Isospin beaking in hadronic reactions

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In the standard model the isospin symmetry is borken by electro magnetic interactions as well as the difference in the quark masses. Given a systematic scheme that allows onr to disentangle these two effects it is possible to get direct access to quark mass ratios from low and medium energy hadronic reactions.

Recently interest in isospin breaking reactions has revived due to the measurement of a forward–backward asymmetry in $pn \to d\pi^0$ as well as the total cross section for $dd \to \alpha\pi^0$—both quantities vanish in an isospin symmetric world. After a brief introduction, in my talk I will present the current status of the theoretical analysis for these reactions. In particular a consistent and convergent power counting scheme for pion production in nucleon–nucleon collisions will be presented, that is mandatory for a model independent extraction of the relevant low energy constants. I will also discuss the important role that a measurement of $dd \to \alpha\pi^0$ at higher excess energies will play for an unambigous extraction of the various isospin violating matrix elements that enter the calculation. This measurement is feasable with WASA at COSY.

In addition, I will briefly discuss how the isospin violating $a_0(980) - f_0(980)$ transition amplitude can be studied in dd and pn induced production reactions—a quantity that is believed to reveal important information on the nature of these lightest scalar mesons.

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