$B_s^0 \to J/\psi\phi$ update, lifetime difference and mixing phase

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In this talk, we present the status of untagged decay of $B_s^0 \to J/\psi\phi$ study, which have been done at CDF and DØ detectors at Fermilab. In the standard model (SM), the light (L) and heavy (H) eigenstates of the mixed (B_s^0, $\overline{B}_s^0$) system are expected to have a sizeable mass and decay width difference, $\Delta M \equiv M_H - M_L$ and $\Delta\Gamma \equiv \Gamma_L - \Gamma_H$. The CP violating phase, $\delta\phi$, defined as the the relative phase of the off-diagonal elements of the mass and decay matrices in the B_s^0- $\overline{B}_s^0$ basis, is predicted to be small, and to a good approximation the two mass eigenstates are expected to be CP-eigenstates. Through a study of the time-dependent angular distribution of the decay products of the J/ψ and ϕ mesons, it is possible to separate the two CP components of the decay $B_s^0 \to J/\psi\phi$, and thus to measure the lifetime difference, and the CP violating phase.

From a simultaneous fit to the distributions in the B_s^0 candidate mass, proper decay length, and three angles of the decay products, the CDF collaboration obtain the average lifetime of the (B_s^0, $\overline{B}_s^0$) system, $\overline{\tau}(B_s^0)$ =1.39 $^{+0.15}_{-0.13}$ (stat) $\pm$ 0.02 (syst) ps, and $\Delta\Gamma$ = 0.47 $^{+0.19}_{-0.24}$ $\pm$ 0.01 ps^{-1}. DØ measures $\overline{\tau}(B_s^0)$ =1.49 $\pm$ 0.08 (stat) $^{+0.01}_{-0.03}$ (syst) ps, $\Delta\Gamma$ = 0.17 $\pm$ 0.09 $\pm$0.03 ps^{-1}, and $\delta\phi$ = -0.79 $\pm$ 0.56 (stat) $\pm$ 0.01 (syst). With an additional constraint from the charge asymmetry in B_s semileptonic decays, DØ measures $\Delta\Gamma$ = 0.15 $^{0.09}_{-0.08}$ $\pm$0.03 ps^{-1}, and $\delta\phi$ = -0.56 $^{+0.44}_{-0.41}$ $\pm$ 0.01 (syst).
These results are consistent with SM predictions within the measurement uncertainties. The data sample corresponds to an integrated luminosity of 1.0 fb^{-1} and 260 pb^{-1} accumulated with the DØ detector and the CDF detector respectively at the Tevatron.