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Synthetic Flux Attachment

Tuesday 15 December 2020 14:00 (30 minutes)

Flux attachment is a mechanism by which charged particles capture magnetic flux quanta and form composite entities. As a consequence of flux dressing, these composites may acquire fractional quantum numbers (e.g. electric charge) and statistics. This phenomenon is directly associated to the emergence of a Chern-Simons gauge field.

Although charge-neutral systems do not couple to vector potentials, geometric (Berry) phases induced in ultracold neutral atoms allow emulating the behaviour of charged particles in electromagnetic fields. Nowadays, these phases can be engineered in Bose-Einstein condensates by means of laser coupling.

We describe how a suitable interaction of this light-matter system generates an effective singular nonlinear gauge potential. Such a field is a function of matter density and performs a laser-tuned version of flux attachment. We derive bottom-up the macroscopics (i.e. emergence) of an Abelian Chern-Simons theory from a microscopic, weakly-interacting system of bosons. We find that the effective description of the condensate is that of a fractional quantum Hall fluid where anyonic flux-charge vortices are formed. Finally, we outline the implementation of the current scheme and its implications as a quantum simulation of a gauge theory in 2+1D that uses a single atomic species only.

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Will you be pre-recording your talk?

No

Length of talk

15-25 minutes

Are you happy for your talk to be recorded?

Yes

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