How does a synthetic non-Abelian gauge field influence the bound states of two spin-1/2 fermions?¹ JAYANTHA VYASANAKERE, VIJAY SHENOY, Indian Institute of Science, Bangalore — We study the bound states of two spin-1/2 fermions interacting via a contact attraction (characterized by the scattering length) in the singlet channel in 3D space in presence of a uniform non-Abelian gauge field. The configuration of the gauge field that generates a Rashba type spin-orbit interaction is described by three coupling parameters ($\lambda_x, \lambda_y, \lambda_z$). For a generic gauge field configuration, the critical scattering length required for the formation of a bound state is negative, i.e., shifts to the “BCS side” of the resonance. Interestingly, we find that there are special high-symmetry configurations (e.g., $\lambda_x = \lambda_y = \lambda_z$) for which there is a two body bound state for any scattering length however small and negative. Our results show that the BCS-BEC crossover is drastically affected by the presence of a non-Abelian gauge field. We discuss possible experimental signatures of our findings both at high and low temperatures.

¹Work supported by DST, India through Ramanujan grant