

# Search for invisible decays at BESIII

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## Introduction



- Strong evidence for the existence in astronomy
- > No evidence of dark matter particles yet
- ➤ Hadron invisible decays
  - ♦ very rare in the Standard Model,
  - ◆ ideal environment for dark matter particle searches.



02 04 06 08 m. (GeV/c<sup>2</sup>)

# **Baryon Invisible Decay** $(\Lambda)$



#### Quarkonium Invisible Decays $(J/\psi)$ invisible decay 🔪 $e^+e^- \rightarrow \pi^+\pi^- I/\psi$ , $I/\psi \rightarrow \gamma + invisible$ Tag $I/\psi$ sample from 4.5 × 10<sup>8</sup> $\psi$ (3686) events Trigger & Tag Scan m(inv) from 0 to 1.2 GeV No significant signal observed Max. significance is $1.15\sigma$ at 1.2 GeV $\epsilon_{J/\psi}$ $\mathcal{B} =$ 6.2 times better upper limit than CLEO-c For small $\tan\beta$ , BESIII better than Belle Hadron invisible decay 0.4 0.6 0.8 1 1.2 m<sub>invisible</sub>(GeV/c<sup>2</sup>) BESIII (tanβ=0.7) BESIII (tanβ=0.6) Combine with Belle result exclude large $\cos\theta_A$ Trigger & Tag

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### Summary

- Progress on hadron invisible decays at BESIII since PANIC 2017 is reported.
- $\blacktriangleright$  With huge charmonium sample collected in the  $e^+e^-$  annihilation, invisible decays of quarkonia ( $\omega, \phi, I/\psi$ ) and  $\Lambda$  baryon are searched.
- > More huge data in BESIII. Many ongoing invisible searches with exciting results anticipated in the future.



0.4 0.6 0.8

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- $\blacktriangleright$  Huge data sets
  - >  $1.0 \times 10^{10} I/\psi$
  - $\rightarrow$  4.5 × 10<sup>8</sup>  $\psi$ (3686) ; (3 × 10<sup>9</sup> in the near future)
- > Ideal place for hadron invisible decay searches
  - > Accompanying final states for trigger and tagging
  - Clean sample with low background level

