



## Physical Sciences Seminar

# Electron-Chiral-Phonon Interaction in 3d Ferromagnetic Metals

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**Host: Misha Lemeshko**

The first detection of the phonon spin [1, 2] in a magnetic insulator and observation of its chiral behavior [3] in a semiconductor, have been made early this year. This brings the natural question: are chiral, spinful phonons naturally excited in pure metals and, if so, how would they contribute to their electrical resistivities? In this talk, I present evidence that this should be the case for the 3d ferromagnetic metals, and connect its consequence to a long-standing puzzle (dating back to the 50s) regarding the quantum mechanical explanation of an anomaly observed in the electrical resistivity of iron, cobalt and nickel around liquid-helium temperatures. I propose a theory [4] which, with no fitting parameters, is able to explain the anomaly, with the extra gift of predicting the observed spin-lattice relaxation times of these metals at room temperature. It rests on a type of correlated motion of the conduction electrons that I conjecture which, by interaction with the angular-momentum reservoir provided by chiral phonons, allows them to find a channel for spin-flip transitions. Ideas relating this problem with the anyon theory including possible research avenues will be presented.

References:

[1] J. Holanda, et al., Detecting the phonon spin in magnon-phonon conversion experiments, *Nature Physics*, <https://doi.org/10.1038/s41567-018-0079-y> (2018).

[2] M. B. Jungfleisch and A. Hoffmann, A new twist on phonons, *Nature Physics*, <https://doi.org/10.1038/s41567-018-0104-1> (2018).

[3] H. Zhu et al., Observation of Chiral Phonons, *Science* 359, 579 (2018). [4] E. Solano-Carrillo, Chiral phonons and electrical resistivity of ferromagnetic metals at low temperatures, to appear in *Phys. Status Solidi B*, (2018).

**Tuesday, November 20, 2018 11:00am - 12:30pm**

IST Austria Campus Big Seminar room Ground floor / Office Bldg West (I21.EG.101)



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