The decades long trend of transistor size reduction has recently faced a roadblock because of its reliance on already extremely scaled silicon transistors. However, atomically thin semiconductors such as transition metal dichalcogenides possess many useful and novel properties including a direct bandgap and strong photoluminescence, promoting the next big innovation in optoelectronics and photovoltaic devices. A key component of this innovation and its potential applications is the control of the optical properties of these materials which requires investigating their underlying mechanisms.

Here I explore the optical properties of these materials by understanding how they can be changed and the underlying mechanisms that are driving these changes. The photoluminescent emissions were measured and analysed with their relation to the nanoslit by constructing an MoS_2/WSe_2 Van der Waals heterostructure suspended on a gold nanoslit substrate using dry transfer techniques and using photoluminescence spectroscopy to create a spatial-spectral map of the sample. This substrate was used to study the effect of substrate and strain in conjunction with plasmonic effect which impacts the efficiency of the excitonic process as a whole.

The data revealed increased plasmonic enhancement especially at the edges of the nanoslit, a shorter lifetime on the nanoslit, strain-induced redshifting on the nanoslit, and increased interlayer emissions on the nanoslit. These results can further be used to study the plasmonic effect and interlayer coupling in the heterostructure, advancing the potential for use in devices and understanding of the physical phenomena behind these properties.