Bose condensation of excitons in a transition metal dichalcogenide

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Bose condensation has shaped our understanding of macroscopic quantum phenomena, having been realized in superconductors, atomic gases, and liquid helium. Excitons are bosons that have been predicted to condense into either a superfluid or an insulating electronic crystal. But definitive evidence for a thermodynamically stable exciton condensate has never been achieved. In this talk I will describe our use of momentum-resolved electron energy-loss spectroscopy (M-EELS) to demonstrate the existence of an exciton condensate in the transition metal dichalcogenide semimetal, 1T-$TiSe_2$. This phase of matter was predicted in the 1960's and nicknamed "excitonium" by Halperin and Rice, but not realized for certain until now. I will discuss the experimental signature of exciton condenstation, a plasmon that disperses to zero energy at the transition temperature, and latest results on its stability against carrier doping and hydrostatic pressure.