

$\frac{\Delta\Gamma_s}{\Gamma_s}$ measurements

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Mixing in the B system

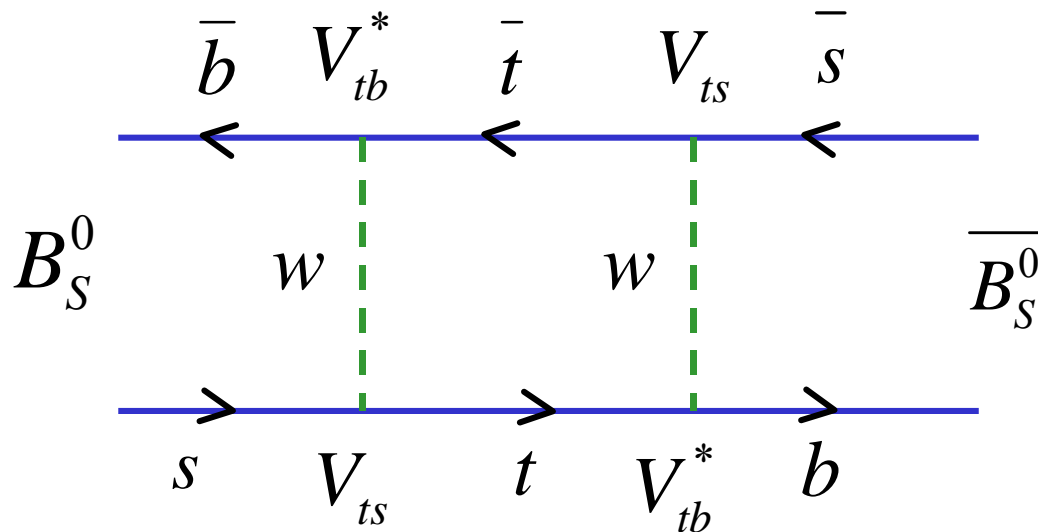
$$\sum_{i=u,c,t} \frac{V_{is} V_{ib}^*}{q^2 - m_i^2} \approx \sum_{i=u,c,t} \frac{V_{is} V_{ib}^*}{q^2} \left[1 + \frac{m_i^2}{q^2} + \dots \right]$$

propagator

Since

$$m_t^2 \gg m_c^2$$

the t -diagram is the main contribution to the mixing





We think we understand the mixing of B 's. A deviation from this simple diagram is a deviation from SM.

...Mixing in the B system

If CP is a good symmetry in the B mixing...

$$\frac{\Delta\Gamma_q}{\Delta m_q} = \left| \frac{\Gamma_{12}}{M_{12}} \right| \approx \frac{3\pi}{2} \cdot \frac{m_b^2}{m_W^2} \cdot \frac{1}{S_0(m_t^2 / m_W^2)} \sim O\left(\frac{m_b^2}{m_t^2}\right) \quad q = d, s$$

 independent of
CKM V_{ij} elements

 $\sim 5 \times 10^{-3}$ ($\pm 30\%$)
lattice QCD

A measurement of one of $\Delta\Gamma$, Δm is a SM prediction for the other

Experimental methods

- Fit of proper time distributions of untagged data samples:
 - large statistics
 - sensitivity $\sim \left(\frac{\Delta\Gamma_S}{\Gamma_S} \right)^2$
- Fit of proper time distributions of CP eigenstates
- From the measurement of the BR of $B_S \rightarrow D_S^{(*)+} D_S^{(*)-}$
 - reduced statistics
 - sensitivity $\sim \frac{\Delta\Gamma_S}{\Gamma_S}$

Measurements

- Assuming $\Gamma_S = \frac{1}{\tau(B_d)}$ (expected within $\pm 1\%$)

PDG2001

$$\frac{|\Delta\Gamma_S|}{\Gamma_S} < 0.32 \quad , \text{C.L.} = 95\%$$

- Without external constraints

LEP B-Oscillation Group
(CDF not included)

$$\frac{|\Delta\Gamma_S|}{\Gamma_S} < 0.52 \quad , \text{C.L.} = 95\%$$

Phenomenology



$$\frac{|\Delta\Gamma_S|}{\Gamma_S} \sim 20\%$$

Outlook

- Both Δm_s & $\Delta\Gamma_s$ expected to be measured by CDF and DØ (RunII)
- Phenomenology: hadronic uncertainties expected to be reduced (currently at 30%)
- Compare $\left(\frac{\Delta\Gamma_s}{\Delta m_s}\right)_{\text{exp}}$ & $\left(\frac{\Delta\Gamma_s}{\Delta m_s}\right)_{\text{theory}}$