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日時：2022 年 8 月 29 日（月）15:00 - 16:30

場所：理学合同 B 棟 745 号室

講師：Magdalena Marganska 氏（University of Regensburg, Germany）

題目：On the quest for topological superconductivity: experimental and theoretical study of carbon nanotubes and NbSe2

概要：
At the origin of our project lay the question: can Majorana bound states form in semiconducting carbon nanotubes (CNTs), in proximity to a superconductor? Their intrinsic spin-orbit coupling and possibility of synthesizing ultraclean atomic lattices could make them a Majorana platform as attractive as the Rashba nanowires. We predicted [1] that if the CNTS are proximitized by an isotropic s-wave superconductor, the Majorana states could form - but only at high magnetic fields, due to the low g-factor of the CNTs. We proposed to use as the superconductor the NbSe2 - one of the van der Waals materials, whose superconductivity is protected by Ising spin-orbit coupling and capable of withstanding such high fields. As we progressed in both experimental and theoretical exploration of our nanotube/NbSe2 system, it revealed features more interesting than we had expected.
On the one hand, the theoretical investigation of NbSe2 showed that it is much more than an isotropic provider of superconducting s-wave pairing. Its spin-orbit coupling and the presence of disjoint Fermi surfaces offer the possibility of superconducting pairing arising from competing scattering processes with different strength, caused by purely repulsive interactions [2]. Secondly, the experimental measurement of the electronic transport in a nanotube/NbSe2 device showed a surprisingly strong proximity effect [3], which still awaits its theoretical understanding. It may be related to the rich nature of the superconducting phase in NbSe2, whose proximity to carbon nanotubes could induce more complex pairing than hitherto suspected.

[1] M. Marganska, L. Milz, W.Izumida, C. Strunk and M. Grifoni, "Majorana quasiparticles in semiconducting carbon nanotubes", Phys. Rev. B 97, 075141 (2018)
[2] S. Horhold, J. Graf, M. Marganska, M. Grifoni "Two bands Ising superconductivity from Coulomb interactions in monolayer NbSe2", arXiv:2206.06645
[3] C. Bauml, L. Bauriedl, M. Marganska, M. Grifoni, C. Strunk, N. Paradiso "Supercurrent and Phase Slips in a Ballistic Carbon Nanotube Bundle Embedded into a van der Waals Heterostructure", Nano Lett. 21, 8627 (2021)

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