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Ultrafast electric Mott transition in $GaTa_4Se_8$ following THz photoexcitation

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Mott insulators are archetypal examples of quantum materials. Strong interest in these systems has arisen due in part to the insulator-to-metal transition that some exhibit when the balance between on-site Coulomb repulsion and hopping is overturned via temperature, doping or, as more recently demonstrated, photoexcitation or the application of short electric field pulses. Driving the transition using short electric field pulses is of particular interest for technological applications. Some Mott insulators exhibit an abrupt drop in resistivity under the application of electric fields with durations of a few tens of microseconds, with typical threshold fields on the order of 1 – 10 kV/cm [1]. These electrical Mott transitions are volatile for fields just above threshold, but persistent switching into a metallic phase can be achieved for sufficiently high amplitude electric fields [2], making these materials promising for e.g. memory devices.

Quasi-dc electric fields well in excess of 1 – 10 kV/cm can currently be generated with ultrashort pulses in the low frequency or THz range, which enables the investigation of the sub-picosecond dynamics of the electric field driven Mott transition. THz pulses can also be used to track the Drude conductivity response of the material directly, without the need to deposit any electrical contacts on the sample. We will present our results on THz driven dynamics in $GaTa_4Se_8$, a Mott insulator which exhibits clear electrical Mott transitions.

[1] P. Diener *et al.*, Physical Review Letters **121** 016601 (2018).
[2] E. Janod *et al.*, Advanced Functional Materials **25** 6287 (2015).

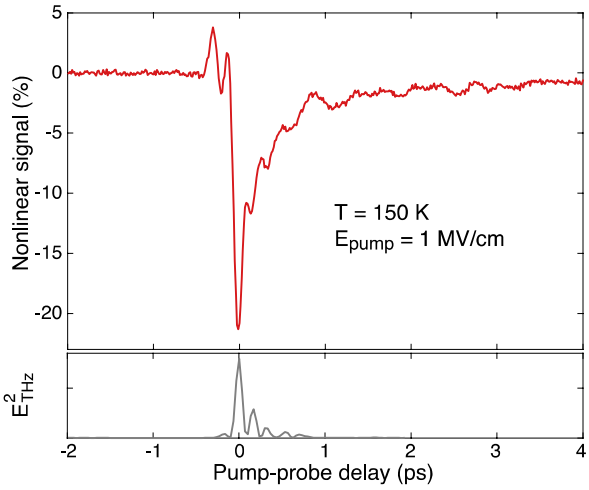

Figure 1 : Top: transient change in the THz probe transmission through a 150 μm thick $GaTa_4Se_8$ sample at 150 K, following THz excitation at ~1 MV/cm. Bottom: temporal trace of the square of the THz pump pulse.