Particle Accelerators and Their Applications

Session Co-chairs: Daniela Leitner, Michigan State University, USA, and Julia Herzen, Technical University Munich, Germany

The scope of this session highlights new aspects in particle accelerator technology and their applications. The session is planned around the question: How can the knowledge and technological progress provided by accelerator physics best be used to benefit society?

Particle accelerators that were originally developed for fundamental physics studies have now found their way into societal applications. Modern medical accelerators and cancer treatment facility have evolved from research facilities at National Laboratories to turnkey machines produced by industry. Intense x-ray accelerators for food sterilization and packaging are standard tools for the food industry. Similarly, rare isotopes were originally only used in nuclear science laboratories are now used in a wide variety of applications ranging from medical diagnostics to the tracing of groundwater migration patterns. They serve as sensitive probes in materials science studies of nano-scale devices and in the study of mechanical wear in novel materials. With more powerful large scale rare isotope facilities under construction or coming online access to a wide range of new isotopes that may have properties better matched to a range of specific will be available.

As the accelerator technology matures, dedicated storage rings for high-brilliance synchrotron radiation generation and tailored towards specific applications are being developed. The special beam characteristics of these X-ray sources push the quality of various X-ray inspection techniques, like e.g nono-diffraction in materials science.

The researchers and engineers speaking in this session are from universities, national Laboratories and large-scale facilities. The first half of the session focuses on cutting edge magnet design for scientific and medical accelerator applications and superconducting accelerator technology for large-scale facilities. The second part will introduce the generation of laser-driven ion and X-ray beams and discuss their applications.

Matthew Johnson is a senior engineer at Michigan State University responsible for the mechanical engineering of the cryomodules for the Facility for Rare Isotopes. Helene Felice is an engineer at the Lawrence Berkeley National Laboratory working on next-generation high field superconducting magnets. Christina Krywka is Senior Scientist at the Helmholtz-Centre Geesthacht responsible for the Nanofocus Endstation of the beamline P03 at the synchrotron radiation source PETRA III (DESY, Hamburg). Christina is developing X-ray nano-diffraction techniques and applying them to special cases in materials science. Jörg Schreiber is professor at the Ludwig-Maximilian-University of Munich and at the Max-Planck-Institute for Quantum Optics in Garching working on the generation of high-energy ion beams within the Excellence-Cluster “Munich Advanced Photonics” (MAP).