Nuclear Data Activities and Needs in South Africa

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Activities

The contributions in this report have been obtained from staff members and users of iThemba LABS, the South African Nuclear Energy Corporation Limited (Necsa) and the National Metrology Institute of South Africa (NMISA).

iThemba LABS is a national facility and one of the business units of the state-owned National Research Foundation (NRF). It currently operates six accelerators for basic and applied research using particle beams, and for the supply of accelerator-produced radioisotopes for nuclear medicine and related research. It has two campuses ─ the main campus at Faure (near Cape Town) and a satellite campus in Johannesburg. Four of the accelerators are cyclotrons and two are electrostatic accelerators. In the past, particle radiotherapy for the treatment of cancer was performed with both protons and neutrons. These activities have been terminated during the current reporting period; currently no particle radiotherapy with hadrons is being performed in South Africa. The old therapy building is in the process of being repurposed to accommodate a new commercial 70 MeV H^- cyclotron and four new target stations for an expanded radionuclide production programme. Delivery of the new cyclotron (IBA Cyclone 70) to the Faure Campus is expected in October 2021. This will, to a large extent, separate the radionuclide production programme from the research programme (mainly nuclear physics and radiobiology, both of which are currently being served by the k=200 separated-sector cyclotron.)

iThemba LABS participated on only one CRP during the current reporting period (Mathis Wiedeking – Updating the Photonuclear Data Library and generating a reference database for photon strength functions). Both aspects have been completed and are published [1,2]. Several studies measured excitation functions or related data [3-7], some of which in collaboration with staff of ATOMKI, therefore probably also listed in the Progress Report from Hungary. In recent times, various requests for data measured on the K600 magnetic spectrometer of iThemba LABS have been requested for inclusion in EXFOR, in particular on fine structure of giant resonances and characterization of cluster states in light nuclei. Some papers of possible interest from K600 experiments [8–12] as well as other studies on nuclear structure [13-41] are included in the references list.

The Radionuclide Metrology and Radioactivity Standards Laboratory of NMISA is located in Cape Town. This facility employs a number of different techniques for the absolute measurement of radioactivity. Some of their output may be of interest to the nuclear data community [42-45]. In a recent development, the quasi mono-energetic neutrons (QMN) facility of iThemba LABS has been officially designated by NMISA as a Neutron Metrology Facility, with all required international accreditations in place. A planned upgrade to the facility (to reduce an asymmetric low-energy background and to increase the 16° flight path) commenced in 2019 and has recently been completed, however, due to the Covid-19 pandemic the characterisation of the facility with cyclotron beam has been postponed until May 2021. Due to many lockdown restrictions, only approved staff members are currently allowed on site (currently limited to 50% of staff). Students and users are still not allowed on the premises of iThemba LABS due to the Covid-19 pandemic, since March 2020.

Nuclear Data Needs

- TENDL-2019 data, processed into the ACE format and bundled with the code MCNP6 as shipped by the RSICC, do not currently include (α,n) cross-section sets for a range of isotopes. There is a need for complete (α,n) cross sections in ACE format.
- Continued support for the 709-neutron energy group structure of FISPACT-II in addition to the newer 1102-group format, especially for TENDL data.

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