Comment on "πNN Coupling from High Precision *np* Charge Exchange at 162 MeV"

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In a recent letter [1], a measurement of the *np* differential cross section in the backward direction at a single energy T_{lab} = 162 MeV was reported. These 31 data were then used to extract for the charged pion-nucleon coupling constant the value $f_c^2 = 0.0808$, with an extrapolation error of 0.0003 and a normalization error of 0.0017.

We make the observation that this coupling constant has been determined in recent years by several groups in various energy-dependent partial wave analyses (PWA) which give very good fits to *several thousands* of *np* [2, 3, 4], πN [5, 6], and $\overline{p}p$ charge-exchange [7] scattering data. The values of f_c^2 determined in these different PWA's are in excellent agreement. A representative value (with error) for this coupling constant is $f_c^2 = 0.0748(3)$ [8].

The backward *np* differential cross section is sensitive to f_c^2. That it is *therefore* a good place to determine this coupling constant is a widespread misunderstanding. This has been shown [8] in an energy-dependent PWA of the *np* data. The backward *np* data do not show any *particular* sensitivity to f_c^2. In table V of [8] one can see that in our energy-dependent PWA using *all np* scattering data and *all* types of observables, f_c^2 shows no special sensitivity to any particular type of observable.

In the same paper it has been shown, using physical extrapolation techniques, that analyzing backward *np* data at a single energy, as in Ref. [1], gives values of f_c^2 with a large spread which result in a total error of 0.003, which is 10 times larger than the extrapolation error claimed in [1]. This was confirmed by Arndt *et al.* [9], who used exactly the same techniques as used in [1] for *all* the available backward data, and not for only one dataset as was done in [1]. Their values for f_c^2 as determined at a single energy vary from 0.061 to 0.091 with an average of 0.075 and an error of 0.009, which is 30 times the extrapolation error quoted in [1].

The extrapolation method of Ericson *et al.* relies heavily on the absolute normalization of the data. Normalizing *np* cross sections is very difficult. In their determination of f_c^2 it is another important source of uncertainty. In energy-dependent PWA's, however, as in [2], one does not need normalized data to determine the coupling constant; one can use the *shapes* of the measured differential cross sections.

The authors have applied their method for extraction of f_c^2 to data which cannot be described satisfactorily by either the Nijmegen PWA [2] or the VZ40 PWA of Arndt *et al.* [4]. The Nijmegen PWA gives, after refitting, $\chi^2 = 264.0$ for these 31 data points and the VPI&SU PWA gives $\chi^2 = 236.7$. One reason for the bad fit can be seen in the large discrepancy between the shape of the newly reported data and the shape of the older data of Bonner *et al.* [10] at exactly the same energy. The authors should have reported f_c^2 from applying their extrapolation method to the Bonner data and compared the results. However, the new data disagree not only with the Bonner data, they disagree with the whole Nijmegen *np* data set, consisting of circa 3900 data below 500 MeV. They disagree because their shape is *more than* 25 standard deviations (sd) away from both the Nijmegen and VPI&SU databases. Such a shape we consider, for statistical reasons, to be wrong.

Our conclusions are as follows: (i) The experimental data *as presented* are statistically flawed (more than 25 sd). This is at least partially caused by the way these data are normalized. Similar data [11] at 96 MeV from the same group are not included in the Nijmegen database [2] because they also disagree significantly with the total dataset. (ii) Achieving an *accurate* determination of f_c^2 from the backward *np* data at one single energy is a rather unrealistic exercise. To determine f_c^2 accurately, we have shown that the energy-dependent PWA's are superior.

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M.C.M. Rentmeester, R.A.M. Klomp, and J.J. de Swart
Institute for Theoretical Physics,
University of Nijmegen,
Nijmegen, the Netherlands
E-mail: `swart@sci.kun.nl`

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