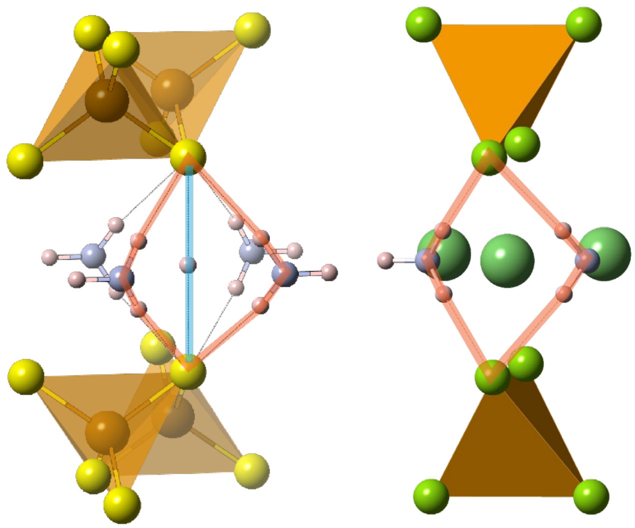
Hydrogen bonding in layered superconductors and magnetic materials

Huafei Zheng, Brandon C. Wilfong, and Efrain E. Rodriguez

Chemistry and Biochemistry, University of Maryland, College Park, MD 20742

Recent work from my research group has focused on the synthesis and structural studies of compounds broadly known as quantum materials. Although resistant to a precise definition, quantum materials broadly encompass categories such as superconductors, topological insulators, highly-correlated electron systems, and materials that express frustrated magnetism. In this lecture I will focus on the layered iron-based superconductors and the intercalated phases such as $(Li_{1-x}Fe_xOH)Fe\mathit{Ch}$, $[Na_{1-x}Fe_x(OH)_2]Fe\mathit{Ch}$, and $[Li(C_2H_8N_2)_y]Fe\mathit{Ch}$ where *Ch* is S and Se. We propose that hydrogen bonding of the type N—H···*Ch* and O—H···*Ch* stabilize the growth of these layered iron chalcogenides. Due to the preparation from hydrothermal and solvothermal syntheses, the crystal growth of these layers involves several intermediate phases involving hydrogen bonding as evidenced by powder neutron and X-ray diffraction studies.



Configuration of ammonia and amide molecules between layered metal chalcogenides. The N—H bond is directed towards the chalcogenide anion, S^{2-} or Se^{2-}, to form N—H···S(Se) motifs.