THE $\rho(770)$

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The determination of the parameters of the $\rho(770)$ is beset with many difficulties because of its large width. In physical region fits for hadroproduced ρ mesons, the line shape does not correspond to a relativistic Breit-Wigner function with a P-wave width, but requires some additional shape parameter. This dependence on parameterization was demonstrated long ago [1]. Bose-Einstein correlations are another source of shifts in the $\rho(770)$ line shape, particularly in multiparticle final state systems [2].

The same model dependence afflicts any other source of resonance parameters, such as the energy-dependence of the phase shift δ_1^1, or the pole position. It is, therefore, not surprising that a study of $\rho(770)$ dominance in the decays of the η and η' reveals the need for specific dynamical effects, in addition to the $\rho(770)$ pole [3,4].

The cleanest determination of the $\rho(770)$ mass and width comes from e^+e^- annihilation and τ-lepton decays. Barate *et al.* [5] shows that the charged $\rho(770)$ parameters measured in τ-lepton decays are consistent with those of the neutral one determined from e^+e^- data [6]. This conclusion is qualitatively supported by the high-statistics study of Anderson *et al.* [7]. However, model-independent comparison of the two-pion mass spectrum in τ decays, and the $e^+e^- \to \pi^+\pi^-$ cross section, gives indications of discrepancies between the overall normalization: τ data are about 3% higher than e^+e^- data [7,8]. A detailed analysis using such two-pion mass spectra from τ decays measured by OPAL [9], CLEO [7], and ALEPH [10], as well as recent pion form factor measurements in e^+e^- annihilation by CMD-2 [11,12], show that the discrepancy can be as high as 10% above the ρ meson [13,14]. This discrepancy remains after recent measurements of the two-pion cross section in e^+e^- annihilation at KLOE [15,16] and SND [17,18]. The effect is not accounted for by isospin breaking [19–21], but the accuracy of its calculation may be overestimated [22,23]. Ghozzi [24] suggests that this effect can be explained if the

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charged ρ mass were higher than that of the neutral one by a few MeV. Existing theoretical models of the possible mass difference predict either a much smaller value [25], or a heavier neutral ρ meson [26]. Experimental accuracy is not yet sufficient for unambiguous conclusions. The size of the effect is also sensitive to the possible width difference [27,28]. The dicrepancy between e^+e^- and τ becomes smaller after a new measurement of the pion form factor using radiative return at BaBar [29], a high-statistics study of τ decays into two pions at Belle [30] and reanalysis of isospin breaking effects [31]. Benayoun *et al.* [32,33] performs a detailed analysis of the whole set of the ρ, ω, and ϕ decays, consistently taking into account mixing effects in the hidden local symmetry model, and claims that in this approach τ decays to two pions can be naturally accounted for.

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