The Bethe–Salpeter Equation and Unitarization of χpT Amplitudes.

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The Bethe-Salpeter equation restores exact elastic unitarity in the $s-$ channel by summing up an infinite set of chiral loops. We use this equation to show how a chiral expansion can be undertaken in the two particle irreducible amplitude and the propagators accomplishing exact elastic unitarity at any step. Renormalizability of the amplitudes can be achieved by allowing for an infinite set of counter-terms as is the case in ordinary Chiral Perturbation Theory. Crossing constraints can be imposed on the parameters to a given order. Within this framework, we study the $s-$wave meson-baryon scattering, for the strangeness $S = 0$ sector, in a coupled channel formalism, and the leading and next-to-leading contributions to the vector pion form factor. In the latter case, Watson's theorem is automatically satisfied and obtain a quite accurate determination of some of the ChPT $SU(2)-$low energy parameters ($\bar{l}_1 - \bar{l}_2 = -6.1^{+0.1}_{-0.3}$ and $\bar{l}_6 = 19.14 \pm 0.19$). Extensions to the study of Kl_3 form-factors are also discussed. For the meson-baryon scattering process, four channels have been considered: πN, ηN, $K\Lambda$, $K\Sigma$, and a good overall description of data, from πN threshold up to 2 GeV, including masses and widths of the $S_{11}-$ $N(1535)$ and $-N(1650)$ resonances is achieved (see Fig. 1). Some more details can be found in Refs. [1] and [2].

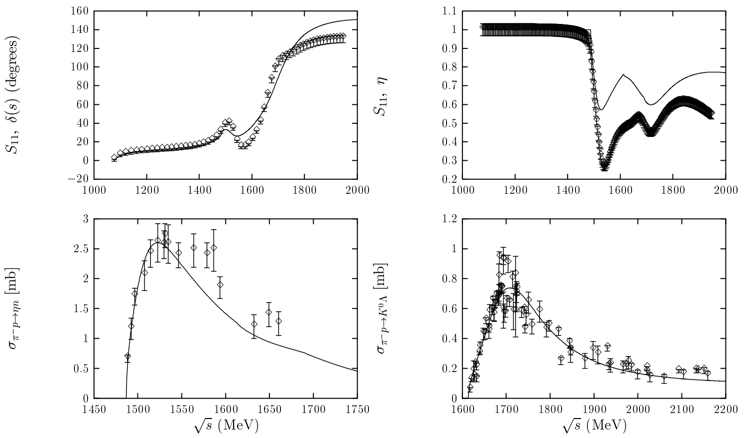

Figure 1: πN scattering BSE results as a function of C.M. energy $\sqrt{s}$. Upper left pannel: S_{11} phase shifts. Upper right pannel: inelasticity in the πN channel. Lower left pannel $\pi N \to \eta N$ cross section. Lower right pannel $\pi N \to K\Lambda$ cross section.

References

[1] J. Nieves and E. Ruiz Arriola, Phys. Lett. **B 455** (1999) 30; *ibidem* Nucl. Phys. **A679** (2000) 57.

[2] J. Nieves and E. Ruiz Arriola, Phys. Rev. **D64**, 116008 (2001).