



Contribution ID: 68

Type: **invited**

Radiation and pair production in oriented crystals: innovative application to future particle accelerators and detectors

Wednesday, 7 June 2023 09:00 (30 minutes)

It has been known since decades that the alignment of a beam of high-energy e^- or photons with particular crystal direction involves a huge increase of radiation emission or pair production probability, respectively. While crossing an oriented crystal, such penetrating particles experience an electromagnetic field so strong that it leads to a huge enhancement of the e.m. shower development with consequent reduction of the radiation length. Here we present recent results in this topic, with a focus on materials and configurations suitable for applications in future accelerators/detectors.

The presented results open up several application scenarios in accelerators, e.g. in intense e^+ source for the Future Circular Collider, and particle detectors, e.g. in the development of compact forward calorimeters and photo-absorber in fixed-target experiments, as well as in satellite-borne gamma-telescopes.

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Session Classification: S1 & S3: Beams Interactions & Acceleration Techniques