Materials containing the transition metal ions, boasting efficient luminescence, serve as crucial emitters of near-infrared (NIR) light, imperceptible to the human eye. Selected NIR phosphors, characterized by persistent luminescence phenomena lasting hours after excitation, play a pivotal role in marking and imaging substances introduced into living organisms on top of its ability to penetrate the skin tissue. Moreover, NIR phosphors are integral components of miniature LED sources, aiding in food freshness, quality, and composition analysis. Additionally, NIR phosphors contribute to optical thermometry, a non-invasive method for determining internal body temperature.

A comprehensive understanding of the physical attributes of luminescent materials enables the prediction of their characteristics, facilitating the design of materials with desired luminescent properties vital for applications. One of the factors that can significantly affect the luminescent properties, including emission shape, efficiency, and luminescence kinetics, is the surrounding environment of the emitting ion. Altering this environment can lead to notable changes in the emission spectra. One method capable of modifying this environment is through high pressure generated in diamond anvil cells (DACs). DACs can achieve pressures up to 300,000 times greater than atmospheric pressure. Despite typically considered incompressible solids, the pressure generated within DACs can reduce the atomic distances within solids. This high pressure impacts the vicinity of the luminescent ion, causing changes in the material's physical properties. These changes may unveil characteristics not observable through standard measurement techniques under normal conditions.

Investigating optical and structural properties at high pressures enables a more profound comprehension of optical material phenomena. This project will explore how structural changes, such as symmetry alterations and phase transitions, affect the luminescence properties of transition metal ions, such as Cr^{4+}, Mn^{5+}, and Ni^{2+}. This endeavor offers an opportunity to bridge the gap between alterations in crystal structure and luminescence properties, paving the way for the design of materials with suitable luminescent properties for near-infrared emitter applications.