Ph.D. Course in Materials Science and Nanotechnology

University of Milano-Bicocca, Department of Materials Science, via R. Cozzi 55, 20125 Milano

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Seminar room - Department of Materials Science U5

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Perspective on nanoscintillators

Scintillators are materials able to emit photons when impinged with ionizing radiations. They are currently widely used in many detection systems addressing different fields, such as medical imaging, homeland security, high energy-physics (HEP) calorimetry, industrial control, and oil drilling exploration. Nowadays, the requirements in terms of performance are more and more demanding and scintillating materials developments become very specialized. While material composition impacts light production, the material form plays a key role in light collection. Apart from the performance in terms of stopping power needed in all applications, the light collection aspect plays a major role in imaging and detection systems. The best scintillator becomes useless if appropriate light collection cannot be achieved to reach required performances such as spatial resolution, granularity, or spectral resolution. Reducing materials dimensions down to nano-sizes affect both aspects. On one hand, the nanoparticle shape allows to prepare original geometries offering new opportunities of detection devices. From the fundamental point of view, the involved mechanisms may differ at the nanoscale. Indeed, high energy excitation involves multi-scale along the energy relaxation process, and mean free paths become longer than the particle size rendering the mechanism description rather complex. In some cases, when nanoparticles experience quantum confinement, it changes in consequence the light production characteristics under both optical and ionizing radiation excitations. In this presentation, after a wide introduction on the scintillating materials and the specificities for nanoparticles, the 3 following topics involving nanoscintillators will be developed: 1) porous scintillating architectures build up from scintillating nanoparticles assembled as aerogels to detect radioactive gas, 2) Lead Halide nanoperovskite as active centers for liquid scintillation, 3) Nanoparticles of direct bandgap II-VI semiconductors as ultra fast emitters for fast timing applications.

PhD students and all interested in the seminar are kindly invited to participate.

The PhD Coordinator

Prof. Marco Bernasconi