High Energy Physics - Lattice

Exploring Three-Nucleon Forces in Lattice QCD

Takumi Doi (Tsukuba U., GSPAS), Sinya Aoki, (Tsukuba U., GSPAS and Tsukuba U., CCS), Tetsuo Hatsuda (Tokyo U. and Tokyo U., IPMU, and Nishina Ctr., RIKEN), Yoichi Ikeda (Tokyo Inst. Tech.), Takashi Inoue (Nihon U., Fujisawa), Noriyoshi Ishii (Tsukuba U., CCS), Keiko Murano (Nishina Ctr., RIKEN), Hidekatsu Nemura (Tohoku U.), Kenji Sasaki (Tsukuba U., GSPAS), for HAL QCD Collaboration

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Three-nucleon forces (3NF) are investigated from two-flavor lattice QCD simulations. We utilize the Nambu-Bethe-Salpeter (NBS) wave function to determine two-nucleon forces (2NF) and 3NF in the same framework. As a first exploratory study, we extract 3NF in which three nucleons are aligned linearly with an equal spacing. This is the simplest geometrical configuration which reduces the huge computational cost of calculating the NBS wave function. Quantum numbers of the three-nucleon system are chosen to be (I, J^P)=(1/2,1/2^+) (the triton channel). Lattice QCD simulations are performed using N_f=2 dynamical clover fermion configurations at the lattice spacing of a = 0.156 fm on a 16^3 x 32 lattice with a large quark mass corresponding to m_\pi= 1.13 GeV. We find repulsive 3NF at short distance in the triton channel. Several sources of systematic errors are also discussed.

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