PAUL SCHERRER INSTITUT

Invitation

LMU-Seminar

Title: **Making muons measure unconventional superconductors**

Speaker: **Dr. Pabitra K. Biswas**
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Time: **Wednesday, April 11th 2018, 8:15**

Place: **WBGB/021**

Abstract:

Unconventional superconductivity remains one of the most interesting problems in condensed matter physics. I have used the μSR technique to explore various exotic superconducting properties of several unconventional superconductors. Among them, FeSe is the basic building block of all iron-chalcogenide superconductors. Transverse-field μSR measurements performed along different crystallographic axes of FeSe crystals show that while the superconducting gap is most probably anisotropic but nodeless along the c-axis, it is nodal in the *ab*-plane, as indicated by the linear increase of the superfluid density at low temperature [1]. This is the first direct experimental demonstration of the existence of nodes in the superconducting gap structure of FeSe using a microscopic bulk probe and offers new insights into the still mysterious superconducting mechanism in iron-based superconductors. $Sr_{0.1}Bi_2Se_3$ is a topological superconductor, which is assigned to be fully gapped in the bulk along with gapless surface Andreev bound states. Zero-field μSR measurements performed on $Sr_{0.1}Bi_2Se_3$ show time-reversal symmetry (TRS) breaking superconducting state in this material and provide strong evidence for coexisting singlet and triplet pairing states [2]. ZrB_{12} displays a variety of deviations from the conventional behaviour and lies very close to the cross-over region between type-I and type-II superconductivity. The μSR technique has been successfully used to unveil the superconducting phase diagram of ZrB_{12} which show both type-I and type-II characteristics. We also observe regions of the phase diagram where the type-I and type-II states overlap and coexist, which put strong constraints on the validity of type-1.5 superconductivity in multi-band superconductors [3].

[1] P. K. Biswas, Q. Wang, A. Kreisel, D. T. Adroja, A. D. Hillier, et al., Evidence of nodal gap structure in the basal plane of the FeSe superconductor, submitted for publication (2018).

[2] P. Neha, P. K. Biswas, T. Das, and S. Patnaik, Direct evidence for time-reversal symmetry breaking superconductivity in $Sr_{0.1}Bi_2Se_3$, submitted for publication (2018).

[3] P. K. Biswas, A. D. Hillier, R. P. Singh, N. Parczyk, G. Balakrishnan, et al., Direct evidence of temperature and field-induced type-I and type-II superconductivity in ZrB_{12}, submitted for publication (2018).