Analysis of B^0 decay to the Charmless Final State $K^0_S\pi^+\pi^-$ at the *BaBar* Experiment

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Abstract

This thesis investigates neutral B decays to the charmless final state $K^0_S\pi^+\pi^-$ using a sample of $210\,\mathrm{fb}^{-1}$ of data collected by the *BABAR* detector using the PEP-II collider at SLAC. The branching ratios ($\mathcal{B}$) measured are:

$$
\begin{aligned}
\mathcal{B}(B^0 \to K^0\pi^+\pi^- \text{ Inclusive}) &= 43.0 \pm 2.3 \pm 2.3 \times 10^{-6} \\
\mathcal{B}(B^0 \to K^0_S\pi^+\pi^- \text{ nonresonant}) &< 2.1 \times 10^{-6} \\
\mathcal{B}(B^0 \to K^{**\pm}\pi^\mp, K^{**\pm} \to K^0\pi^\pm) &= 24.4 \pm 2.6 \pm 0.9 \times 10^{-6} \\
\mathcal{B}(B^0 \to \rho^0 K^0_S) &= 4.0 \pm 1.0 \pm 0.5 \times 10^{-6} \\
\mathcal{B}(B^0 \to f_0 K^0_S) &= 5.5 \pm 0.7 \pm 0.5 \times 10^{-6} \\
\mathcal{B}(B^0 \to K^{*+}\pi^-) &= 11.0 \pm 1.5 \pm 0.5 \times 10^{-6}
\end{aligned}
$$

In all cases, the first uncertainty is statistical and the second is systematic. An upper limit was set for the nonresonant branching ratio because the significance of the result was only 2.75σ. The result of the $B^0 \to \rho^0 K^0_S$ measurement was significant at the 3.6σ level, which the *BABAR* Collaboration considers to be evidence of the decay, but not observation. The term K^{**} is a collective term for the $K^*_0(1430)$, $K^*_2(1430)$, $K^*(1410)$ and $K^*(1680)$ resonances. The charge asymmetry ($\mathcal{A}_{CP}$) in $B^0 \to K^{*+}\pi^-$ was measured to be:

$$\mathcal{A}_{CP}(B^0 \to K^{*+}\pi^-) = -0.11 \pm 0.14 \pm 0.05$$