Abstract Submitted
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Antiferromagnetic nuclear spin helix and topological superconductivity in ^{13}C nanotubes[1] CHEN-HSUAN HSU, PETER STANO[2], RIKEN Center for Emergent Matter Science, Japan, JELENA KLINOVAJA, Department of Physics, University of Basel, Switzerland, DANIEL LOSS[3], RIKEN Center for Emergent Matter Science, Japan — We investigate the Ruderman-Kittel-Kasuya-Yosida (RKKY) interaction arising from the hyperfine coupling between localized nuclear spins and conduction electrons in interacting carbon nanotubes made of ^{13}C [1]. Using the Tomonaga-Luttinger liquid formalism, we show that the RKKY interaction is sublattice dependent, consistent with the spin susceptibility calculation in noninteracting nanotubes. The RKKY interaction forms $q = \pm 2k_F$ peaks with the Fermi wave number k_F, and induces a novel antiferromagnetic nuclear spin helix with a spatial period π/k_F. Due to the feedback effect through the Overhauser field from the ordered nuclear spins, the transition temperature reaches up to several tens of mK. The nuclear spin helix, combining spin and charge degrees of freedom, results in a synthetic spin-orbit interaction, leading to nontrivial topology. In the presence of the proximity-induced superconductivity, this system has a potential to realize Majorana fermions without fine-tuning the external parameters, such as chemical potential and external magnetic field. Ref: [1] C.-H. Hsu, P. Stano, J. Klinovaja, and D. Loss, Phys. Rev. B 92, 235435 (2015).

[1]We acknowledge support from the Swiss NSF and NCCR QSIT.
[2]Also Institute of Physics, Slovak Academy of Sciences, Slovakia
[3]Also Department of Physics, University of Basel, Switzerland

Chen-Hsuan Hsu
RIKEN - Saitama

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