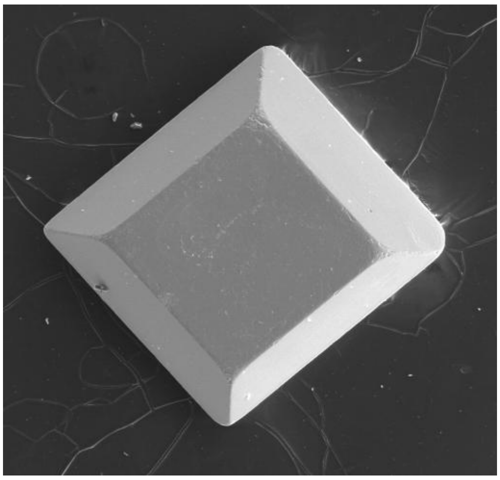
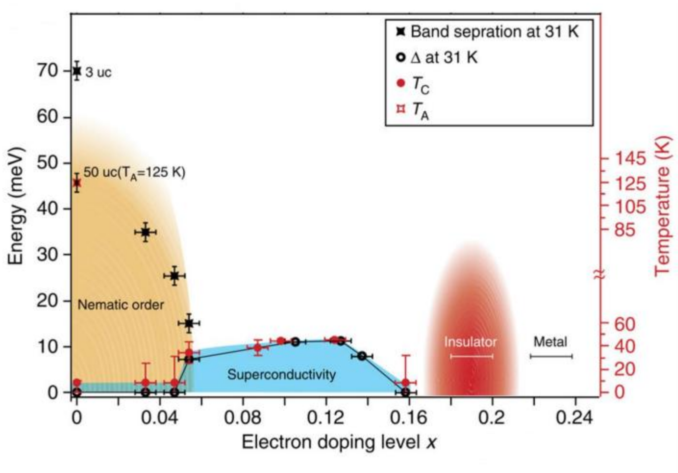
The iron-based superconductivity

Among recently discovered iron-based superconductors, i.e. $SrSmFe_2As_2F_2$ (T_C ~ 56 K), $Ca_3Al_2Fe_2As_2O_5$ (~ 30 K), LiFeAs (~ 18 K), FeSe (~ 8 K), the iron selenide possesses lowest critical temperature. It is however one of the most attractive objects in this field. It is because this superconductor has simplest crystal structure consisting of layers weakly coupled by van der Waals force and quite



susceptible to any external effect. In particular, it was reported that under pressure the single atomic layers of FeSe grown on $SrTiO_3$ substrate reach the superconducting state at about 100 K. The high quality single crystals of iron selenide grown in Low Temperature Physics and Superconductivity Department of Lomonosov Moscow State University allow conducting several pioneering experiments. Among them, the investigation of enhanced critical current density in the pressure-induced magnetic state in FeSe. It was shown that the sharp increase in critical current in superconducting phase demonstrates that vortices can be effectively trapped by the comperting antiferromagnetic order [1]. The anomalous correlation effects in electron-doped FeSe were revealed by photoemission spectroscopy. An exotic phase diagram of FeSe with electron doping, including a nematic phase,



a superconducting dome, a correlation-driven insulating phase and a metallic phase was established [2]. Finally, the strong interplay between stripe spin fluctuations, nematicity (that breaks four-fold rotational symmetry in the iron plane) and superconductivity in FeSe has been revealed in neutron scattering study [3].

1. S.G. Jung, A.V., et al. Scientific Reports **5**, 16385 (2015).
2. C.H.P. Wen, A.V., et al. Nature Communications **7**, 10840 (2016).
3. Q. Wang, A.V., et al. Nature Materials **15**, 159 (2016).

Alexander Vasiliev, Moscow State University