

SCINTILLATING NANOCOMPOSITES FOR THE NEXT GENERATION MEDICAL IMAGERS

LABORATORY : Institut Lumière Matière
IN COOPERATION WITH : iLM

TEAM(S) : LUMINESCENCE

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SCIENTIFIC CONTEXT :

Photon-counting computed tomography (PCCT) heralds the next leap in (medical) X-ray imaging and delivers images with astonishingly high contrast, high spatial resolution, and low noise. Moreover, PCCT allows a reduction in X-ray dose compared to conventional CT. Uniquely, the spectral capabilities of PCCT (also called "color" CT) enable quantitative imaging functions, such as measuring tissue composition or the concentration of contrast agents. The widespread use of PCCT in hospitals is still hampered by high costs; PCCT scanners are 3 to 5 times more expensive than conventional CT systems. Moreover, current PCCT detector technology has limited accuracy in spectral imaging tasks. The QuPIX EIC Pathfinder project (<https://qupixeu.base44.app/>) will unlock the full clinical potential of X-ray photon counting, both in diagnosis and image-guided interventions, by delivering a new, affordable, and scalable X-ray photon counting detector based on quantum-enhanced perovskite scintillators (QuPS).

MISSIONS :

The objective of this PhD project is to develop a new generation of scintillating nanocomposite materials tailored for photon-counting X-ray imaging. The project will focus on colloidal perovskite nanocrystals (NCs) embedded in a pixelated polymer matrix, with the aim of combining the outstanding scintillation properties of quantum-confined materials with a scalable detector architecture. Alternative self-absorption free compositions will be also explored. The PhD candidate will design and optimize composite materials fulfilling the key requirements for highperformance photon-counting detectors, namely:

- high X-ray stopping power through dense scintillating formulations;
- high scintillation yield for efficient X-ray-to-visible photon conversion;
- fast scintillation decay compatible with high-count-rate imaging;
- minimal self-absorption to preserve light collection efficiency and spatial resolution;
- compatibility with pixelated polymer matrices for scalable detector fabrication.

OUTLOOKS :

Exploit the benefits of quantum confinement in NCs for scintillation and spectral X-ray imaging

BIBLIOGRAPHY :

Profile: Master's degree in Chemistry, Materials Science, Nanotechnology, Chemical-Physics or a related field. Background in nanomaterials synthesis and characterization. Student with a taste for interdisciplinarity, highly motivated, curious, and capable of working independently as well as in a collaborative environment. Familiarity with colloidal nano-perovskites and their applications is a plus.