

A model for non-thermalized neutron spectra emitted from para-hydrogen - DTU Orbit (09/11/2017)

A model for non-thermalized neutron spectra emitted from para-hydrogen

At spallation and reactor cold neutron sources, neutrons are cooled by moderators. At high power neutron sources, such as the Japan Proton Accelerator Research Complex (JPARC), European Spallation Source (ESS) and the Spallation Neutron Source (SNS) only few moderator materials are practical, due to the high radiation environment near the moderator and cooling demands. One of the very popular materials, used at J-PARC and planned for ESS, is the spin singlet state of H₂, para-hydrogen. This study assesses the non-Maxwellian neutron spectral structure achieved in para-hydrogen moderators, which is due to the complexity of the inelastic scattering cross section below 50 meV. The analytical description of a thermalized spectrum with slowing down components are discussed, then a formula is developed which is a good description of this non-equilibrium para-hydrogen neutron spectrum. These analytical descriptions are fitted to the thermal and cold neutron spectra expected at the European Spallation Source according to the baseline configuration, as described in the Technical Design Report (TDR). The results of the fits have been implemented in McStas 2.0 and is used throughout the ESS instrumentation community. Though not shown here it is worth noting that the spectra for different heights of moderators in the more recent ESS geometry have also been fitted to this para-hydrogen spectrum model, the fits have been implemented and released in McStas 2.1.

General information

State: Published

Organisations: Center for Nuclear Technologies, Radiation Physics, Department of Physics, Neutrons and X-rays for Materials Physics, European Spallation Source ESS AB

Authors: Schönfeldt, T. (Intern), Batkov, K. (Ekstern), Klinkby, E. B. (Intern), Lauritzen, B. (Intern), Mezei, F. (Ekstern), Takibayev, A. (Ekstern), Willendrup, P. K. (Intern), Zanini, L. (Ekstern)

Pages: 134-140

Publication date: 2016

Host publication information

Title of host publication: Proceedings of the 21st Meeting of the International Collaboration on Advanced Neutron Sources (ICANS XXI) : Dawn of High Power Neutron Sources and Science Applications

Publisher: Japan Atomic Energy Agency

Editors: Oku, T., Nakamura, M., Sakai, K., Teshigawara, M., Tatsumoto, H., Yonemura, M., Suzuki, J., Arai, M.

Article number: 3.2.12

Series: K E K Proceedings

Number: 2015-7

Series: J A E A - Conf

Number: 2015-002

Main Research Area: Technical/natural sciences

Conference: 21st Meeting of the International Collaboration on Advanced Neutron Sources, Mito, Japan, 29/09/2014 - 29/09/2014

DOIs:

10.11484/jaea-conf-2015-002

Source: PublicationPreSubmission

Source-ID: 123117960

Publication: Research - peer-review › Article in proceedings – Annual report year: 2016