



Charm decays and spectroscopy at BaBar

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The flavor-changing neutral-current decays $D^0 \rightarrow e^+e^-$, $D^0 \rightarrow \mu^+\mu^-$, and $D^0 \rightarrow \gamma\gamma$ are highly suppressed in the standard model, well below observable levels. The decay $D^0 \rightarrow e^+\mu^-$ is further lepton-flavor violating, and thus can occur only through very slow neutrino mixing. Thus, these decays constitute sensitive probes for possible new-physics contributions. We report new limits on the branching fractions of these decays. The electron and di-photon channels, in particular, benefit greatly from the high photon efficiency and clean environment of the B factory.

Charm decays that are very rare or forbidden within the standard model constitute a sensitive search for new physics. We report results of searches for 35 such decays of the D^+ , D^0 , D_s , and Λ_c into final states containing two leptons plus a pion, kaon, or proton. This includes final states involving lepton-number or lepton-flavor violation. We obtain branching-fraction limits of order 10^{-6} . Most of these are the tightest limits to date, in some cases they are the only results published so far, and some cut into the allowed parameter spaces of published new-physics models.

Precision properties of charm mesons help test and provide reference points for many of the tools and approximations used in hadronic calculations, such as lattice QCD computation of hadronic matrix elements. We present a new measurement of the natural line width of the D^+ meson and of the difference between the masses of the D^+ and the D^0 mesons. Using the full BABAR dataset, we reconstruct the decays $D^+ \rightarrow D^0 \pi^+$, with the D^0 identified in its decays into $K\pi^+$, $K\pi^+\pi^-\pi^+$, $K\pi^+\pi^0$, and $K_s \pi^+\pi^-$. We extract the D^+ width and the pole position in the mass difference Δm in each sample by fitting the measured Δm distribution to the sum of background and signal, modeled as a relativistic P-wave Breit-Wigner line shape convolved with a resolution function. Our results are several times more precise than the previous world average.

We report results of measurements of the angular-momentum-excited charmed baryon $\Lambda_c(2880)^+$ decaying to $\Lambda_c^+ \pi^+ \pi^-$ using approximately 316 fb^{-1} of BaBar e^+e^- collision data. We reconstruct the Λ_c^+ candidates in the decay mode $pK\pi$ and measure the $\Lambda_c(2880)^+$ mass, width, and production cross section, and study resonances in the $\Lambda_c^+ \pi^+ \pi^-$ final state. We report the first measurements of the relative branching fractions for decays of the $\Lambda_c(2880)^+$ into the final states $\Sigma_c^0(2455) \pi^+$, $\Sigma_c^{*++}(2455) \pi^-$, $\Sigma_c^{*++}(2520) \pi^-$, $\Sigma_c^0(2520) \pi^+$, and the non-resonant $\Lambda_c^+ \pi^+ \pi^-$ contribution.

Primary author: Dr GODANG, Romulus (University of South Alabama (US))

Presenter: Dr GODANG, Romulus (University of South Alabama (US))

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