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Editorial

Compact accelerator-driven neutron sources

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Advances in science and technology in the field of neutron science have been heightened by a fruitful combination of major international facilities supported by networks of smaller regional facilities. Recent progress in accelerator technology and neutronic design have made it possible to construct small-scale accelerator-driven neutron facilities that could play a significant role in neutron technology and science. The neutron applications using compact accelerator-driven neutron sources are now becoming more and more important since they can contribute to various fields such as material science, engineering, nuclear physics, cancer therapy, soft error and so on; therefore, they could play a more significant role in the future.

To promote such activities, in 2010, the Union for Compact Accelerator-driven Neutron Sources (UCANS) was established. Following fruitful meetings held in Beijing (China), Bloomington (US), Bilbao (Spain), Hokkaido University (Japan) and Padova (Italy) (please visit `http://www.indiana.edu/~lens/UCANS/`), the Union realized its expanding role in education and training of users for the large neutron sources as well as in R&D of neutron applications beyond materials characterization. The reasons for the increasing activities are manifold. Firstly, as high-power (~ 0.5–$2\,\mathrm{MW}$) neutron-scattering facilities become available to users through competitive proposal systems, an increasing number of beginners and research students could seek training or practice of scattering experiments at small sources. Secondly, small sources are ideal test beds for R&D and validation of advanced instrumentation and techniques, leading to eventual utilization at existing and future big facilities. Thirdly, there are other disciplines, such as nuclear astrophysics, neutron capture therapy, isotope production, etc., whose advancement depends on experimentation at small-to-medium energy neutron sources. Therefore, the growth of the scientific and engineering communities that associate with utilization of neutrons will rely, to a large extent, on the dynamic balancing of availability and capability between large and small neutron sources.

The six papers focusing on CANS selected for *EPJ Plus* aim to promote awareness of the progress and various functionalities of CANS against a backdrop of international landscape of neutron facilities. In Europe, a major change in the neutron arena over the next 10 years is expected, given several reactor sources will close, leading to a substantial reduction in the capacity that is inadequate to fulfill scientific demands of the user community. The advent of the ESS operation, with 16 neutron beamlines by 2025, will merely replenish the capacity lost by the closure of one reactor, *e.g.*, the BERII in Berlin. Given the highly unlikely scenario that any European country will consider building a new research reactor, accelerator-driven sources have to step up to maintain scientific productivity in order to avoid a collapse of the system. In Asia and in the Americas, increasing number of neutron users have realized the synergetic roles of compact accelerator sources in neutronics and instrumentation development, education, and ancillary research accompanying the operation of large, national spallation sources. This set of papers show, on the one hand, that the success of CANS in advancing the field of neutron scattering in spite of their original spin-off from legacy accelerator projects and, on the other hand, that new, optimized high-brilliant or special-purpose CANS are needed for sustaining neutron research thrusts in the future, not only for materials research but also for other disciplines and applications. The focus of these papers also calls attention to the burgeoning opportunity of international collaboration between the networks of high-power sources (*i.e.*, ICANS) and compact sources (*i.e.*, UCANS) within the multi-disciplinary accelerator-base neutron source communities.

Carla Andreani, Chun-K. Loong, and Gianfranco Prete

Guest Editors