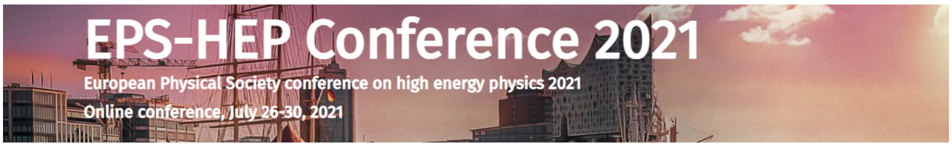

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GAGG scintillation crystals family for HEP instrumentation

Friday 30 July 2021 11:00 (15 minutes)

Homogeneous electromagnetic calorimeters made of crystalline scintillation elements played a crucial role in the discoveries in high-energy physics experiments at colliders during the last three decades [1]. Nevertheless, their future application at high luminosity collider facilities (High Luminosity LHC, FCC in hh mode) might become limited by radiation damage effects under the charged and neutral hadrons in the bulk elements. The high luminosity puts in the list of the priorities the combination of the capability for the high time resolution and radiation tolerance as the primary properties of the scintillation material to be exploited. Recently it was demonstrated that compositionally disordered crystalline materials of gallium-aluminum garnets meet these requirements [2]. Their composition may be engineered from ternary to quaternary garnets allowing tuning of the properties of the material for a particular application.
The combination of the scintillation properties, particularly the high light yield up to 50000 photons/MeV, the decay time shorter than 80 ns and a high time resolution better than 160 ps with a modern SiPM photosensor, and outstanding radiation hardness and chemical and mechanical stability make the complex garnet oxides the candidates of choice for a range of various applications in HEP experiments.
In our report we review the last achievements for the properties of multidoped Gd3Al2Ga3O12 - (Gdx-Y1-x)Al2Ga3O12 crystal family produced by the wide-spread Czochralski crystal growth technique. Superior mechanical properties make possible production of different shape scintillation elements to equip heterogeneous detecting units of "Shaslyk"or SPACAL type. Due to its cubic crystalline structure, the crystals of the family may be obtained as a polycrystalline ceramic using various techniques, including 3D printing [3]; this further widens the range of the possible applications.

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Collaboration / Activity

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