PAUL SCHERRER INSTITUT

Invitation

LMU-Seminar

Title: **Engineering Approach to Instrumentation Development for High-Pressure Research**

Speaker: **Prof. Konstantin Kamenev**
The University of Edinburgh, United Kingdom

Time: **Wednesday, April 26th 2017, 14:00**

Place: **WBGB/019**

Abstract:

Historically high-pressure (HP) research has been an area that is heavily dependent on the availability of the experimental equipment. Many of the discoveries in HP science followed promptly from breakthroughs in instrumentation development, which provided researchers with higher pressure limits or larger sample volumes. A limited availability of commercial pressure cells and the need to remain at the cutting edge of the research make it likely that anyone working in this field will at some point engage in designing new or in modifying existing HP equipment. However, most HP scientists are not mechanical engineers and it is therefore difficult for them to endeavor in the design process. This presentation aims to introduce an engineering approach to developing pressure cells and to present such generic tools as computer aided design (CAD) and finite element analysis (FEA).

The use of engineering methods in the design of HP equipment will be illustrated using recently developed pressure cells. This includes some new devices for neutron scattering such as a rotator for the Paris-Edinburgh (P-E) press which provides rotational motion of the anvils at loads of up to 100 tonnes and can be used to study large single crystals at pressures of up to 10 GPa[1]. Another example is a gas loader for the P-E press which can be used to load gases into the sample space at pressures over 0.15 GPa for subsequent studies of gases and gas mixtures as well as for use of gases as pressure-transmitting media to pressures of over 6 GPa[2]. A large volume pressure cell with optimized transmission for inelastic neutron scattering will also be presented[3]. The examples of use of FEA for miniaturization of the pressure cells and their components will include miniature pressure cells for X-ray diffraction[4] and magnetic property measurements[5]. The first 3D-printed diamond anvil cell will be presented to illustrate the advantages of using this fast developing manufacturing technique[6].

[1] J. Fang, C. L. Bull, H. Hamidov, J. S. Loveday, M. J. Gutmann, R. J. Nelmes, K. V. Kamenev, Rev. Sci. Instrum. 2010, 81, 113901.

[2] A. Bocian, C. L. Bull, H. Hamidov, J. S. Loveday, R. J. Nelmes, K. V. Kamenev, Rev. Sci. Instrum. 2010, 81, 093904.

[3] W. Wang, D. A. Sokolov, A. D. Huxley, K. V. Kamenev, Rev. Sci. Instrum. 2011, 82, 073903.

[4] G. Giriat, S. Moggach, S. Parsons, K. V. Kamenev, (in preparation).

[5] G. Giriat, W. Wang, J. P. Attfield, A. D. Huxley, K. V. Kamenev, Rev. Sci. Instrum. 2010, 81, 073905.

[6] H. Jin, C. Woodall, X. Wang, S. Parsons, and K. V. Kamenev, Rev. Sci. Instrum. 2017, 88, 035103.