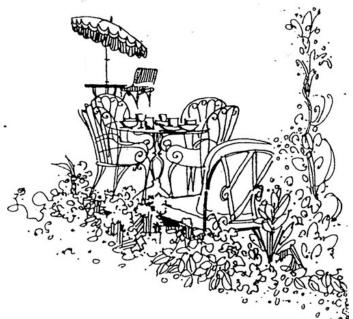


Presents ... Monday, May 5th, 2025 12:00 pm -1:00 pm Duboc Room – 4-331



**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<sub>2</sub> an H-TaS<sub>2</sub>, superconducting properties are retained down to a single layer, making these materials useful platforms for studying thickness-dependent effects. Specifically, NbSe<sub>2</sub> exhibits a reduction in its  $T_{\rm C}$  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<sub>2</sub>, 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  $\Delta$ ,  $T_{\rm C}$ , and the upper critical field  $H_{\rm C2}$ . Although TaS<sub>2</sub> is considered as a dirty superconductor, we find that  $H_{\rm C2}$  is proportional to  $\Delta^2$ , a relation expected for clean superconductors. Even more curiously, we find that the same ratio between  $H_{\rm C2}$  and  $\Delta^2$  holds for other TMDs: NbSe<sub>2</sub> of all thicknesses, and NbS<sub>2</sub> and TaSe<sub>2</sub>, covering 4 orders of magnitude in  $H_{\rm C2}$  and covering both clean and dirty limits.