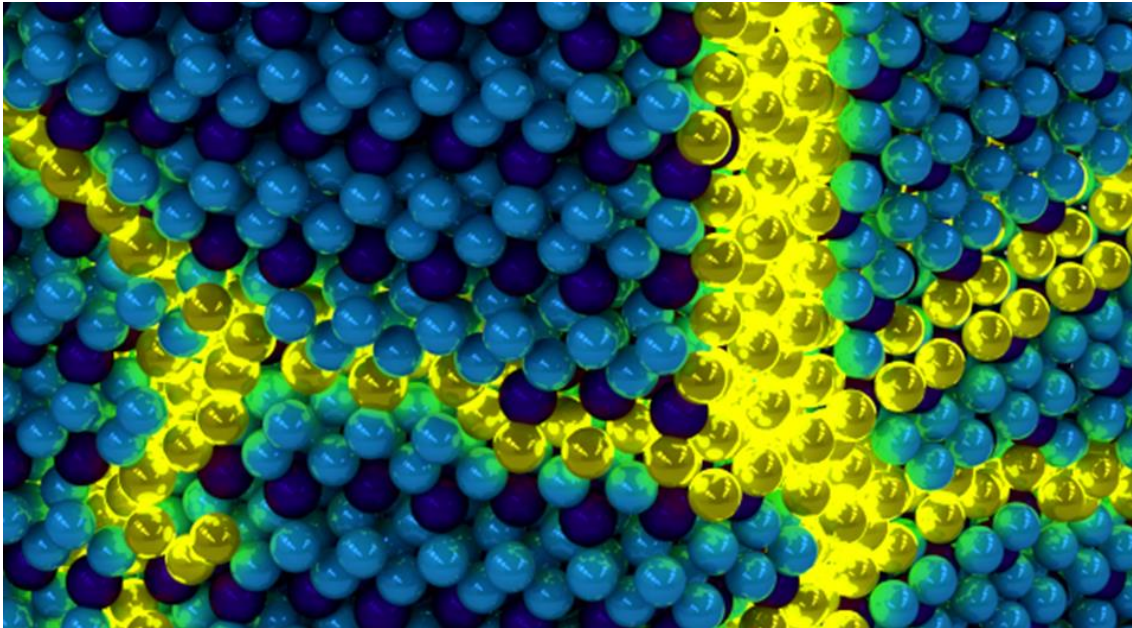


Excitonium: A new form of matter found by the scientists

By tarun - December 9, 2017

The scientists have claimed the existence of the new form of matter – 'Excitonium' which was theorized 50 years ago.



The University of California Berkeley and University of Illinois at Urbana Champaign researchers in the US have studied about the non-doped crystals of dichalcogenide titanium diselenide ($1T\text{-TiSe}_2$)— transition metal. This new form of matter is a condensate, and like a superfluid, it exhibits macroscopic quantum phenomena. It is made of particles which are formed in a quantum mechanical pairing (which is very strange) – 'excitons,' from that of an escaped electron and the hole which it left behind.

The researchers said that they were able to observe 'smoking gun proof' of its existence by spotting its precursor phase— a soft Plasmon phase which appears as the material reaches its critical temperature.

"Exciton" – when an escaped electron having a negative charge on it pairs up with the hole then the two forms a composite particle called a boson. Earlier the scientists were unable to distinguish between an excitonium positively was not a Peierls phase as the material shares the same symmetry as exciton formation and they do not have the proper experimental tools for the study.

But Peter Abbamonte, a professor at the University of Illinois with his team overcame this challenge and developed momentum-resolved electron energy-loss spectroscopy (M-EELS) by using a novel technique.

Bert Halperin coined the term "excitonium," Harvard theoretical physicist in the 1960s and the physicists have sought to demonstrate its existence, according to Abbamonte. He says that the theorists have debated whether it would be an insulator or perfect conductor or a superfluid and according to them they were able to reproduce five times the results on the different crystals.

Many scientists have published evidence of excitonium existence, but they do not have definitive proof of their findings. In-band solids, it will throw some light on the metal-insulator transition in which it is believed that condensation play a role as well as the applications of the excitonium are purely speculative.

