Determination Hanbury-Brown Twiss correlations with electrons and photons

EVA ZAKKA-BAJJANI, SPEC/IRAMIS/DSM/CEA, J. DUFOULEUR, P. ROCHE, D.C. GLATTLI, F. PORTIER, NANOELECTRONICS TEAM — What is the statistics of the photons emitted by a quantum conductor? We present the first experiment addressing this question, where the electronic shot noise power of a 500Ω tunnel junction is measured in the 4-8 GHz frequency range in an Hanbury-Brown Twiss geometry (E. Zakka-Bajjani et al. Phys. Rev. Lett. 99, 236803 (2007)). The emitted noise is analyzed in two different manners. The fluctuations of the transmitted and reflected electronic currents are shown to be anti-correlated. The auto-correlated power fluctuations reveal that the junction emits power into the detection in the form of photons, and the emitted powers show positive cross-correlation, proportional to the squared emitted power. The photons emitted by a biased low impedance (i.e. $R_{\text{tunnel}} << \frac{e^2}{h}$) tunnel junction are thus shown to obey the same statistics as thermal photons, also in the quantum regime, $eV \approx h\nu$, in agreement with a recent prediction of Beenakker and Schomerus (Phys. Rev. Lett. 93. 096801 (2004)).