

50 Years of Neutron Backscattering Spectroscopy



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Almost 50 years of rotational tunneling

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4 years after observations of almost free rotation in solid methane II (Kapulla and W. Gläser, 1970) B. Alefeld and A. Kollmar performed the first backscattering experiment. Together with that on methane tunneling it set the start to many more neutron experiments dedicated to quantum rotations. Neutron spectra with well-defined lines, both benefitted from theoretical work and stimulated it; the principal centers were Erlangen (A. Hüller) and Kyoto (T. Yamamoto).

A large diversity of systems can be found in the Tunneling Atlas (M. Prager, A. Heidemann). In parallel the basics of “coherent” and “incoherent” tunneling (P. Trommsdorff) remained in the focus.

A review (W.P., 1981) summarizes the initial activities. Important generalizations comprise rotation-translation coupling (P. Schiebel, ~1995), partial deuteration (K. Maki et al, 1981) and intermolecular coupling (M. Neumann et al., 2000).

Scientists from other experimental techniques - nmr (S. Clough and A. Horsewill), optics (P. Trommsdorff) and specific heat (Jim Morrison) - also became experts in high resolution neutron scattering, particularly backscattering and time-of-flight experiments.

Today tunneling experiments are rather infrequent guests at modern instruments. The field could greatly benefit from the extended dynamical ranges, higher intensity and also some-what improved resolution.

Primary author: PRESS, Werner (IEAP University Kiel, Germany)

Presenter: PRESS, Werner (IEAP University Kiel, Germany)

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