**Abstract**

Quantum Sensing is a rapidly advancing field within quantum science and technology that exploits uniquely quantum resources to develop sensing techniques beyond the capabilities of classical approaches. Our research focuses on harnessing the quantum properties of photons to design innovative quantum sensors with enhanced performance. In particular, we investigate **Quantum Ghost Spectroscopy (QGS)**, the spectral counterpart of Quantum Ghost Imaging (QGI), extending ghost imaging concepts to the frequency domain. Ghost imaging reconstructs information about an object without directly detecting the light interacting with it. In the quantum regime, this is achieved by exploiting correlations between photon pairs generated through Spontaneous Parametric Down-Conversion (SPDC). While most studies rely on spatial correlations, our work explores spectral correlations, enabling indirect spectral measurements. Using a nondegenerate SPDC source that generates photon pairs in the visible (VIS) and near-infrared (NIR) regions, spectral information in the infrared can be inferred by measuring only visible photons. This approach replaces costly and less efficient IR detection with mature, reliable, and inexpensive VIS technologies. Within the HADES and QUASAR projects, we demonstrated the potential of QGS for detecting hazardous substances exhibiting characteristic NIR signatures. By comparing classical and quantum protocols, we quantified the metrological advantage provided by quantum correlations. We further showed that combining QGS and QGI enables the simultaneous retrieval of spectral and spatial information, opening the way to hyperspectral quantum ghost imaging based on multiple degrees of freedom. Finally, we developed and experimentally validated a quantum spectrometer operating in the NIR using standard visible-light detectors, successfully characterizing a variety of samples and demonstrating the versatility and practical potential of this quantum sensing approach.