Broadband ultrafast fluorescence spectroscopy and its application in optoelectronic materials

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Ultrafast fluorescence spectroscopy (UFS) is a valuable tool to investigate novel optoelectronic materials, which usually involve rich ultrafast photoexcitation dynamics. Compared with other ultrafast spectroscopy techniques, UFS offers several key advantages: 1. Simple data interpretation: Fluorescence plays a critical role in the functionality of optoelectronic applications. By selectively probing emissive species, UFS, in contrast to other pump-probe type spectroscopy, can provide straightforward data interpretations for the crucial mechanisms, such as energy transfer and carrier thermalisation. 2. Tracking interactions and evolution of photoexcitation species: Fluorescence spectra can reveal material’s electronic and vibronic structures, local environment, and morphology. Therefore, the time-resolved fluorescence spectra can be used as a fingerprint to track interactions and evolution of photoexcitation species.

Recently, we developed a new UFS technique, transient grating fluorescence spectroscopy (TGFS),1 which features sub-picosecond time resolution, broadband detection, and high sensitivity. Therefore, TGFS has the potential to become an important optical characterisation tool for materials science. In this short presentation, we will demonstrate some examples of TGFS to advance the knowledge on light emitting and lasing dynamics in novel optoelectronic materials.

References