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Effective Field Theory and Pseudospin Symmetry¹

JOSEPH GINOCCHIO, Los Alamos National Laboratory — Recently effective field theories have been developed which derive effective nucleon-nucleon interactions which involve the spin. We may ask why don't these expansions naturally involve the pseudospin [1] as well? First we found that the spin-spin interaction between nucleons is equivalent to the pseudospin-pseudospin interaction between nucleons. Second we showed that the tensor interaction is a spin-pseudospin interaction. This is an interesting insight and implies that the tensor interaction violates both spin and pseudospin equally. However, the two body spin-orbit and the two body pseudospin-pseudo-orbit interactions are not equivalent and imply different physics. The two body pseudospin-pseudo-orbit interaction can be written in terms of a linear combination of the two body spin-orbit interaction and the tensor interaction. Although the tensor interaction conserves neither spin or pseudospin, the two body spin-orbit interaction conserves spin but not pseudospin and, vice-versa, the two body pseudospin-pseudo-orbit interaction conserves pseudospin but not spin. This suggests that, instead of writing the effective nucleon-nucleon interaction in terms of the tensor interaction, a more revealing exposition would to be to write the effective nucleon-nucleon interaction as a linear combination of the two body spin-orbit interaction and two body pseudospin-pseudo-orbit interaction.

[1] Joseph N. Ginocchio, Physics Reports 414, 165 (2005).

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