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The ORiEnted calOrimeter R&D: status and prospectives

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Relativistic particles passing through crystalline structures experience a Lorentz-boosted external electric field. For high-Z crystals, if the impinging angle relative to a lattice axis is up one degree, the strong field (SF) felt by electrons and photons at an order of few GeV or higher can overcome the Schwinger limit, where the QED effects become nonlinear, and enhance the standard Bremsstrahlung and pair-production cross-sections described by the Bethe-Heitler model which applies to amorphous materials.

The SF-induced enhancement accelerates the formation of the electromagnetic shower and the ORiEnted calOrimeter (OREO) team, exploited this effect to develop an innovative homogeneous electromagnetic crystal calorimeter based on oriented scintillator crystals. This new type of calorimeter has higher energy resolution, improved photon detection efficiency, and higher particle identification due to the relative enhancement of electromagnetic interactions over hadronic ones. OREO is developed within subtask 1.3.4 of the DRD6 collaboration.

This contribution summarizes the results of the ongoing OREO R&D, from the realization of the first 3x3 prototype with oriented PWO crystals and its first tests on beam. We will also present the potential applications of this technology, including future accelerators, fixed-target experiments, and satellite-based γ-ray observatories.

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