Non-mesonic weak decay of the hypertriton with effective field theory

Axel Pérez-Obiol[12], Andreas Nogga[3], David R. Entem[4]

[1] Departament d'Estructura i Constituents de la Matèria, Institut de Ciències del Cosmos (ICC), Universitat de Barcelona, Martí i Franquès 1, E-08028 Barcelona, Spain

[2] Nuclear Physics Institute, 25068 Řež, Czech Republic

[3] Institute for Advanced Simulation, Institut für Kernphysik, and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany

[4] Grupo de Física Nuclear and Instituto Universitario de Física Fundamental y Matemáticas (IUFFyM) Universidad de Salamanca, E-37008 Salamanca, Spain

The non-mesonic weak decay rate of the hypertriton —for which recently a specially short lifetime has been measured [1]— has been computed within the effective field theory (EFT) framework. Strong, next-to-leading order (NLO), YN and NN EFT potentials [2] have been used to obtain the initial wave function of the hypertriton and to solve the final state interactions (FSI) among the decay products through the Faddeev-Yakubovsky equations. For the weak $\Lambda N \to NN$ transition the leading order (LO) EFT potential has been implemented and the relation between the corresponding LO low energy constants and the decay rate has been studied. The weak $\Lambda N \to NN$ potentials at NLO in momentum [3] and position space have also been computed. This calculation has been done previously using the one-meson-exchange potentials (OME) [4]. Applying the same OME potentials in the partial wave approximation we observed the same results, which served as a test of our calculations. The role of the strong FSI is being studied at present.

[1]   C. Rappold et al., Phys. Lett. B, vol. 728, pp. 543-548, 2014.

[2]   H. Polinder, J. Haidenbauer, and U. G. Meissner, Nucl. Phys. A, vol. 779, pp. 244-266, 2006.

[3]   A. Pérez-Obiol, D. R. Entem, B. Juliá-Díaz, and A. Parreño, Phys. Rev. C, vol. 87, p. 044614, 2013.

[4]   J. Golak et al., Nucl. Phys. A, vol. 631, pp. 740-744, 1998.