Ph.D. in Information Technology
Thesis Defense

March 11th, 2026
At 2:30 p.m.
Room BIO 1 - Building 21

Iurii EREMEEV– XXXVIII Cycle

SILICON LOW-GAIN AVALANCHE DETECTORS FOR X-RAY SPECTROSCOPY
Supervisor: Prof. Giuseppe Bertuccio

Abstract:

The evolution of Semiconductor Radiation Detectors (SRD), widely employed in various research and industrial systems, including X-ray spectrometers, has been driven intensively by the most demanding SRD applications in scientific experiments, such as those in High-Energy Physics (HEP). Among SRDs initially developed for tracking in HEP are Low-Gain Avalanche Diodes (LGADs), whose outstanding timing resolution of less than 30 ps is achieved by exploiting the signal charge multiplication gain via impact ionization within a thin detector structure. The LGAD operation principle is similar to that of Avalanche Photodiodes (APD): the multiplication gain increases the signal amplitude and its steepness, thereby reducing the relative noise contributions of the preamplifier and subsequent stages of the electronic chain, which improves the system performance. The increase of the signal amplitude in LGAD detectors has also attracted significant research interest for hybrid soft X-ray spectrometers (from 200 eV to 2 keV), whose energy resolution is expected to improve when LGAD replaces a standard Diode-based sensor. However, the LGAD multiplication gain introduces an excess noise due to the non-deterministic nature of impact ionization. This excess noise component must be precisely determined to optimize the performance of any LGAD-based radiation detector at various operating conditions. Thus, this thesis targets an analysis of different noise components in LGAD-based X-ray spectrometers, including the noise of the electronic chain and excess noise due to multiplication gain, and defines their ultimate performance limits.

PhD Committee

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