



# Search for the decay $B_s^0 \rightarrow \eta\eta$ at $\Upsilon(5S)$ resonance

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## Abstract

We search for the decay  $B_s^0 \rightarrow \eta\eta$  using  $121.4\text{fb}^{-1}$  of data collected at  $\Upsilon(5S)$  resonance by the Belle detector at the KEKB asymmetric energy  $e^+e^-$  collider located at the High Energy Accelerator Research Organization, Japan. In the Standard Model (SM), this decay is a neutral charmless decay which can occur through a variety of processes such as Cabibbo suppressed  $b \rightarrow u$  transition with a further color suppression with respect to the charged modes. Contributions can also arise from electroweak penguins. It has been studied theoretically in the framework of SCET, PQCD and QCDF. The predictions of the branching ratio (BR) of the decay are  $(8.0_{-1.9-2.5-0.0}^{+2.6+4.7+0.0}) \times 10^{-6}$ ,  $(15.6_{-1.5-6.8-2.5-5.5}^{+1.6+9.9+2.2+13.5}) \times 10^{-6}$  and  $(7.1 \pm 6.4 \pm 0.2 \pm 0.8) \times 10^{-6}$ , respectively. All of these predictions have large uncertainties, which are mostly due to the QCD uncertainties. The present experimental upper limit on the BR for  $B_s \rightarrow \eta\eta$  is  $1.5 \times 10^{-3}$  at 90% confidence level (CL). This analysis will be the first attempt to search for this decay using the available dataset from the Belle experiment with an expectation of reaching the SM sensitivity.