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Baryon squishing in synthetic dimensions by effective $SU(M)$ gauge fields[1] SUDEEP KUMAR GHOSH, UMESH K. YADAV, VIJAY B. SHENOY, Indian Institute of Science Bangalore — We investigate the physics of $SU(M)$ symmetric interactions in the "synthetic dimensions" (Celi et al., PRL 112, 043001 (2014)) that provides a cold atom realization of the Hofstadter model. We show that this system is equivalent to particles (with $SU(M)$ symmetric interactions) experiencing an $SU(M)$ Zeeman field at each lattice site *and* a non-Abelian $SU(M)$ gauge potential that affects their hopping. This equivalence brings out the possibility of generating *non-local* interactions between particles at different sites of the optical lattice. In addition, the gauge field induces a *flavor-orbital coupling*, which mitigates the "baryon breaking" effect of the Zeeman field. For M particles, concomitantly, the $SU(M)$ singlet baryon which is site localized in the usual 1d optical lattice, is deformed to a non-local object ("squished baryon"). We conclusively demonstrate this effect by analytical arguments and exact (numerical) diagonalization studies. Our study promises a rich many-body phase diagram for this system. It also uncovers the possibility of using the synthetic dimension system to laboratory realize condensed matter models such as the $SU(M)$ random flux model, inconceivable in conventional experimental systems. Reference: arXiv:1503.02301

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