

Probing quantum decoherence through data from B meson decays

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The time evolution of the neutral B mesons determines key parameters in flavor physics. While their behavior is generally studied under the assumption of perfect quantum coherence, interactions with the surrounding environment can introduce *decoherence*. The influence of such environmental effects on neutral meson systems can be effectively described using the open quantum system framework. This decoherence can obscure the extraction of critical parameters, such as the oscillation frequency Δm and the CP -violating parameter $\sin 2\beta$. Utilizing the available experimental data, we present the first combined analysis of mixing asymmetry and CP -asymmetry measurements for B_d -mesons, revealing that λ_d is non-zero with a significance of approximately 6σ . Furthermore, we establish the first experimental constraints on the decoherence parameter λ_s for B_s -mesons, confirming its non-zero value at 3σ .

Primary authors: CHUNDAWAT, Neetu Raj Singh (高能所); Prof. ALOK, Ashutosh Kumar (IIT Jodhpur); Dr KUMAR, Jitendra (IIT Jodhpur); Mr RAI, Saurabh (IIT Jodhpur); Prof. UMA SANKAR, Sankagiri (IIT Bombay)

Presenter: CHUNDAWAT, Neetu Raj Singh (高能所)

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