

Research Topic for the ParisTech/CSC PhD Program

Field: Chemistry, Physical Chemistry and Chemical Engineering

Subfield: Chemistry & Materials Science

Title: Phosphors with long persistent luminescence in the near infrared range for bioimaging

ParisTech School: Chimie Paristech

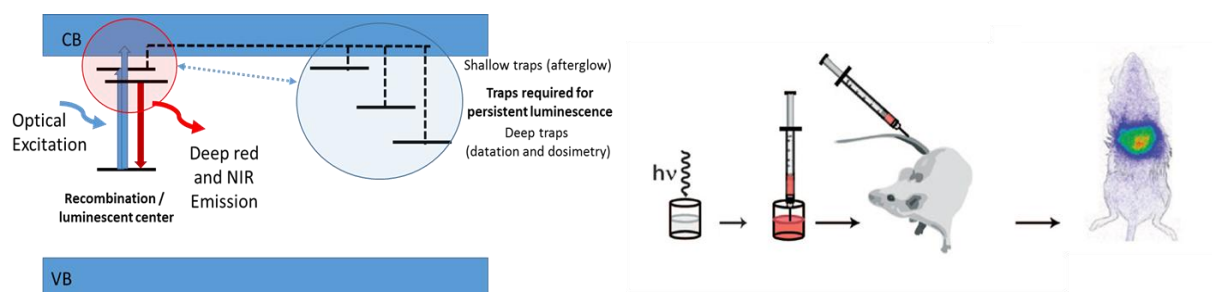
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Short description of possible research topics for a PhD:

Persistent luminescence is a singular property of some materials which are able to store the excitation or light irradiation energy at intrinsic traps or defects before slowly emitting lower energy photons within several hours (see figure). Several new applications are envisioned with these materials. In that context, bioimaging constantly demands more sensitive tools intended for biomedical research and medical applications. Deep red persistent luminescence nanoparticles have recently been introduced to enable highly sensitive *in vivo* optical detection and complete avoidance of tissue autofluorescence (see figure). We proposed within this research program a novel generation of optical nanoprobes, presenting long persistent luminescence in the near infrared biological window between 1000 nm and 1550 nm. Functionalization of this new photonic probes can be adjusted as well as the wavelength of the optical stimulation to favour multiple challenging applications.



Required background of the student: Materials Science, Chemistry, Optical Spectroscopy

A list of representative publications of the group:

- [1] T. Maldiney, et al. "The *in vivo* activation of persistent nanophosphors for optical imaging of vascularization, tumours and grafted cells", *Nature Materials* 13, 418-426 (2014).
- [2] D. Jaque, et al. "Inorganic nanoparticles for optical bioimaging" *Advances in Optics and Photonics* 8 (1), 1-103 (2016)
- [3] S. Sharma; et al. "Persistent luminescence induced by near infra-red photostimulation in chromium-doped zinc gallate for in vivo optical imaging" *Optical Materials* 63, 51-58 (2017)
- [4] M. Pellerin et al. "LaAlO₃: Cr³⁺, Sm³⁺: Nano-perovskite with persistent luminescence for in vivo optical imaging" *Journal of Luminescence* 202, 83-88 (2018)
- [5] J. Xu et al. "Toward Rechargeable Persistent Luminescence for the First and Third Biological Windows via Persistent Energy Transfer and Electron Trap Redistribution" *Inorganic chemistry* 57 (9), 5194-5203 (2018)