To investigate the optoelectronic properties of transition metal dichalcogenides (TMDs) and optimise their film growth, spatial characterization is crucial. In this work, we employed a multimodal microscopy platform that combines conventional widefield imaging, Raman spectroscopy, photoluminescence, and second harmonic generation (SHG) imaging to characterise 2D materials.

This platform was applied to examine various lab-grown CVD-grown flakes, with each technique revealing unique features of the TMDs. Raman imaging identified both monolayer and multilayer regions by detecting shifts in the intensity and position of the E^1_{2g} / A_{1g} phonon modes. Photoluminescence imaging confirmed the presence of monolayers and distinguished multilayer regions based on variations in wavelength and intensity. Finally, polarisation-dependent SHG imaging is the fastest and most accurate method for determining crystal orientation in TMDs, particularly for TMD heterostructures.

By combining these three techniques in a single microscope, the platform enables rapid, correlated data collection from the same sample area. With unified software control, this approach simplifies and accelerates TMDs analysis, making it a powerful tool for advancing 2D material research.

Figures

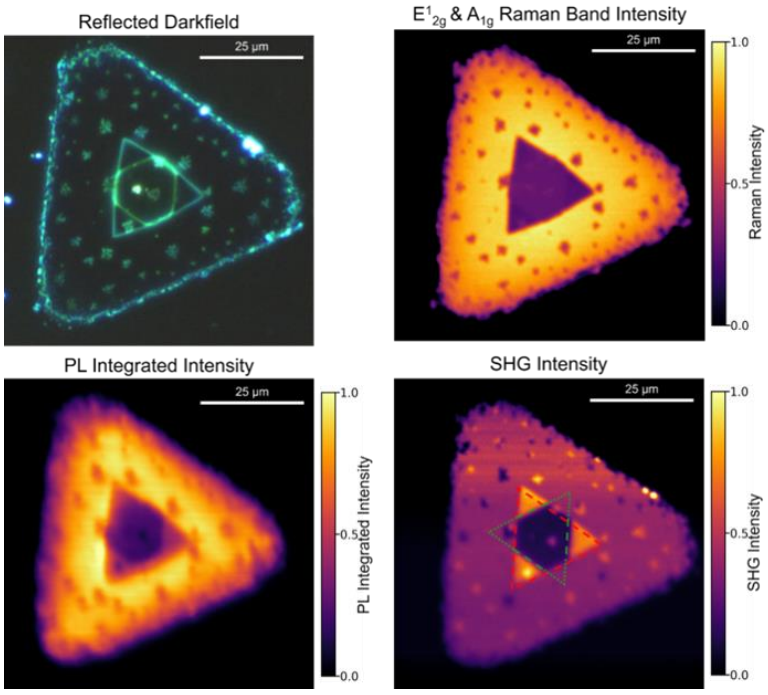

Figure 1: Multimodal analysis of a WSe_2 crystal using Raman, PL and SHG.