Search for "Missing" Resonances in the Electroproduction of Omega Mesons

V. Burkert, H. Funsten, D.M. Manley, B. Mecking, Spokespersons

Electroproduction of \( \omega \) mesons via the \( ep \rightarrow ep\pi^+\pi^-X \) reaction will be used at CEBAF to search for a group of "missing" \( N^* \) resonances not observed in \( \pi N \) scattering and predicted to lie in the mass region between \( \omega \) production threshold and 2.2 GeV. The two-pion background contribution underneath the \( \omega \) peak in the missing mass spectrum is eliminated by requiring detection of the \( \pi^+\pi^- \) pair.

The \( \omega N \) decay channel is well suited to search for "missing" resonances because of the narrow 9-MeV \( \omega \) decay width. It is sensitive to these resonances because the isoscalar \( \omega \) can couple with the proton only to \( I = \frac{1}{2} \) resonances and the quark-model predictions by Koniuk \(^1\) and Isgur \(^2\) show that the \( \omega N \) decay of these resonances should be generally as strong as their other decays. Decay by the \( \pi N \) channel is predicted to be weak.

Two nonresonant processes \( t \) channel \( \pi \) exchange and vector-meson-dominated diffraction, are strong and could easily mask a resonance signal, particularly at forward angles. The differential cross section was calculated taking into account these two processes and a \( N^*(1955)5/2^+ \) "missing" resonance, predicted to have strong \( \gamma N \) and \( \omega N \) couplings and an almost vanishing \( \pi N \) coupling.\(^1,2\) The calculation showed that backward \( \omega \) production is dominated by the resonance contribution.

Data for \( \omega \) production in the resonance region are sparse. In the \( \omega \) electroproduction data of Joos et al.\(^3\) at \( W = 1.9 \) GeV, \( 0.3 < -Q^2 < 1.4 \) (GeV)\(^2\), there is evidence of a leveling off of the differential cross section at backward angles, which is suggestive of resonance production. A similar indication for resonance production appears in the \( \omega \) photoproduction data of the ABBHHM\(^4\) collaboration at \( W = 2.2 \) GeV. Our cross section calculation agrees with the \( W = 2.0 \) GeV photoproduction data over all angles, indicating the possibility of resonance(s) with an \( \omega N \) decay. In the previous experiments no attempt was made to study a resonance-induced variation of the backward-angle cross section with \( W \).

The angular correlation of the \( \omega \)-decay plane was also calculated. The results indicate a strong resonance signal even in the presence of appreciable \( \pi \) exchange and diffraction at nonforward scattering angles.

\[^{4}\] ABBHHM Collaboration, Phys. Rev. 175, 1669 (1968).