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Séminaires d'Instrumentation

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Recent Developments in Semiconductor Detectors: Opportunities for Basic and Applied Research

Advances in the fabrication and readout of large and segmented semiconductor detectors enable the development and demonstration of new and improved concepts in the detection of ionizing radiation.
The segmentation of semiconductor detectors along with pulse-shape analysis enable the determination of energies and three-dimensional positions of individual gamma-ray interactions with high resolution and efficiency. This in turn allows us to fully reconstruct the gamma ray by so-called gamma ray tracking, which provides new capabilities in a wide range of applications. For example, it enhances the performance of gamma-ray spectrometer for nuclear physics experiments. It also provides the ability for gamma ray imaging without using collimators. The concept of Compton-scatter based gamma ray imaging can be realized resulting in highly sensitive instruments, which enhances capabilities in areas ranging from astrophysics to homeland security, nuclear nonproliferation and safeguards, and biomedical imaging.
Complementary to the ability to segment conventional detector configuration, recently large-volume Ge-drift detectors have been fabricated and successfully demonstrated. These detectors promise significant increases in the sensitivity to observe rare physics processes due to their very low-noise and the ability to implement them in low-mass and low-background configurations. This so-called p-type point contact detectors are now being developed in basic research applications such as the search for the neutrinoless double beta decay, the detection of weakly interacting massive particles, and the coherent neutrino scattering.
In this talk, I will give on overview on the technologies and concepts associated with the advances in the fabrication of semiconductor detectors which are currently being developed and map them to some of the possible applications in areas ranging from basic physics to nuclear safeguards and biomedical imaging.

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