

## **New Book on Ultra-Low-Field Nuclear Magnetic Resonance**

April 28, 2014 (HP75). We attract the attention of SNF readers to a new book designed to introduce the reader to the field of NMR/MRI at very low magnetic fields, from millitesla to microtesla, the ultra-low field (ULF) regime. The book *Ultra-Low Field Nuclear Magnetic Resonance: A New MRI Regime* is written by Robert H. Kraus, Jr., Michelle A. Espy Per E. Magnelind and Petr L. Volegov, all of Los Alamos National Laboratory (LANL), and published by Oxford University Press (ISBN 978-0-19-979643-4). It is written for the technical non-specialist, and assumes only the most basic familiarity with the concepts of nuclear magnetic resonance. The book is primarily focused on the application to human brain imaging and hardware methods based upon magnetic field pre-polarization and SQUID-based signal detection. The goal of the text is to provide insight and tools for the reader to better understand what applications are best served by ULF NMR/MRI approaches, as well as how to fairly assess the potential difficulties and limitations of the approach. A discussion of the hardware challenges, such as shielding, operation of SQUID sensors in a dynamic field environment, and pulsed magnetic field generation are presented. One goal of the text is to provide the reader a framework of understanding the approaches to estimation and mitigation of low signal-to-noise and long imaging time, which are the main challenges.

Special attention is paid to the combination of MEG and ULF MRI, and the benefits and challenges presented by trying to accomplish both with the same hardware. The book discusses the origin of unique relaxation contrast at ULF, and gives special considerations to image artifacts (*i.e.*, concomitant gradients, ghost artifacts) and how to correct them. A general discussion of MRI is presented, emphasizing challenges inherent in imaging at ULF and unique opportunities in pulse sequences. The book also presents an overview of some of the primary applications of ULF NMR/MRI being pursued at the time of its writing.

This short overview is not a review of this publication and does not express any opinion on its merits and demerits.