GOETHE UNIVERSITÄT FRANKFURT AM MAIN

Fachbereich Physik
Institut für Theoretische Physik

CONDENSED MATTER THEORY SEMINAR

Subject: **Crystalline spin-orbital liquids with an emergent SU(4) symmetry**

Speaker: **Masahiko G. Yamada, the Institute for Solid State Physics, University of Tokyo**

Date & time: **Friday, October 20th, 2017 at 3.15 p.m.**

Venue: **Seminar room 1.114**

A promising approach to realize quantum spin liquids is to enhance the spin-space symmetry from usual SU(2) to SU(N). While the SU(N) symmetry with a general N is proposed in ultracold atoms using nuclear spin degrees of freedom, its realization in magnetic materials is challenging. Here we propose a new mechanism by which the SU(4) symmetry emerges in the strong spin-orbit coupling limit. The spin-orbit coupling in d^1 transition metal compounds with edge-sharing anion octahedra leads to strongly bond-dependent hopping, which is apparently not SU(4)-symmetric. However, in the honeycomb structure, a gauge transformation maps the system to an SU(4)-symmetric Hubbard model. In the strong repulsion limit at quarter filling, the low-energy effective model is the SU(4) Heisenberg model on the honeycomb lattice, which cannot have a trivial gapped ground state and is expected to host a gapless spin-orbital liquid. By generalizing this model to other three-dimensional lattices, we also propose crystalline spin-orbital liquids protected by this emergent SU(4) symmetry and space group symmetries.