

# Charm decays at Belle

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Dalitz plot analysis of the decay  $D^0 \rightarrow \pi^+\pi^-\pi^0$

We report preliminary results of the Dalitz plot analysis of the decay  $D^0 \rightarrow \pi^+\pi^-\pi^0$  using a  $532 \text{ fb}^{-1}$  data sample collected with the Belle detector at the KEKB asymmetric-energy  $e^+e^-$  collider. The fit model includes the intermediate vector resonances  $\rho(770)$ ,  $\omega$ ,  $\rho(1450)$ , and  $\rho(1700)$ , the scalar states  $\sigma(600)$ ,  $f_0(980)$ ,  $f_0(1370)$ , and  $f_0(1500)$  as well as the tensor state  $f_2(1270)$ . The asymmetry between the two flavour samples -  $D^0$  and  $\bar{D}^0$  - has been also estimated.

Search for  $D^0$  leptonic decays with Belle

We present a search for the rare  $D^0$  leptonic decays,  $D^0 \rightarrow e^+e^-$ ,  $\mu^+\mu^-$ , and the decays  $D^0 \rightarrow e^+\mu^-$  which are forbidden in the Standard Model. Limits on the branching fractions for these decays are obtained using the well measured  $D^0 \rightarrow \pi^+\pi^-$  decay channel for normalization. The search is performed using a large sample of  $D^0$  decays recorded by the Belle experiment corresponding to an integrated luminosity of  $660 \text{ fb}^{-1}$ .

Study of  $D_{(s)}^+$  decays to  $K_S\pi^+$  and  $K_S K^+$

Using  $605 \text{ fb}^{-1}$  of data collected by the Belle detector at the KEKB asymmetric energy  $e^+e^-$  collider, we study the decays of  $D_{(s)}^+$  mesons to  $K_S\pi^+$  and  $K_S K^+$  final states. We report branching fractions normalized with respect to Cabibbo-favored modes,  $\Gamma(D^+ \rightarrow K_S K^+)/\Gamma(D^+ \rightarrow K_S \pi^+)$  and  $\Gamma(D_s^+ \rightarrow K_S \pi^+)/\Gamma(D_s^+ \rightarrow K_S K^+)$ .

Study of  $\eta_c^{(\prime)}$  properties in  $B \rightarrow \eta_c^{(\prime)} K$  decays

Reconstructed  $B$  decays to a charged kaon and an  $\eta_c$ -type charmonium from a data sample of 535 million  $B\bar{B}$  meson pairs collected in the Belle experiment at the KEKB  $e^+e^-$  collider have been used to study properties of the  $\eta_c$  and its first excitation, the  $\eta_c(2S)$ . We use the decay mode  $K_S K \pi$  to study the effects of interference between charmonium signal and  $B$  decays into the same final state without an intermediate charmonium. Taking this interference into account we obtain masses, widths, and decay branching fractions of the  $\eta_c$  and  $\eta_c(2S)$  mesons. The results agree with the world average values; for the first time, interference effects are taken into account.

Measurement of the inclusive decay  $D^0 \rightarrow \phi X$  and of exclusive decays of the  $D^0$  particle involving a  $K^+ K^-$  pair

Using data collected by the Belle detector at the KEKB storage ring and applying a novel method of completely reconstructing events up to a  $D^0$ , with a  $K^+ K^-$  pair "left over", the branching fraction of the inclusive decay of  $D^0 \rightarrow \phi X$  has been measured with high precision. In addition, the exclusive branching fraction  $D^0 \rightarrow K^+ K^-$  has been determined with good precision. Furthermore various branching fractions of  $D^0$  decays involving a  $K^+ K^-$  pair have been measured for consistency:  $D^0 \rightarrow (K^+ K^- K^0)_{nonres}$ ,  $\phi K^0$ ,  $K^+ K^- \pi^0$ ,  $\phi(K^+ K^-) \pi^0$ , and  $\phi(K^+ K^-) \pi^0$ , and  $\phi(K^+ K^-) \pi^0$ . Results presented in the study are preliminary.

Observation of the doubly Cabibbo-suppressed decay  $D_{s^+} \rightarrow \phi K^+ + K^+ + \pi^+$

We report the first observation of the doubly Cabibbo-suppressed decay  $D_{s^+} \rightarrow \phi K^+ + K^+ + \pi^+$  using  $605 \text{ fb}^{-1}$  of data collected with the Belle detector at the KEKB asymmetric-energy  $e^+e^-$  collider. The branching ratio with respect to its Cabibbo-favored counterpart  $\mathcal{B}(D_{s^+} \rightarrow \phi K^+ + K^+ + \pi^+) / \mathcal{B}(D_{s^+} \rightarrow \phi K^+ + K^+ + \pi^+)$  is  $(0.229 \pm 0.028 \pm 0.012)$

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