Chez Pierre

Presents ...

Monday, May 5th, 2025
12:00 pm -1:00 pm
Duboc Room – 4-331

Chez Pierre Seminar

Hadar Steinberg, Hebrew University

"Universality of Upper Critical Field in the TMD Superconductor Family".

In transition metal dichalcogenides (TMDs) such as *H*-$NbSe_2$ an *H*-TaS_2, superconducting properties are retained down to a single layer, making these materials useful platforms for studying thickness-dependent effects. Specifically, $NbSe_2$ exhibits a reduction in its T_C from 7.2K in the bulk to approximately 3K in the single-layer limit. In TaS_2, conversely, T_C increases from 0.8K in the bulk to approximately 3K in the single layer limit. This contradicting behavior, which long puzzled researchers, could be related to a thickness-dependent suppression of superconductivity by the competing charge density wave (CDW) phase.

I will present measurements of device-based high-resolution tunneling spectra in TaS_2, where we track the gap structure from the bulk all the way to a single layer. Our devices allow for simultaneous evaluation of the gap Δ, T_C, and the upper critical field H_{C2}. Although TaS_2 is considered as a dirty superconductor, we find that H_{C2} is proportional to Δ^2, a relation expected for clean superconductors. Even more curiously, we find that the same ratio between H_{C2} and Δ^2 holds for other TMDs: $NbSe_2$ of all thicknesses, and NbS_2 and $TaSe_2$, covering 4 orders of magnitude in H_{C2} and covering both clean and dirty limits.