**Ghost Rotationally-Invariant Slave-Boson: An Efficient and Accurate Approach to Strongly Correlated Materials**

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The rotationally-invariant slave-boson (RISB) approach is a highly efficient method for simulating strongly correlated systems [1]. When combined with density functional theory (DFT+RISB), it becomes a powerful tool for studying strong correlation effects in materials [2,3]. However, despite its efficiency, the RISB method sometimes suffers from insufficient accuracy, leading to inaccurate descriptions of material properties, such as the overestimation of the critical Coulomb interaction for Mott transitions [4].

In this talk, I will introduce a systematic way to enhance the accuracy of RISB by introducing auxiliary ghost orbitals, which we refer to as the ghost-rotationally-invariant slave-boson (g-RISB) method or equivalently ghost-Gutzwiller approximation [5]. I will first present examples of transition metal oxides where DFT+RISB necessitates the use of unrealistic Coulomb parameters, significantly deviating from first-principle calculated values, to reproduce the experimental observations [4]. Subsequently, I will demonstrate how DFT+g-RISB offers a systematic approach to improve the accuracy of DFT+RISB, enabling accurate descriptions of correlated materials with realistic Coulomb interactions [6,7,8]. Moreover, I will compare the accuracy and efficiency of g-RISB with the well-established dynamical mean-field theory (DMFT) and discuss the advantages and disadvantages of g-RISB over DMFT.

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