Contribution ID: **8** Type: **not specified**

Scintillation mechanisms in II-VI semiconductor nanostructures

Saturday 4 June 2022 13:00 (15 minutes)

II-VI semiconductor nanocrystals (NCs) are known to show very good optical fluorescence quantum yields. As direct band gap semiconductors they also exhibit a fast excitonic emission in the order of a few tens of ns. In addition, because of their reduced size, multiple excitation generation are favoured, resulting in a significantly faster emission which can be attractive for the scintillation field. Nevertheless, the stopping power for x-ray and gamma-ray requires to handle materials in bulky form or to implement strategies with hybrid materials. As an illustration, for CdSe nanoplatelets deposited on Lu2SiO5Ce3+ single crystal, the energy sharing has demonstrated a coincidence time resolution improvement, a crucial parameter for time of flight positron emission tomography. Nevertheless, the use of semiconducting NCs at very high concentrations is facing the self-absorption issue due to a small stokes shift, leading to a decrease of the light extraction efficiency. One strategy to overcome the self-absorption issue is to use core/shell NCs, allowing to increase the stopping power of the media while keeping constant the concentration of emitting centers and thus the self-absorption. The shell acts in this case as an "antenna"or collector for the ionizing radiation, and does not contribute to the self-absorption. On the other hand, large shells reduce the confinement effect and may induce bulk crystal defects.
Therefore, exploring nanocrystals-based materials in a large variety in morphologies and sizes is of high interest to describe the underlying physics of the energy deposition and relaxation process under ionizing radiation in nanoscintillators. In this contribution, we present the cases of CdSe/CdS based spherical quantum wells, CdSe-based nanoplatelets as core/crown and core/shell, and discuss the comparison of optical response under intense optical excitation and x-ray excitation as compared to simulations of energy relaxation.

Authors: Prof. VASIL'EV, Andrey; MAHLER, Benoit (CNRS - Institut Lumière Matière)

Co-authors: Dr MENG, Zhu; Dr HOUEL, Julien; DUJARDIN, Christophe (Université Lyon1)

Presenter: MAHLER, Benoit (CNRS - Institut Lumière Matière)

Session Classification: Technologies for ≤100ps TOFPET resolution: Scintillators

Track Classification: Technologies: Scintillators