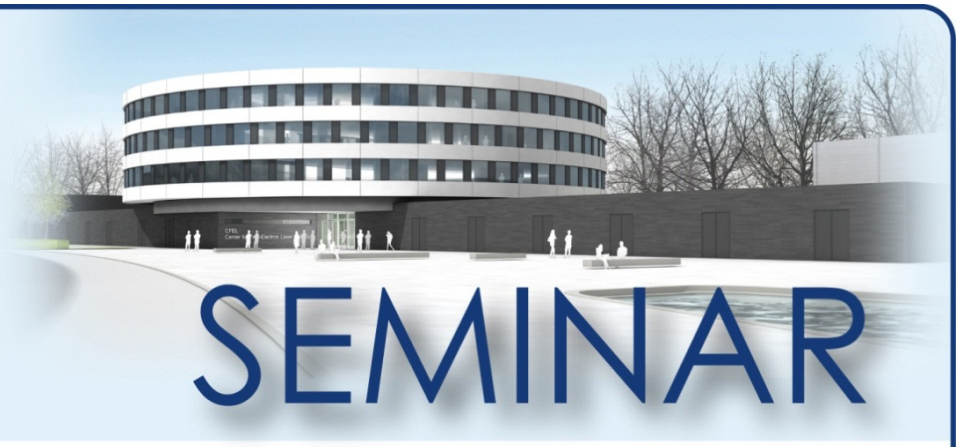
CFEL SCIENCE



SEMINAR

27th October 2021 - 2:00 p.m.

Virtual meeting room in ZOOM (ID: 992 7237 2470 / PW: 755622)

George Booth

Department of Physics, King's College London, United Kingdom

High harmonic generation, quantum control and the prospects for correlated wave function methods

Intense lasers can now enable science on the natural timescales of electron dynamics to be probed, with recent work extending these tools to solid state systems. However, when strong electron correlations are added to the mix, the ability to computationally simulate these extended systems becomes substantially complicated. We have worked on developing a range of approaches to enable tractable and accurate wave function methods which can overcome the curse of dimensionality, for both time-dependent and static problems.

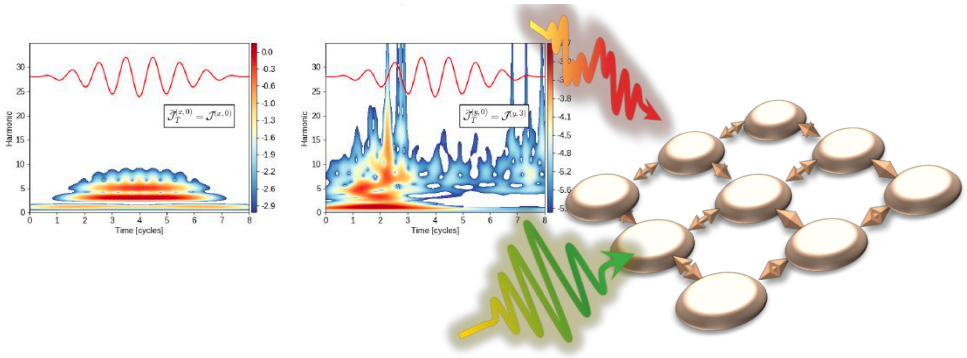
We will start from highly simplified strongly correlated lattice models, and consider a description of the dynamical phase transitions which can be induced with these intense laser pulses. Going beyond this, we consider the challenge of not just simulating the effect of these laser pulses, but a protocol to engineer custom laser pulses, to track desired quantum observables. This 'quantum control' has implications for the engineering of quantum phases of matter. Finally, we will turn to challenge of modelling going from parameterized lattice models to ab initio materials, and consider the prospects for correlated methods in these systems.

References:

[1] M. Nusspickel, G. H. Booth, arXiv:2107.04916 (2021).

[2] C. Orthodoxou, A. Zaïr, G. H. Booth, *npj Quantum Materials* **6**, 76 (2021).

[3] G. McCaul, C. Orthodoxou, K. Jacobs, G. H. Booth, D. I. Bondar, *Phys. Rev. Lett.* **124**, 183201 (2020).



Host: Robin Santra – CFEL-DESY Theory Division