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Search for Neutral D Meson Mixing using Semileptonic Decays

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SEARCH FOR NEUTRAL D MESON MIXING USING SEMILEPTONIC DECAYS

A Dissertation Presented

by

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To all the lost sheep and the good shepherds who search for them.

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ABSTRACT

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Based on a 87 fb^{-1} dataset, a search for D^0–$\overline{D}^0$ mixing is made using the semileptonic decay modes $D^{*+} \to \pi^+ D^0, D^0 \to [K/K^*]e\nu$ (+c.c.) at the B-Factory facility at the Stanford Linear Accelerator Center. These modes offer unambiguous initial and final-state charm flavor tags, and allow the combined use of the D^0 lifetime and D^{*+}–D^0 mass difference (ΔM) in a global likelihood fit. The high-statistics sample of reconstructed unmixed semileptonic D^0 decays is used to model both the ΔM distribution and the time-dependence of mixed events directly from the data. Neural networks are used both to select events and to fully reconstruct the D^0. A result consistent with no charm mixing has been obtained, $R_{mix} = 0.0023 \pm 0.0012(stat) \pm 0.0004(sys)$. This corresponds to an upper limit of $R_{mix} < 0.0047$ (95% C.L.) and $R_{mix} < 0.0043$ (90% C.L.). The lowest current published limit on semileptonic charm mixing is 0.005 (90% C.L.) (E791, E.M. Aitala *et al.*, Phys.Rev.Lett. **77** 2384 (1996)). The current

best published limit using any analysis technique on the total rate of charm mixing is 0.0016 (95% C.L.) (Babar $K\pi$ mixing, B. Aubert *et al.*, Phys.Rev.Lett. **91** 171801 (2003)).

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