

CONDENSED MATTER SPECIAL SEMINAR

Thursday 22 June at 14:30

Simpkins Lee room

“Many-body Effects on Exciton Dynamics in Low-Dimensional Materials”

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In low-dimensional and nanostructured materials, the optical response is dominated by correlated electron-hole pairs---or excitons---bound together by the Coulomb interaction. Understanding the energetics and dynamics of these excitons is essential for diverse applications across optoelectronics, quantum information and sensing, as well as energy harvesting and conversion. By now, it is well-established that these large excitonic effects in low dimensional materials are a combined consequence of quantum confinement and inhomogeneous screening. However, many challenges remain in understanding their dynamical processes, especially when it comes to correlating complex experimental signatures with underlying physical phenomena through the use of quantitatively predictive theories. In this talk, I will discuss three different frontiers related to the first principles understanding of exciton dynamics. First, we will look at exciton effects in metal-organic halide perovskites and new computational tools that let us break down calculations on complex hybrid materials into minimal building blocks. Second, I will discuss how the electron-hole exchange interaction can drive the intermixing of bulk and topological surface states in topological materials. Finally, we will explore new real-time approaches for understanding exciton effects in nonlinear optics, including signatures of exciton-driven Floquet effects in time-resolved ARPES and high harmonic generation (HHG).

Host: Prof Marina Filip