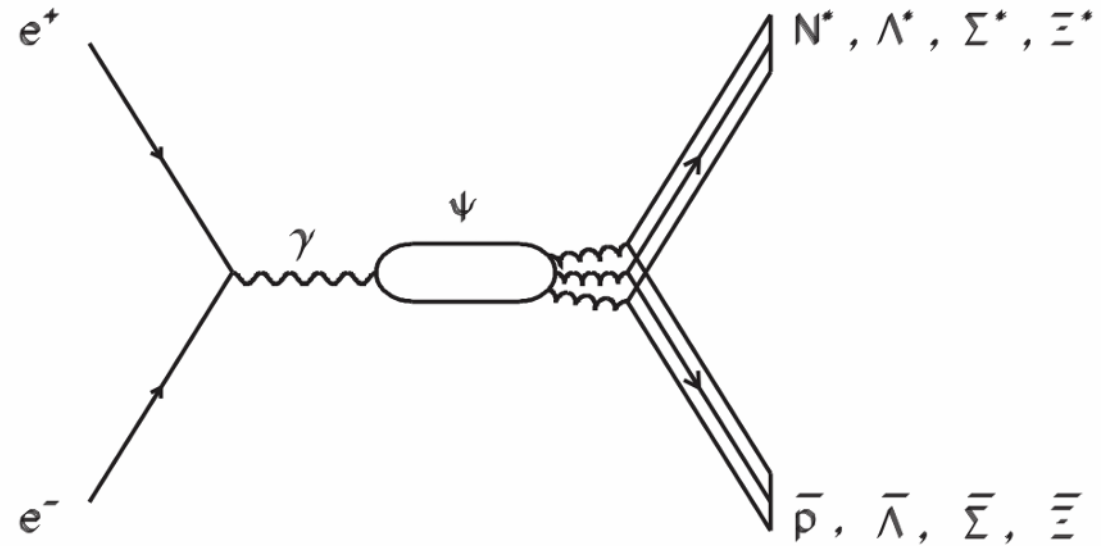


Why BESIII is complementary for baryon spectroscopy study?

- When compared to hadron collider or fixed target experiments, electron positron collision has a different production method:
 - the **direct** production: **vector** state
 - Background is **low**, and the initial state (energy, J^{PC}) is **known**
 - Could run the collisions on the **critical** points, such as J/ψ peak, where the cross section is **large**.
 - Coupling of unobserved states through conventional production channels could be small, but coupling may be large to $gggN$:
 - $\psi \rightarrow N\bar{N}(\pi/\eta/\eta'/\omega/\phi), pK\bar{\Lambda}, pK\bar{\Sigma}$

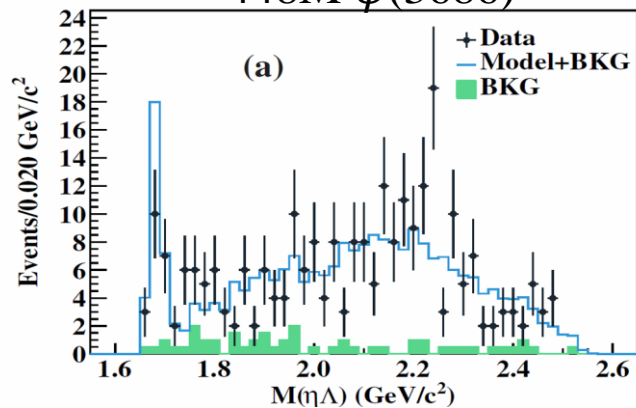


- Threshold enhancement
- Missing resonance of $N^*, \Lambda^*, \Sigma^*, \dots$
- Multiquark baryon
-

Λ^* near $\Lambda\eta$ threshold in $\psi(3686) \rightarrow \Lambda\bar{\Lambda}\eta$

