

## THE $f_0(1710)$

Updated April 2002 by M. Doser (CERN).

The  $f_0(1710)$  is seen in the radiative decay  $J/\psi(1S) \rightarrow \gamma f_0(1710)$ ; therefore  $C = +1$ . It decays into  $2\eta$  and  $K_S^0 K_S^0$ , 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  $4\pi$  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  $K\bar{K}$  (FALVARD 88) in  $J/\psi(1S) \rightarrow \omega K\bar{K}$  and  $J/\psi(1S) \rightarrow \phi K\bar{K}$ , 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  $K_S^0 K_S^0$  (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  $K^-p \rightarrow K_S^0 K_S^0 \Lambda$  (ASTON 88D) and  $K^-p \rightarrow K_S^0 K_S^0 Y^*$  (BOLONKIN 86); these non-observations are explained by a spin of 0 (LINDENBAUM 92). It is not observed in  $\bar{p}p$  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  $\gamma\gamma \rightarrow \pi^+\pi^-$  (BARATE 00E), are consistent with a large  $\bar{s}s$  component.

## References

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