

Preface

By involuntary timing this volume will appear almost exactly thirty years after neutron spin echo (NSE) was discovered and the echo effect was experimentally first demonstrated in April 1972 at the Budapest Research Reactor on the forested hills around the city. The idea to organize the present volume arose during a recent workshop¹ which followed by twenty years the first workshop devoted to the technique of NSE and research using NSE held at ILL^{2,3}.

The context and content of the two workshops were, of course, very different. In 1979 there was just one operational NSE spectrometer, the IN11 at ILL and the discussion focussed on establishing the fundamental technique and reviewing the first set of successful applications of the method in condensed matter research. Today 13 NSE instruments serve a broad and well-established user community and more machines are being planned. Current examples of research results obtained by NSE spectroscopy well illustrate the broad relevance of the method for the study of a variety of phenomena, including phase transitions, magnetism, superconductivity and in particular soft matter in general, such as polymers, liquids, glassy and biological systems.

A wealth of innovations proposed in the past two decades by quite a number of people have been realized. The zero field (ZF) or resonance NSE (NRSE) variant was introduced some 15 years ago. At about the same time it was also realized and demonstrated that the NSE principle can also be efficiently used by neutron velocity dependent modulation of a parameter of the neutron beam other than polarization, for example intensity. More recent years have seen a particular surge of new ideas for extending both the techniques and the field of applications to new domains such as to use the NSE principle in small angle scattering, reflectometry, and to develop combinations of NSE and neutron optical phenomena such as nuclear refractive index and interference effects.

On the other hand, instrument performance in those “classical” applications in quasi-elastic scattering has also tremendously progressed. Resolutions available today exceed 200 ns (about 3 neV HWHM equivalent) compared to 10 ns 20 years ago. The technique of using high detector solid angles has also been established with the actual capability of taking NSE data simultaneously in an

¹ *International Workshop on Neutron Spin Echo Spectroscopy*. Hahn-Meitner-Institut, Berlin, Germany, October 16.-17. 2000

² Neutron Spin Echo, Institute Laue-Langevin, Grenoble, France, October 15.-16. 1979

³ *Neutron Spin Echo* ed. by F. Mezei, Spinger Verlag, Heidelberg, 1980

angular range of about 30° to 80° with more than 200° in principle accessible if one can afford to acquire a vast collection of either supermirror analysers or polarized ^3He filter cells.

Since its advent in the early seventies a broad range of applications have been developed covering the study of a variety of phenomena in condensed matter research. The present volume, after a general introduction to the principles of NSE, gives detailed technical descriptions of various approaches and new developments in NSE instrumentation (Part I) and selected examples of NSE studies (Part II).

The carefully selected contributions collected in this volume present to the interested reader and researchers recent developments, current status and future perspectives of NSE research. We believe they will not only introduce newcomers to the field by describing principal techniques and approaches but also highlight by examples the power and usefulness of NSE spectroscopy in various fields of exploration of condensed matter.

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