Gate-induced hole superconductivity in transition-metal dichalcogenide

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Few-atoms-thick semiconducting transition-metal dichalcogenides (TMDs) attracted great research interest and showed a variety of promising phenomena. Most of these TMDs show superconducting behaviour when a large amount of carriers are induced by ionic liquid gating [1–3]. Ionic liquid gating is a powerful tool to accumulate high carrier density of the order of 10^{14} cm^{-2} for both electrons and holes. However, all these superconducting behaviours are reported in the conduction band only. Recently, a new gating method, which uses lithium-ion conducting glass ceramic (LICGC) as a substrate for electrostatic gating, was developed [4]. LICGC has a good gating ability which is comparable with ionic liquid. By combining LICGC gating and ionic liquid gating, one can induce larger amount of holes into a 2-dimensional sample than using ionic liquid only. Moreover, this method can provide a tunable perpendicular electric field through the sample which is much larger than any other gating method [5]. In this poster, we show transport studies on the valence band of TMDs using this double gating technique. We searched hole superconductivity by accumulating a higher density of holes and tuning its band structure by a strong perpendicular electric field.

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