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Few Body Physics in Synthetic Dimensions with SU(N) Interactions[1] SUDEEP K. GHOSH, UMESH K. YADAV, VIJAY B. SHENOY, Department of Physics, Indian Institute of Science — Cold atomic systems with SU(N) symmetric interactions have been of recent experimental and theoretical interest. Motivated by this, we study few body physics in such systems which also realize synthetic dimensions (Celi et al., PRL 112, 043001) within the cold atom setting by coupling the atomic hyperfine states via light. Choosing the light appropriately also provides ability to control magnetic flux in the plaquettes of the synthetic lattice. Using a combination of exact diagonalization and analytical methods, we uncover the novel physics that emerges in the interplay of non-local interactions in synthetic dimensions and the magnetic flux. Attractive SU(N) interactions, in absence of flux, obtains a sequence of multi-particle "baryonic" bound states. We show how the presence of flux stabilizes a different sequence of baryonic states, presenting a detailed few body phase diagram. We also discuss consequences of our findings to the many body setting, pointing out the novel phases that can be realized in these systems. These results will be of interest to both experimentalists (suggesting systems with novel physics), as well as theorists for exploring the novel phases realized.

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