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book reviews

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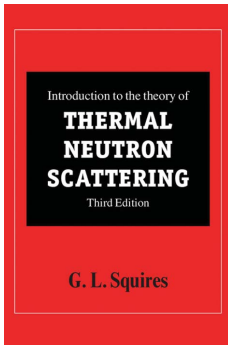

Introduction to the Theory of Thermal Neutron Scattering, third edition. By G. L. Squires. Cambridge University Press, 2012. Pp. 270. Price (paperback) GBP 45.00. ISBN 978-1-107-64406-9.

Eighty years after the discovery of the neutron, neutron-scattering techniques have developed into mature methods, yielding unique insights into the static and dynamic properties of solids. The first edition of G. L. Squires' book *Introduction to the Theory of Thermal Neutron Scattering* was published in 1978, and became one of the most studied textbooks in this field. The new third edition in paperback format is almost unchanged. Therefore it is not suprising that the passing years have rendered parts of this book rather dated, but these are essentially the experimental aspects. Spallation sources, cold neutrons and zero-field polarization are just a few examples of modern instrumentation missing in this book, and the quality of the illustrations is certainly below the standard of today's publications. Furthermore, the reader will not find links to any current scientific topics. However, this introduction aims to explain the quantum-mechanical theory of neutron scattering, and this has not changed since 1978.

G. L. Squires deduces the main theoretical concepts for modelling neutron scattering from quantum mechanics in a very elegant, clear and compact manner. The book can be easily and rapidly studied without prior knowledge of scattering experiments, but it is based on the main concepts in quantum mechanics and solid-state physics. Crystals, liquids and magnetic systems are described. The book is addressed more to experimenters wishing to quantitatively analyse their data and less to theorists advancing the models. For example, harmonic lattice dynamics is not explained in this book, but the reader may find the cross section for one-phonon scattering processes. Owing to the clear and compact structure of this book, the important formulae can be found rapidly.

The basic properties of the neutron and the definitions in scattering experiments are briefly introduced in the first chapters. Then coherent and incoherent scattering in crystals are described in detail as a method for determining the crystal structure of a material as well as the associated excitations. The more general concept of correlation functions prepares for the treatment of scattering by liquids. The unique magnetic properties of the neutron render it an ideal tool for investigating magnetic structures and magnetic excitations. These magnetic theories are explained in the last third of the book, covering scattering by spin and orbital moments and touching on polarization analysis. At the end of each chapter there are some exercises which can be used for personal training.

Introduction to the Theory of Thermal Neutron Scattering is ideally suited for scientists aiming to quantitatively model neutron-scattering data. Owing to the clear and simple presentation, the proper quantum-mechanical concepts can be quickly learned from Squires' book as a first step into deeper studies with more specialized literature.

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