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NEUTRON SCATTERING AND MODELS:- IRON

by

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ABSTRACT

Differential elastic and inelastic neutron-scattering cross sections of elemental iron are measured from 4.5 to 10 MeV in increments of ≈ 0.5 MeV. At each incident energy the measurements are made at forty or more scattering angles distributed between ≈ 17^{0} and 160^{0}, with emphasis on elastic scattering and inelastic scattering due to the excitation of the yrast 2^{+} state. The measured data is combined with earlier lower-energy results from this laboratory, with recent high-precision ≈ 9.5 → 15 MeV results from the Physikalisch-Technische Bundesanstalt and with selected values from the literature to provide a detailed neutron-scattering data base extending from ≈ 1.5 to 26 MeV. This data is interpreted in the context of phenomenological spherical-optical and coupled-channels (vibrational and rotational) models, and physical implications discussed. Deformation, coupling, asymmetry and dispersive effects are explored. It is shown that, particularly in the collective-rotational context, a good description of the interaction of neutrons with ^{56}Fe is achieved over the energy range ≈ 0 → 30 MeV, avoiding the dichotomies between high and low-energy interpretations found in previous work.