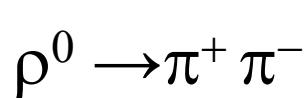


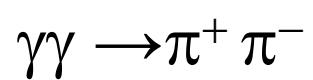
Inteference of s-wave  $\pi\pi$  Primakoff photo-production with p-wave  $\rho$  photo-production

From circa 2012 GlueX  
collaboration meeting

## Total Amplitude



$$W(\theta, \Psi) = \frac{3}{8\pi} \sin^2 \theta (1 + P_\gamma \cos 2\Psi)$$



$$W(\theta, \Psi) = \frac{1}{4\pi}$$

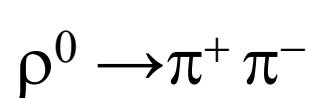
$$|A_{\text{Primakoff}} + A_\rho|^2 = \frac{1}{4\pi} \frac{d\sigma_{\text{Primakoff}}}{d\Omega} + \frac{3}{8\pi} \sin^2 \theta (1 + P_\gamma \cos 2\Psi) \frac{d\sigma_\rho}{d\Omega}$$

$$+ 2 \cos \varphi \frac{1}{4\pi} \sqrt{\frac{3}{2}} \sin \theta \sqrt{1 + P_\gamma \cos 2\Psi} \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega}} \sqrt{\frac{d\sigma_\rho}{d\Omega}}$$

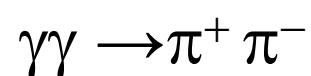
Complex phase between electromagnetic amplitude and  $\rho$  photo-production

From circa 2012 GlueX  
collaboration meeting

## Total Amplitude



$$W(\theta, \Psi) = \frac{3}{8\pi} \sin^2 \theta (1 + P_\gamma \cos 2\Psi)$$



$$W(\theta, \Psi) = \frac{1}{4\pi}$$

$$|A_{\text{Primakoff}} + A_\rho|^2 = \frac{1}{4\pi} \frac{d\sigma_{\text{Primakoff}}}{d\Omega} + \frac{3}{8\pi} \sin^2 \theta (1 + P_\gamma \cos 2\Psi) \frac{d\sigma_\rho}{d\Omega}$$

Wrong !

$$+ 2 \cos \varphi \frac{1}{4\pi} \sqrt{\frac{3}{2}} \sin \theta \sqrt{1 + P_\gamma \cos 2\Psi} \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega}} \sqrt{\frac{d\sigma_\rho}{d\Omega}}$$

Complex phase between electromagnetic  
amplitude and  $\rho$  photo-production

$$\left| A_{\text{Primakoff}} + A_\rho \right|^2 = \left( 1 - P_\gamma \right) \left| \frac{1}{\sqrt{4\pi}} \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega}} + e^{i\phi} \sqrt{\frac{3}{8\pi}} \sin \theta \sqrt{\frac{d\sigma_\rho}{d\Omega}} \right|^2 +$$

$$P_\gamma \left| \frac{1}{\sqrt{4\pi}} \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega}} + e^{i\phi} \sqrt{\frac{3}{4\pi}} \sin \theta \cos \Psi \sqrt{\frac{d\sigma_\rho}{d\Omega}} \right|^2$$

$$\begin{aligned} \left| A_{\text{Primakoff}} + A_\rho \right|^2 &= \frac{1}{4\pi} \frac{d\sigma_{\text{Primakoff}}}{d\Omega} + \frac{3}{8\pi} \sin^2 \theta (1 + P_\gamma \cos 2\Psi) \frac{d\sigma_\rho}{d\Omega} + \\ &2 \cos \phi \frac{\sqrt{3}}{4\pi} \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega} \frac{d\sigma_\rho}{d\Omega}} \sin \theta \left[ (1 - P_\gamma) \frac{1}{\sqrt{2}} + P_\gamma \cos \Psi \right] \end{aligned}$$

$\cos 2\Psi$  amplitude gives:

$$P_\gamma \sin^2 \theta \frac{d\sigma_\rho}{d\Omega}$$

$\cos \Psi$  amplitude gives:

$$P_\gamma \sin \theta \cos \phi \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega} \frac{d\sigma_\rho}{d\Omega}}$$

Isotropic amplitude gives:

$$\frac{1}{4\pi} \frac{d\sigma_{\text{Primakoff}}}{d\Omega} + \frac{3}{8\pi} \sin^2 \theta \frac{d\sigma_\rho}{d\Omega} + (1 - P_\gamma) \frac{\sqrt{6}}{4\pi} \sin \theta \cos \phi \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega} \frac{d\sigma_\rho}{d\Omega}}$$

$\cos 2\psi$  amplitude gives:

$$P_\gamma \sin^2 \theta \frac{d\sigma_\rho}{d\Omega}$$

$\cos \psi$  amplitude gives:

$$P_\gamma \sin \theta \cos \phi \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega} \frac{d\sigma_\rho}{d\Omega}}$$

Isotropic amplitude gives:

$$\frac{1}{4\pi} \frac{d\sigma_{\text{Primakoff}}}{d\Omega} + \frac{3}{8\pi} \sin^2 \theta \frac{d\sigma_\rho}{d\Omega} + (1 - P_\gamma) \frac{\sqrt{6}}{4\pi} \sin \theta \cos \phi \sqrt{\frac{d\sigma_{\text{Primakoff}}}{d\Omega} \frac{d\sigma_\rho}{d\Omega}}$$

Do partial wave analysis of the  $\psi$  distribution to extract amplitudes