Superconductivity and magnetism in quantum materials

Since its discovery almost a century ago, superconductors have fascinated many physicists for their rich physical properties as well as wide-ranging applications. The discovery of high-temperature superconductors sparked a dream of realizing a world of loss-free power transmission and of levitated trains. However, physicists soon realized that understanding high-temperature superconductivity is a very difficult problem, which still remains unsolved. These high-temperature superconductors are often found in materials containing transition metals, such as “copper” and “iron”. The iron based superconductors were discovered only recently, and have been generating a lot of excitement among condensed matter physicists.

One of the interesting research directions is to search for another transition metal element that can be a building block of next generation of high temperature superconductors. In particular, “iridium” is considered as a very promising candidate for discovering superconductivity. Current research efforts are aimed at understanding magnetic and electrical properties of iridium containing materials using various experimental and theoretical techniques.

The summer student will participate in our ongoing research program of synthesis and physical properties measurement of iridium based materials. In this project, we will systematically investigate various materials with the goal of discovering a new superconductor or other exotic quantum phases. This project is an opportunity to learn about sophisticated techniques for synthesizing high purity samples, and measuring magnetic susceptibility, heat capacity, and crystal structure. This project is suitable for a student with strong interest in physics and chemistry of new materials.

For more information, please refer to Prof. Kim’s website at http://www.physics.utoronto.ca/~yjkim.