Foreword

The international thematic school on "Crystallography and Neutrons" was organized in order to celebrate the International Year of Crystallography in 2014, under the patronage of the "Société Française de la Neutronique" (SFN) with the support of the CNRS and the European neutron facilities network NMI3[1]. The school took place in September 2014 in Oléron, France, as first part of the "22ème Journées de la Neutronique" (JDN22). The school gathered participants from European countries and therefore the lectures were given in English. It intended to promote cooperation and networking among users of large scale facilities with researchers involved in the field of Crystallography.

Crystallography is fundamental in Physics, Chemistry and Materials Science because it permits to link the structural and dynamic properties at the atomic scale (also accessible by theoretical calculations) to the local and macroscopic properties (observed by other experimental probes). Contrary to a usual belief, crystallography is not limited to structure determinations by diffraction and indeed almost all previous thematic SFN schools were devoted to a domain belonging to crystallography. The school "Crystallography and Neutrons" was mainly dedicated to the study of crystalline materials in the solid state using neutron diffraction but also provided introductive lectures on other neutron scattering techniques of interest for condensed matter research.

The school highlighted the specific strengths of neutron scattering (magnetism, light elements, contrast methods) for the study of crystalline materials of various kinds, with regards to other investigative techniques. The most relevant neutron techniques for studying crystalline matter were presented during the school (diffraction, 3-axes spectroscopy, reflectometry), as well as their applications to various problems (nuclear structure / dynamics / magnetism) and various studied materials (powder / single crystal / thin film). Tutorials on data analysis with the Jana and Fullprof softwares were given by their own authors, V. Petříček (Prag) and J. Rodriguez-Carvajal (ILL), for some representative systems, in order to complement the theoretical training.

Reminders on the basics of crystallography, neutron scattering and production of neutron beams were presented at the beginning of the school but unfortunately no written contributions were provided by the lecturers. However, the description of fundamentals of crystallography and neutron-matter interaction as well as the description of neutron sources may be found in previous editions of the SFN collection[2,3]. The principles of the determination of nuclear and magnetic structures from experimental neutron diffraction data were also presented in previous volumes[2,4].

This book gathers lectures going further than routine nuclear or magnetic structure determinations by neutron diffraction. The first chapter provides an overview of the available

[1] Integrated Infrastructure Initiative for Neutron Scattering and Muon Spectroscopy.

[2] JDN 15 - Études structurales par diffraction des neutrons, série des «Écoles Thématiques de La Société Française de la Neutronique», O. Isnard, Ed. (EDP Sciences, Les Ulis, ISBN: 978-2-7598-0407-8,2000).

[3] JDN 10 - Neutrons et Matériaux, W. Paulus et J. Meinnel, J. Phys. IV (Proceedings) **103** (2003), ISBN: 2-86883-656-9.

[4] JDN 20 - Neutrons et Magnétisme, série des «Écoles Thématiques de La Société Française de la Neutronique», V. Simonet, B. Canals, J. Robert, S. Petit et H. Mutka (Eds.) (EDP Sciences, Les Ulis, ISBN: 978-2-7598-1248-6).

neutron diffractometers for powder and single crystal diffraction and more sophisticated instruments using polarized neutron beams, with or without polarization analysis (N. Qureshi, ILL). Twinning and modulation in crystal structure determination by neutron diffraction are examined in the second chapter (V. Petříček and M. Dušek, Prag). The next chapter deals with the structure and dynamics of aperiodic crystals (C. Mariette et al., Rennes). Chapter 4 shows the importance of neutron diffraction for studying texture in material science (V. Klozek, LLB). The last two chapters introduce two worthy techniques for condensed matter physics: diffuse neutron scattering (I. Mirebeau, LLB) which provides insights on nuclear and magnetic short range ordering and inelastic neutron scattering (S. Petit, LLB) which permits to explore lattice and spin dynamics.

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