

# Two heavy fermions bound via Higgs boson exchange

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A system of two heavy fermions, leptons or quarks of the fourth generation, which are bound together via the Higgs boson exchange is studied. The conventional Yukawa-type interaction produced by this exchange is accompanied by several important corrections. We derived the Hamiltonian, which describes the correction arising from the retardation (compare the Breit correction in QED); we also calculated the relativistic and radiative corrections. The Higgs-induced bound state appears for the fermion mass  $m > m_{cr} \approx 500$  GeV. When the long-range Coulomb interaction or the gluon exchange are included, the bound states exist for any mass, but the Higgs exchange drastically increases the binding energy of these states when  $m$  is approaching  $m_{cr}$ . In the region  $m > m_{cr}$  the gluon exchange gives a sizable correction to the Higgs induced binding energy. This correction greatly exceeds typical binding energies in the states produced via the gluon exchange only. The possibility of detection of the considered bound states at LHC is discussed.

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