

# Seminar on Condensed Matter Theory

Group of Theoretical Physics at the Department of Condensed Matter Physics  
of Charles University has a pleasure to invite you to attend the seminar

**on 21 March 2019 at 13:00**

at Faculty of Mathematics and Physics of Charles University, Ke Karlovu 5, 121 16 Praha 2

**Seminar room F052**



## Dr. Jerome Hurst

*Department of Physics and Astronomy, Uppsala University, Uppsala, Sweden*

## Magnetic moment generation in small gold nanoparticles via the plasmonic inverse Faraday effect

During the seminar, I will present a recent work where we theoretically investigate the ultrafast creation of a magnetic moment in gold nanoparticles by circularly polarized laser light. To this end, we describe the collective electron dynamics in gold nanoparticles using a semiclassical approach based on a quantum hydrodynamic model that incorporates the principal quantum many-body and nonlocal effects, such as the electron spill-out, the Hartree potential, and the exchange and correlation effects. We use a variational approach to investigate the breathing and the dipole dynamics induced by an external electric field. We show that gold nanoparticles can build up a static magnetic moment through the interaction with a circularly polarized laser field. We analyze that the responsible physical mechanism is a plasmonic, orbital inverse Faraday effect, which can be understood from the time-averaged electron current that contains currents rotating on the nanoparticles surface. The computed laser-induced magnetic moments are sizeable, of about 0.35  $\mu\text{B}/\text{atom}$  for a laser intensity of 450  $\text{GW}/\text{cm}^2$  at plasmon resonance.

