O 69: Invited Talk (Martin Wolf)

Time: Friday 14:15–15:00 Location: HSZ 02

Invited Talk O 69.1 Fri 14:15 HSZ 02

Transient Electronic Structure and Insulator-to-Metal Transitions Probed by Time-resolved Photoemission Spectroscopy

— •Martin Wolf — Freie Universität Berlin, Dept. of Physics, Arnimallee 14, 14195 Berlin, Germany — Fritz-Haber-Institut d. MPG, Faradayweg 4-6, 14195 Berlin, Germany

One of the basic questions in solid state physics is to understand why a material behaves like an insulator or a metal. Systems with a half-filled band are usually expected to be metallic, however, may undergo a metal-to-insulator transition at low temperatures due to Peierls instabilities (charge density wave (CDW) formation) or electron correlations (Mott insulator). We use femtosecond time- and angle-resolved photoelectron spectroscopy (trARPES) to optically excite and probe two model systems, namely the Mott insulator 1T-TaS2 and the CDW compound TbTe3, to investigate the dynamics of such insulator-to-metal transitions directly in the time domain. In TaS2 photoexcitation by an intense laser pulse leads to an ultrafast transition towards a gapless phase which is accompanied by periodic oscillations of the electronic states. The qualitative difference between the oscillatory dynamics of the CDW, the quasi-instantaneous collapse of the electronic gap and the monotonic recovery of the electronic gap proves that 1T-TaS2 is indeed a Mott insulator. Moreover it is in clear contrast with the retarded (>100fs) response which we observe for the transient melting of the CDW phase in TbTe3. Using trARPES we able to identify the role of collective vibrations in the transition and to document the highly anisotropic dynamics of the electronic system in real time.