

Unusually long carrier lifetime in Mott Insulators: Key property for integration in Mott neurons

Friday, 25 September 2020 18:25 (15 minutes)

The study in non-equilibrium conditions of an emblematic class of quantum materials, the Mott insulators, is currently developing into an active and fruitful branch of solid-state physics. Recent researches indeed demonstrate that Mott insulators excited either by ultrafast infrared or THz laser pulses or by electric fields might display non-trivial insulator to metal transitions (IMT's) whose origin goes beyond the well-established bandwidth- and filling-controlled mechanisms. Interestingly such transitions could be used to build up new electronics based on Mott insulators, called Mottronics, including breakthrough devices such as Mott memories and artificial neurons for artificial intelligence.

A common feature of out-of-equilibrium IMT's in Mott insulators is that they are based on the massive excitation of electrons from the Lower (valence) to the Upper (conduction) Hubbard Band. For example, recent studies proposed that the multiplication of carrier in a Mott insulator placed under the electric field occurs either thanks to an impact ionization or to an electronic avalanche.

In this talk, we will present detected unusually long carrier lifetime in the multiband Mott insulator GaV_4S_8 using the tr-PEEM (time-resolved photoemission electron microscopy) technique. This result is important since it supports the proposed mechanism of electronic avalanche and will guide the future development of new hardware components in artificial intelligence.

Topics

Session A. Physics of condensed matter and spectroscopy

Primary authors: Mr BABICH, Danylo (Institut des Matériaux Jean Rouxel (IMN), Université de Nantes, CNRS); Dr FUKUMOTO, Keiki (High Energy Accelerator Research Organization (KEK)); Dr CORRAZE, Benoit (Institut des Matériaux Jean Rouxel (IMN), Université de Nantes, CNRS); Dr TRANCHANT, Julien (Institut des Matériaux Jean Rouxel (IMN), Université de Nantes, CNRS); Dr LORENC, Maciej (Univ Rennes, CNRSIPR (Institut de Physique de Rennes) - UMR 6251); Dr CAILLEAU, Hervé (Univ Rennes, CNRS, IPR (Institut de Physique de Rennes) - UMR 6251); Dr CARIO, Laurent (Institut des Matériaux Jean Rouxel (IMN), Université de Nantes, CNRS); Dr JANOD, Etienne (Institut des Matériaux Jean Rouxel (IMN), Université de Nantes, CNRS)

Presenter: Mr BABICH, Danylo (Institut des Matériaux Jean Rouxel (IMN), Université de Nantes, CNRS)

Session Classification: Evening Session