

# 凝縮系物理学ゼミナール

## Condensed Matter Seminar

Location: Room 413, School of Science Bldg. 5 (理学 5 号館 413 号室)

Time and date: 15:30 – 17:00, Monday, 9 September 2013

### **Fractional Chern insulators - explorations of higher Chern bands in the Hofstadter Butterfly**

Speaker: Dr Gunnar Möller

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Abstract:

Topological flat bands can give rise to incompressible quantum liquids known as fractional Chern insulators (FCI). We show how the topological order of such FCI's in bands with Chern number  $C=1$  is related to fractional quantum Hall phases in a continuum Landau level by an explicit adiabatic continuation procedure.

Going beyond  $C=1$ , we note that the fractal spectrum of a charged particle on a lattice pierced by a homogenous flux density provides bands of any Chern number. Using the fact that magnetic flux per plaquette is defined only modulo the flux quantum, we explicitly construct the Hofstadter problem at flux density  $n_\phi = p/q$  in terms of a magnetic unit cell of  $q$  sites.

We review the understanding of strongly correlated phases occurring when Hofstadter bands are filled by bosons with repulsive interactions, including composite fermion states at general flux densities and variants of Halperin states found near rational flux densities. Here, we analyse the nature of these phases in the language of fractional Chern insulators, asking in particular to which extent the problem of interacting bosons in the Hofstadter bands is represented faithfully by the projection to the flattened lowest energy band.