Phys.Rev.D 106 (2022) 7, 072006

448M $\psi(3686)$

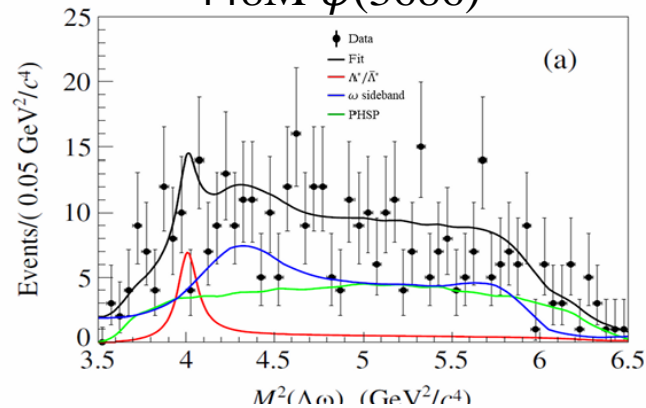


Source	Λ^* in This work	$\Lambda(1670)$	$\Lambda(1690)$
J^P	$1/2^-$	$1/2^-$	$3/2^-$
Mass (MeV/c^2)	$1672 \pm 5 \pm 6$	1670~1678	1685~1695
Γ (MeV)	$38 \pm 10 \pm 19$	25~35	60~80

Evidence for $\Lambda^* \rightarrow \Lambda\omega$ in $\psi(3686) \rightarrow \Lambda\bar{\Lambda}\omega$

Phys.Rev.D 106 (2022) 11, 112011

448M $\psi(3686)$

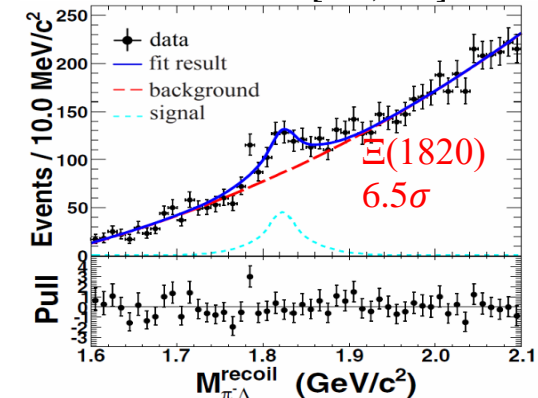


Source	Λ^* in This work	$\Lambda(2000)$	$\Lambda(2050)$	$\Lambda(2070)$
Mass (MeV/c^2)	2001 ± 7	≈ 2000	2056 ± 22	2070 ± 24
Γ (MeV)	36 ± 7	(125~255)	493 ± 61	370 ± 50
Significance/Existence	3.0σ	*	*	*

Observation of Ξ^* in $e^+e^- \rightarrow \Xi^- + \text{anything}$

Phys.Rev.Lett. 124 (2020) 3, 032002

11.0 fb⁻¹ @ [4.1, 4.6] GeV

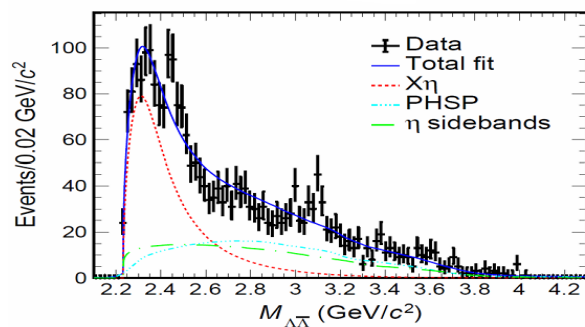


$$M = (1825.5 \pm 4.7 \pm 4.7) \text{ MeV}/c^2$$

$$\Gamma = (17.0 \pm 15.0 \pm 7.9) \text{ MeV}$$

$\Lambda\bar{\Lambda}$ threshold enhancement in $e^+e^- \rightarrow \Lambda\bar{\Lambda}\eta$

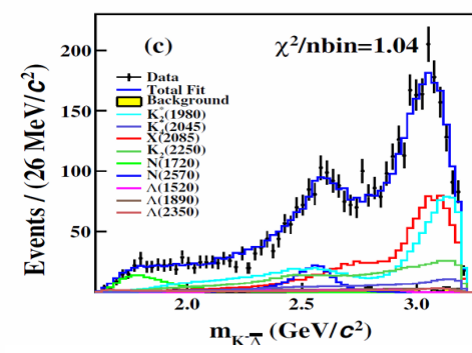
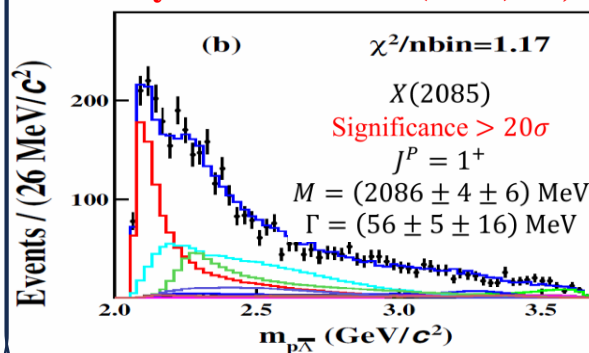
Phys.Rev.D 107 (2023) 11, 112001



