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Discovery and development of improved scintillation detector materials for medical imaging and national security

Abstract

Inorganic scintillators have been an essential tool of the physical sciences for over 100 years and during that time many new materials have been discovered, developed, and put into widespread use. Nonetheless there are many applications where the performance of available materials falls far short of what should be possible. These include gamma-ray stopping power and timing resolution in positron medical imaging, gamma-ray energy resolution for the identification of radioactive materials in national security, and low cost. This talk will review the current efforts in understanding the fundamental limits of detector materials, the use of empirical and first-principles calculations to guide the selection of new candidates, and the use of high-throughput synthesis and measurement techniques to discover new high-performance scintillators. The talk will be followed by a tour of the high-throughput synthesis and scintillator characterization labs and the crystal growing facility. This project maintains the largest open-access database of inorganic scintillation properties at http://scintillator.lbl.gov.

Speaker Bio

STEPHEN E. DERENZO is a Senior Scientist at the Lawrence Berkeley National Laboratory, Head of the Radiotracer Development and Imaging Technology Department in the Life Sciences Division, and Professor-in-Residence in the Electrical Engineering and Computer Science Department at UC Berkeley. He and his colleagues constructed two pioneering positron emission tomographs (PET) and developed advanced scintillation detectors for PET that provide high spatial resolution, depth-of-interaction information, and compact integrated circuit readout. For the past 24 years he has lead a search for new heavy scintillators and currently heads a project for the discovery of scintillation detector materials that uses automation to increase the rate of synthesis and characterization. He has authored or co-authored over 200 technical publications, seven patents, and one textbook. He has received two awards from the IEEE Nuclear and Plasma Sciences Society: the Merit Award in 1992 and the Radiation Instrumentation Outstanding Achievement Award in 2001. He became an IEEE Fellow in 2000.