Project Proposal 1

1. Rose-Innes, Alistair Christopher., and E. H. Rhoderick. Introduction to Superconductivity. Pergamon Press, 1994.
2. Cooper, L. (1956). Bound Electron Pairs in a Degenerate Fermi Gas. Physical Review, 104(4), pp.1189-1190.
3. J. Bardeen, L. N. Cooper, and J. R. Schrieffer. Microscopic Theory of Superconductivity. Phys. Rev., 106(1):162–164, Apr 1957.
4. “BCS Theory and Superconductivity.” *University of Florida Physics*, University of Florida, www.phys.ufl.edu/courses/phy4523/spring12/Sample%202.pdf.

Note: Citation 1 isn’t a paper it’s a book I hope that’s groovy.

Conventional superconductivity is best described by Bardeen-Cooper-Schrieffer theory of superconductivity. Superconductivity is defined by two phenomena; exactly zero electrical resistance and the expulsion of magnetic fields from the material. The first can be described as a macroscopic quantum effect where two electrons pair to form a composite boson that can condense into a single quantum state. The electrons condense into a superfluid that can flow with zero viscosity, an effect that causes exactly zero electrical resistance. The other phenomenon, called the Meissner effect, is when all magnetic field lines are expelled from the superconducting material caused by induced surface currents.

By this time next year I hope to be pursuing a PhD in Condensed Matter Physics. I took a special liking to superconductivity because it is one of the few macroscopic quantum phenomena that is still being researched. More broadly, quantum materials and their properties in general are my main focuses of interest. I chose superconductivity specifically because it is already well known enough so I could find useful explanations that would grant me intuitive understanding but at the same time is not a dead field of study. Plus, cooper pairs are dope.