting can be used to detect single microwave photons and to study quantum mechanical interference of single electrons in a time-resolved fashion.

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(ab 17:00 Uhr Kaffee)
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