

How atomic scale current-noise gives us a deeper insight into the behaviour of electrons

A direct consequence of the discreteness of the electron charge is the presence of time-dependent fluctuations of the electronic current, called shot-noise. Since shot-noise is directly sensitive to the charge of the current carrying entities, as well as to their dynamics, shot-noise has been a powerful tool in the study of mesoscopic systems [1]. In this talk I will present how we managed to increase the spatial resolution of shot-noise measurements to the atomic level by implementing cryogenic circuitry operating in the MHz regime into our home-built scanning tunnelling microscope [2]. After discussing the technique, I will show how atomic scale noise allows us to visualize otherwise hidden interactions between electrons themselves and with the lattice in doped superconductors [3] and semiconductors.

[1] Ya. M. Blanter and M. Büttiker, *Physics Report* 336, 1 (2000)

[2] F. Masee et al., *Rev. Sci. Instrum.* 89, 093708 (2018)

[3] U. Thupakula et al., *Phys. Rev. Lett.* 128, 247001 (2022)