MRSEC researchers at Princeton have discovered an on-chip process for growing ultrathin superconductors on ultrathin layers of transition-metal dichalcogenides (TMD). Palladium is fabricated in contact with exfoliated TMD that are encapsulated between boron nitrides (Fig. 1A). When heated to ~200°C, Pd ions transport outwards (Fig. 1B, D, E) and react chemically with the TMD film to form a new crystalline compound $\text{Pd}_x\text{WTe}_2$ ($x\sim 7$) that displays superconductivity below 1 K (Fig. 1C).

The results demonstrated an unexpected, previously unexplored region of 2D chemistry. It is generalizable to other combinations of materials.

The approach introduces a new route for fabricating high quality, sub-micron-sized superconducting devices based on topological chalcogenides and moiré materials.

The MRSEC team has fabricated superconducting junctions on twisted bilayers of MoTe$_2$. One of the goals is the proximitization of exotic quantum states, e.g. the Fractional Chern Insulator.