凝聚态物理-北京大学论坛

北京大学物理学院凝聚态物理与材料物理研究所
2022年第13期（No.535 since 2001）

Until it breaks: Nuclear Magnetic Resonance spectroscopy in Diamond Anvil Cells

Dr. rer. nat. habil. Thomas Meier

腾讯会议链接：https://meeting.tencent.com/dm/feA3VpCnRw6r
腾讯会议ID：534-164-811
时间：5月26日（星期四）14:30—17:00

报告人简介（Aboutspeaker）：Thomas Meier is a Staff Scientist at the Center of High Pressure Science and Technology Advanced Research (HPSTAR) in Beijing since June 2021. He graduated from Leipzig University in the Felix-Bloch Institute for Solid-State Physics in 2016 and worked as a visiting researcher and later as an independent research fellow in the Bavarian Geoinstitute in Bayreuth University, Germany. He habilitated in Materials Science and High Pressure Research in May 2021.

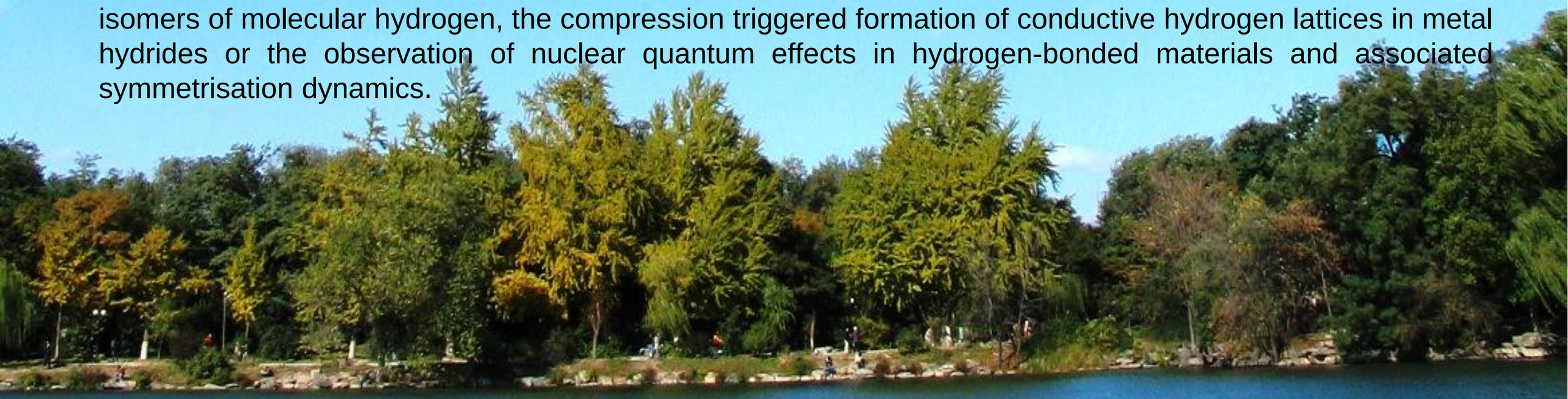
His research focuses on the development and implementation of high-frequency solid-state spectroscopy in diamond anvil cells, in particular Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR) at pressures well into the Mbar range and temperatures above 1000 K.

摘要 (Abstract)：Modern high pressure science rapidly develops into one of the most astonishing fields of condensed matter and solid-state physics as it allows for the generation of static extreme conditions in modern laboratories around the world. Using so-called diamond anvil cell devices, pressures well above 3 Mbar (100 GPa = 1 Mbar) and temperatures in excess of 3000 K can be achieved on a routinely basis.

Such harsh conditions can lead to a manifold of intriguing physical phenomena, such as transitions of a conduction electron`s energy topology, the stabilization of exotic new material phases or room temperature superconductivity.

Systematic spectroscopic structural or physical investigations were, however, largely limited to Raman or UV/VIS spectroscopy, diffraction methods or electronic transport measurements. However, an application of nuclear magnetic resonance (NMR) spectroscopy in diamond anvil cell research was widely considered an impossibility due to low nuclear spin sensitivities of radio frequency transceivers and the overall harsh and isolated conditions present within the sample chambers of high pressure devices.

In this talk, I will outline our technical developments over the last decade, which led to the application of NMR at pressures of up to 200 GPa and temperatures of up to 2500 K. This major advancement of the field led to a number of fascinating experimental observations like pressure induced collapses of the nuclear spin isomers of molecular hydrogen, the compression triggered formation of conductive hydrogen lattices in metal hydrides or the observation of nuclear quantum effects in hydrogen-bonded materials and associated symmetrisation dynamics.



邀请人:刘开辉　khliu@pku.edu.cn

http://www.phy.pku.edu.cn/icmp/xsjl/njtwl__bjdxlt.htm