Zero-Contours in Low-Energy $K-\pi$ Scattering.

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(recevuto il 15 Luglio 1974)

**Summary.** — The paths of zeros of the low-energy $K-\pi$ scattering amplitudes $A_{K\pi}$ and $A_{K\pi}$ are examined in a simple $K^*$ and $\rho$ dominance model, where it is found that the roles of PCAC zero, $K^*$ and $\rho$ Legendre zero, and double-pole-killing zero are played by the same zero-contour in the $(s, t, u)$-plane, an ellipse for the first amplitude, an ellipse plus the line $s = u$ for the second one. The behaviour of these zero-contours in the $u$-channel physical region is studied in comparison with the experimental zeros determined from the $K^+\pi^- \rightarrow K^+\pi^-$ and $K^+\pi^0 \rightarrow K^0\pi^\pm$ scattering results, and it is found that up to the $K^*$ mass region the elliptic contour of $A_{K\pi}$ is essentially unaffected by unitarity, whilst the elliptic contour of $A_{K\pi}$ is slightly more sensitive to such constraints. A comparison with the behaviour of the zeros of the corresponding $\pi-\pi$ amplitudes $A_{\pi\pi}$ and $A_{\pi\pi}$ is also performed.

1. - Introduction.

A few years ago ODORICO has provided a possible explanation of meson-meson scattering data in terms of a hypothesis of a global structure for the straight-line propagation of nearby zeros of the scattering amplitude, whereby lines passing through the intersections of resonances in different channels also pass through the Legendre zeros of resonances in the physical regions of the $(s, t, u)$-plane (1-3).

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Since then numerous studies of zero-contours of the $\pi\pi$ scattering amplitude have been performed using the experimental phase shifts (4,7). Several of them disagree with certain predictions made by ODORICO, such as for example the analyses of PENNINGTON and PROTOPOPESCU (4) and of EGUCHI et al. (5) which contest the suggestion that the anomalous behaviour of the experimental moment $\langle Y_0^4 \rangle$ at 0.98 GeV may be seen as a consequence of the entry in the physical region of a zero at fixed $s = 4\mu^2 - 2m^2$. Nevertheless on the whole these studies find this straight-line zero hypothesis as a reasonable approximation to reality when viewing the Mandelstam plane from afar. However in any local region zero-contours are far from straight, and this is especially evident in the low-energy region as is discussed by PENNINGTON and SCHMID in ref. (8).

The theoretical analysis of ARNEODO, GUERIN and DONOHUE (9) is also very significant of this feature since it emphasizes that, in a simple nonunitary $\rho$ dominance model, the nearby zero-contours of low-energy $\pi\pi$ scattering amplitudes $A_{\pi\pi}(s, t, u)$ and $A_{\pi\pi}^{\pi\pi}(s, t, u)$ form a closed curve: a circle in the $(s, t, u)$-plane. This circle plays the respective roles of PCAC zero, $\rho$ Legendre zero and double-pole-killing zero, and is in large part rather stable when unitarity is enforced.

Such experimental and theoretical studies have not been performed in $K\pi$ scattering. Thus we propose in this article to examine the behaviour of the zero-contours of the low-energy $K\pi$ amplitudes; first in a pure $K^*$ and $\rho$ dominance model, which is a model for the whole amplitude and consequently permits us to define the zero-contours in the unphysical as well as the physical regions; then as determined from the experimental phase shift analyses of the reactions $K^+\pi^- \to K^+\pi^-$ and $K^+\pi^0 \to K^0\pi^+$ (10-13), i.e. only in particular physical

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