Contribution ID: **3** Type: **talk**

Development of new heavy and efficient scintillators for medical imaging and radiation detection

Friday, 28 June 2019 13:35 (20 minutes)

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Inorganic scintillators are widely used materials for the detection of different radiations in the field of radiation detection, medical imaging, security inspection, nuclear and high-energy-physics, and well-logging for oil and gas exploration. In recent years, more attention is devoted in the discovery of new scintillators characterized by excellent energy resolution and high light yield under γ-ray excitation, fast decay time, high density and high Z-number. Most of the popular scintillators shown excellent scintillation properties, however one cannot find a single scintillator among these materials which can fulfill the demands of the mentioned applications. Therefore, the quest for an ideal scintillator is still going on.
In this presentation I will present our work on the new single crystal growth of cerium or europium doped Tl based crystal as well as Tl based intrinsic scintillators grown by using Bridgman technique. Due to the high Z-number and density of Tl ion most of our grown scintillator shows high effective Z-number and density. Therefore, these scintillators are supposed to be ideal for the detection of x- and gamma-rays. Since the f-d transition is favored for Ce or Eu doped scintillator, we expect fast decay time and high light output. Under 661 keV γ-rays excitation, the light outputs of the investigated samples are found to be < 60,000 photons/MeV for various Ce or Eu concentrations with different materials.
Since they contains high Z material, Tl, they can be used to efficiently detect gamma rays or x-rays in many applications such as radiation detection and medical imaging such as computerized tomography (CT), positron emission tomography (PET), single photon emission computed tomography (SPECT). Also Li and Gd contained crystals could be promising candidates for neutron detection.

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Session Classification: Friday