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SiCILIA- Silicon Carbide Detectors for Intense Luminosity Investigations and Applications

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SiCILIA is a Call of V national committee of INFN, which aims to develop technologies for the realization of silicon carbide detection systems, whose characteristics make it very promising for next generation nuclear physics experiments at high beam luminosity. The scientific goal of this apparatus is to detect high fluxes (about 10^7 pps/m 2) and fluences (about 10^14) of heavy-ions in order to determine the cross sections of very rare nuclear phenomena, such as double charge exchange reactions, of impact for determining nuclear matrix elements entering in the expression of the neutrino-less double beta decay half-life (NUMEN project). The main issues for these experiments are the high energy (ΔE/E ~ 1/1000), mass (Δm/m ~ 1/200) and angular resolution (~ 0.1°) required in order to unambiguously select the reaction channels of interest and extract the relevant information from energy spectra and absolute cross section angular distributions. Due to the very low cross sections these features just be guaranteed at fluences which exceed by far those tolerated in state of the art solid state detectors, typically used in present experiment of this kind. Similar constraints come also by other fields of modern and future research in nuclear physics, such as the study of rates of reactions of astrophysical interest in high power (tens of Peta-watt) and high-repetition rate laser-matter interactions. An additional feature of these experiments is the presence of a very strong distortion in the response of traditional active detectors coming from the plasma, that make silicon detectors unusable for that. The Silicon Carbide technology offers today an ideal response to such challenges, since it gives the opportunity to cope the excellent properties of silicon detectors (resolution, efficiency, linearity, compactness) with a much larger radiation hardness (up to five orders of magnitudes for heavy ions), thermal stability and insensitivity to visible light.

Primary author: LITRICO, Grazia (L)

Presenter: LITRICO, Grazia (L)

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