$$J^{PC} = 1^{--}, M = (2356 \pm 7 \pm 17) \text{ MeV}/c^2, \Gamma = (304 \pm 28 \pm 54) \text{ MeV}$$

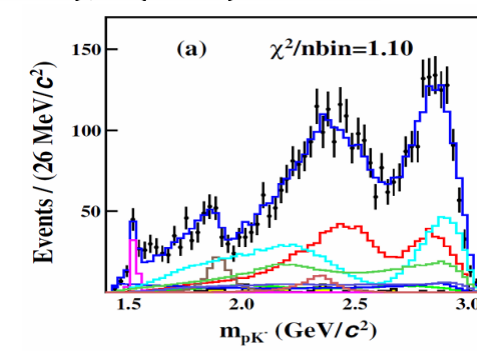
$p\bar{\Lambda}$ threshold enhancement in $e^+e^- \rightarrow pK^-\bar{\Lambda} + c.c.$

Phys.Rev.Lett. 131 (2023) 15, 151901

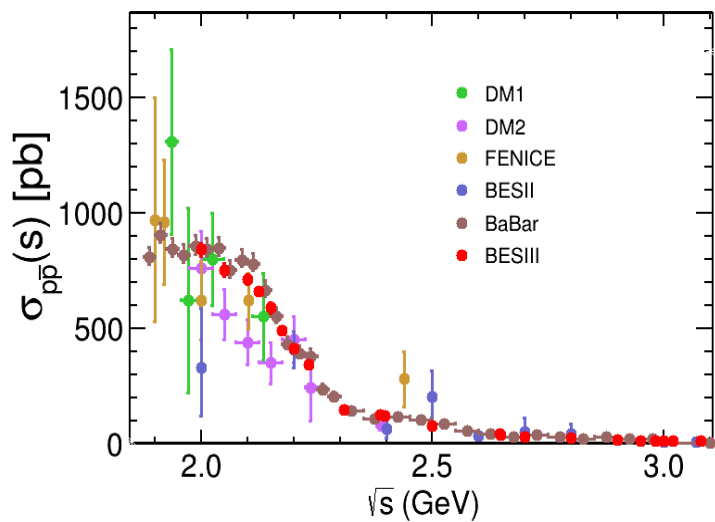
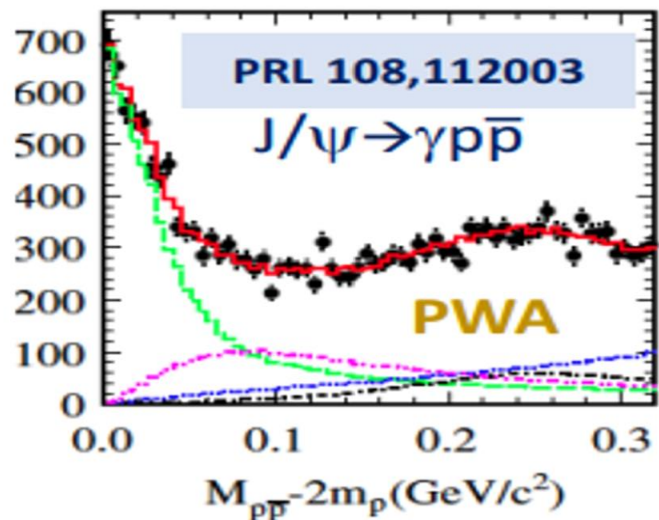


