

# [Belle report] Search for a light Higgs boson in single-photon decays of $\Upsilon(1S)$ using $\Upsilon(2S) \rightarrow \pi^+\pi^-\Upsilon(1S)$ tagging method

Thursday, August 11, 2022 3:15 PM (15 minutes)

We search for a light Higgs boson ( $A^0$ ) decaying into a  $\tau^+\tau^-$  or  $\mu^+\mu^-$  pair in the radiative decays of  $\Upsilon(1S)$ . The production of  $\Upsilon(1S)$  mesons is tagged by  $\Upsilon(2S) \rightarrow \pi^+\pi^-\Upsilon(1S)$  transitions, using 158 million  $\Upsilon(2S)$  events accumulated with the Belle detector at the KEKB asymmetric energy electron-positron collider. No significant  $A^0$  signals in the mass range from the  $\tau^+\tau^-$  or  $\mu^+\mu^-$  threshold to  $9.2 \text{ GeV}/c^2$  are observed. We set the upper limits at 90% credibility level (C.L.) on the product branching fractions for  $\Upsilon(1S) \rightarrow \gamma A^0$  and  $A^0 \rightarrow \tau^+\tau^-$  varying from  $3.8 \times 10^{-6}$  to  $1.5 \times 10^{-4}$ .

Our results represent an approximately twofold improvement on the current world best upper limits for the  $\Upsilon(1S) \rightarrow \gamma A^0 (\rightarrow \tau^+\tau^-)$  production. For  $A^0 \rightarrow \mu^+\mu^-$ , the upper limits on the product branching fractions for  $\Upsilon(1S) \rightarrow \gamma A^0$  and  $A^0 \rightarrow \mu^+\mu^-$  are at the same level as the world average limits, and vary from  $3.1 \times 10^{-7}$  to  $1.6 \times 10^{-5}$ .

The upper limits at 90% C.L. on the Yukawa coupling  $f_{\Upsilon(1S)}$  and mixing angle  $\sin\theta_{A^0}$  are also given.

**Primary author:** 贾, 森 (复旦大学)

**Presenter:** 贾, 森 (复旦大学)

**Session Classification:** Parallel Session IX (2): Hadron and Flavor Physics

**Track Classification:** 强子物理与味物理