

Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Signatures of Majorana fermions in Shiba chains with or without spin-orbit interaction"

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Abstract: Recent spin polarized scanning tunneling microscopy (SPSTM) experiments in magnetic chains [1] opened new routes for detecting the elusive Majorana fermions (MFs). Within the deep Shiba limit we calculate [2] the spatially resolved tunneling conductance of topological ferromagnetic chains [1,3] measurable by means of SPSTM. Our analysis reveals novel signatures of MFs arising from the interplay of their strongly anisotropic spin-polarization and the magnetization content of the tip. We investigate the occurrence and evolution of zero/finite bias peaks for a single or two coupled chains forming a Josephson junction, when a preexisting chiral symmetry controlling the number of MFs per chain edge is preserved or weakly broken. We also reveal alternative routes for engineering MFs without spin-orbit interaction (SOI). On one hand, we highlight that antiferromagnetic Shiba chains become topological by inducing an artificial SOI using external fields [4], while on the other, we pursue mechanisms for stabilizing magnetic textures and topological Shiba lattices following the self-organization principle for topological spiral chains [5].

[1] S. Nadj-Perge *et al.*, Science 346, 602 (2014).

[2] P. Kotetes *et al.*, Physica E 74, 614 (2015).

[3] A. Heimes, D. Mendler, and P. Kotetes, New J. Phys. 17 023051 (2015).

[4] A. Heimes, P. Kotetes, and G. Schön, PRB 90, 060507(R) (2014).

[5] M. Schechter *et al.*, arXiv:1509.07399.

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