**Simultaneous high speed imaging and spectroscopy   
of X-rays and particles with silicon detectors**

*Lothar Strüder*

*PNSensor GmbH, Otto-Hahn-Ring 6, 81739 Munich, Germany  
 and University of Siegen, Walter-Flex Str.1, 51228 Siegen, Germany*

Silicon detectors are widely used as high-performance sensors for photons from 1 eV energy up to hundreds of keV and as particle detectors for tracking, imaging and spectroscopy. In the visible domain CCDs, CMOS imagers and SiPMs are spread over a wide range of scientific applications. In the UV and X-ray range from 20 eV up to 20 keV the direct detection of the photons is usually done on back-illuminated fully depleted, thus fully sensitive silicon detectors: Silicon Drift Detectors, pnCCDs and CMOS based Active Pixel Sensors or hybrid CMOS detectors. For higher X-ray energies, up to 1 MeV the signal conversion into visible photons is performed in scintillators coupled to light sensitive detectors. High spatial resolution direct electron detection for TEMs and SEMs are equally achieved with dedicated silicon sensors based on pnCCDs and DePFET active pixel sensors. The description of the physical limits of the measurement precision will be derived as well as the semiconductor device concepts to get as close as possible to these limits. New developments and applications in basic and applied science will be highlighted as well as scientific instrumentation for industry.