Λ^* : $\Lambda(1520), \Lambda(1890), \Lambda(2350)$

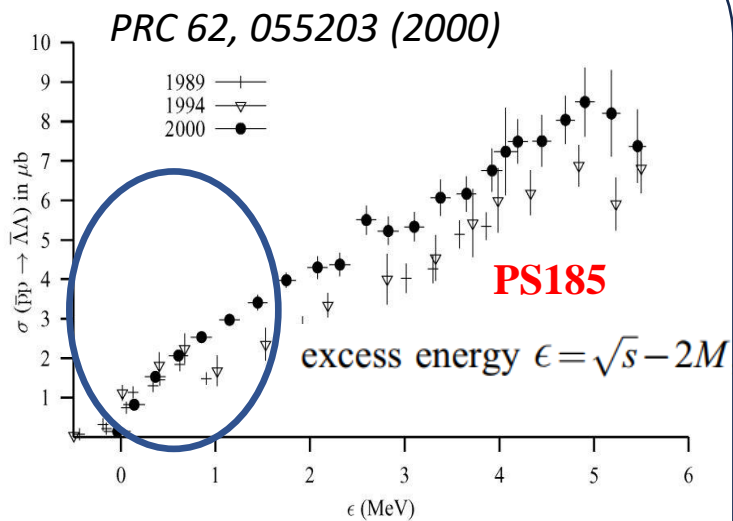
N^* : $N(1720), N(2570)$



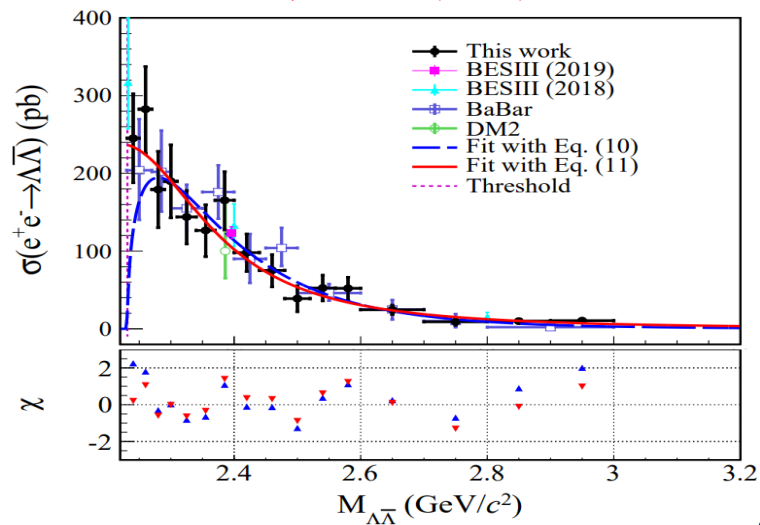
$$e^+e^- \rightarrow p\bar{p}$$



$$e^+e^- \rightarrow \Lambda\bar{\Lambda}$$

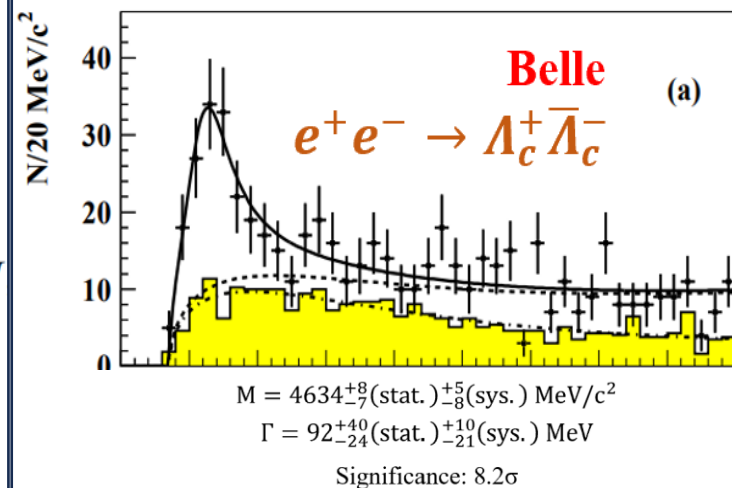


PRD 107, 072005 (2023)



$$e^+e^- \rightarrow \Lambda_c^+\bar{\Lambda}_c^-$$

Phys. Rev. Lett. 101, 172001 (2008)



PRL 131, 191901 (2023)

