THE $f_0(1710)$

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The $f_0(1710)$ is seen in the radiative decay $J/\psi(1S) \rightarrow \gamma f_0(1710)$; therefore $C = +1$. It decays into 2η and $K^0_S K^0_S$, which implies $I^G J^{PC} = 0^+(even)^{++}$. The spin of the $f_0(1710)$ has been controversial, but evidence for spin 0 has accumulated recently in all production modes.

An analysis of radiative $J/\psi(1S)$ decays at BES into $\pi^+\pi^-\pi^+\pi^-$ (BAI 00) clearly favors spin 0. Combined amplitude analyses of the K^+K^-, $K_S K_S$, and $\pi^+\pi^-$ systems produced in $J/\psi(1S)$ radiative decay by MARK III (CHEN 91 and more recently DUNWOODIE 97) find a large spin-0 component, as well as reproducing known parameters of the $f_2(1270)$ and $f_2'(1525)$. In addition, a recent reanalysis (BUGG 95) of the 4π channel from MARK III, allowing both $\rho\rho$ and two $\pi\pi$ S waves, also finds a 0^{++} assignment for the $f_0(1710)$. Earlier analyses of this final state (BISELLO 89B, BALTRUSAITIS 86B) found only pseudoscalar activity in the $f_0(1710)$ region, but considered only the process $J/\psi(1S) \rightarrow \gamma\rho\rho$. Similarly, earlier analyses of the K^+K^- system based on less statistics (BALTRUSAITIS 87, BAI 96) found a spin of 2 for the $f_0(1710)$.

A similar situation is present in central production, with earlier analyses favoring spin 2 over spin 0 (ARMSTRONG 89D). More recent analyses with greater statistics [BARBERIS 99 (K^+K^-,$K_S K_S$), BARBERIS 99B ($\pi^+\pi^-$), and FRENCH 99 (K^+K^-)], however, clearly indicate spin 0, and exclude spin 2. Generally, analyses preferring spin 2 concentrate on angular distributions in the $f_J(1710)$ region, and do not include possible interferences or distortion due to the nearby $f_2'(1525)$.

The $f_0(1710)$ is also observed in $K\overline{K}$ (FALVARD 88) in $J/\psi(1S) \rightarrow \omega K\overline{K}$ and $J/\psi(1S) \rightarrow \phi K\overline{K}$, but with no spin-parity analysis, as well as in $\eta\eta$ in radiative $J/\psi(1S)$ decays (EDWARDS 82). It is also clearly seen in 300-GeV/c pp central production in both K^+K^- and $K^0_S K^0_S$ (ARMSTRONG 89D). Mass and width are determined via a fit to non-interfering Breit-Wigners over a polynomial background, which leads to large systematic errors for the width. ARMSTRONG 93C also sees a broad peak in $\eta\eta$ at 1747 MeV, which may be the $f_0(1710)$.

This resonance is not observed in the hypercharge-exchange reactions $K^- p \to K^0_S K^0_S \Lambda$ (ASTON 88D) and $K^- p \to K^0_S K^0_S Y^*$ (BOLONKIN 86); these non-observations are explained by a spin of 0 (LINDENBAUM 92). It is not observed in $\overline{p}p$ interactions, neither via its $\pi\pi$ nor its $\eta\eta$ decay (AMSLER 02). A possible observation in $\gamma\gamma$ collisions leading to $K_S K_S$ (BRACCINI 99, but no spin determination), and a non-observation in $\gamma\gamma \to \pi^+\pi^-$ (BARATE 00E), are consistent with a large $\overline{s}s$ component.

References

References may be found at the end of the $f_0(1710)$ Listing.