Ionic challenge of 2D superconductivity

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Gate-induced superconductivity using field effect transistor device structures has a strong advantage over the conventional bulk superconductivity owing to its controllability. To realize the gate-induced superconductivity, researchers have nowadays established two methods; one is to use gate dielectrics which enables high density carrier accumulation. The other is to use channel materials with huge latteic parameters. The former was realized in 2008 [1] on an insulating $SrTiO_3$ by an electrostatic charge accumulaton in the electric double layer using ionic gating. The latter was acieved in 2018 [2] on magic angle twisted bilayer graphene.

In this presentation, I will focus on the ionic gating and its challenge to fabricate 2D superconductors and to investigate their novel properties [3]. In the ionic gating, besides the standard electrostatic carrier doping, electrochemical reaction is also useful to modulate the electronic states of the channel materials. We discuss the giant thermoelectric properties in FeSe monolayer, fabricated by electrochemical etching [4]. Also we would like to touch on gate-controlled ultra low carrier density 2D superconductivity.

References

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