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ON THE NATURE OF THE ABC EFFECT

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The ABC effect, a dramatic enhancement at a missing mass around 300 MeV observed in the reactions $p + d \rightarrow {}^3He + MM$ and $n + p \rightarrow d + MM$, has been the subject of much dissatisfying speculation. Originally thought to be the vector meson when the earliest searches for this were made, this idea was abandoned when the study of other reactions showed that there was no resonance structure in the $\pi\pi$-scattering amplitude at this energy. Recently some light has been cast on the nature of this process by the Saclay deuteron group who observed that the ABC enhancement is largest when the total c.m. energy is larger than the masses of the incident particles by about 600 MeV. This would lead one to suspect that the effect is tied somehow to the excitation of two $\Delta(1236)$-resonances.

This possibility in the reaction $np \rightarrow d\pi\pi$ was explored by two of the authors (T.R. and M.D.S., Phys. Letters 43B(1973)68), who were able to reproduce the enhancement, its supposed isoscalar nature, and its dependence on the total c.m. energy, without adjustable parameters. An enhancement at very large missing masses predicted by the model has been observed recently by the Saclay deuteron group (see elsewhere in this volume). That this mechanism might be responsible for the low-mass enhancement was shown also by the Tel-Aviv-Heidelberg bubble-chamber collaboration in a not altogether different approach analysing slightly different data (I. Bar-Nir et al., to be published). The $\Delta\Delta$-excitation also accounts for the c.m. energy at which the ABC effect occurs in other reactions and there are indications that it may account as well for certain peculiarities of the reaction $pd \rightarrow {}^3He\,\pi\pi$.

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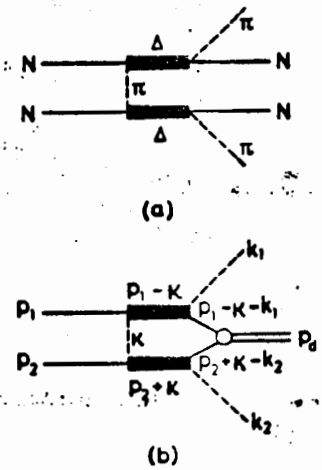
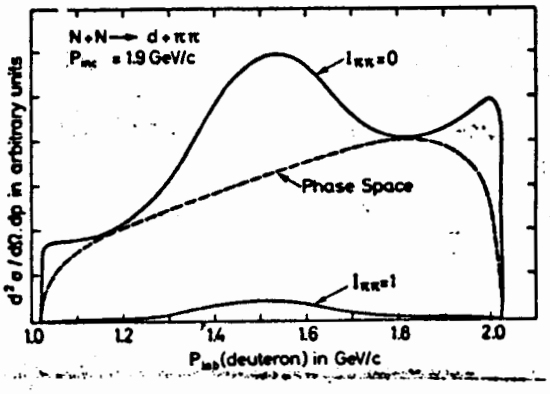


. Feynman diagrams for the reactions NN → NNππ and NN → dπ.



. Calculated deuteron recoil-momentum spectra in the laboratory for the isospin-zero and isospin-one channels for deuterons emitted at 0 deg.