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BLOOMINGTON



Recent Highlights from BESIII

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Oct. 19-23, 2026, Stony Brook U

Outline

CONTENTS

- ◆ **The search for glueballs**
 - Recent studies of $X(2370)$
- ◆ **Hyperons**
 - Precision physics & antihyperon–nucleon interactions
- ◆ **Charm**
 - Precision tests of the Standard Model

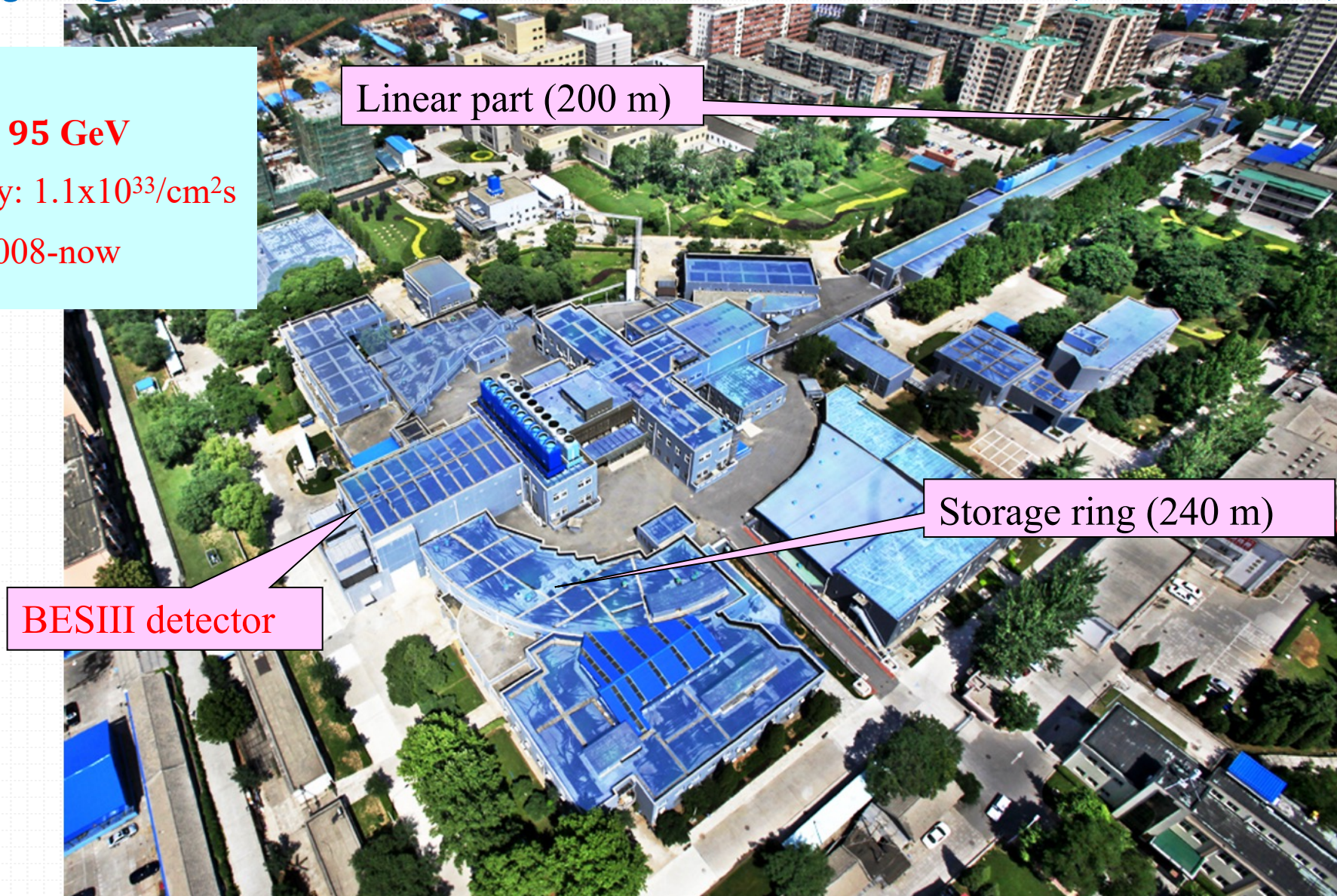
/// Beijing Electron-Positron Collider II (BEPCII)

e^+e^- collider

$\sqrt{s} = 1.84 \sim 4.95 \text{ GeV}$

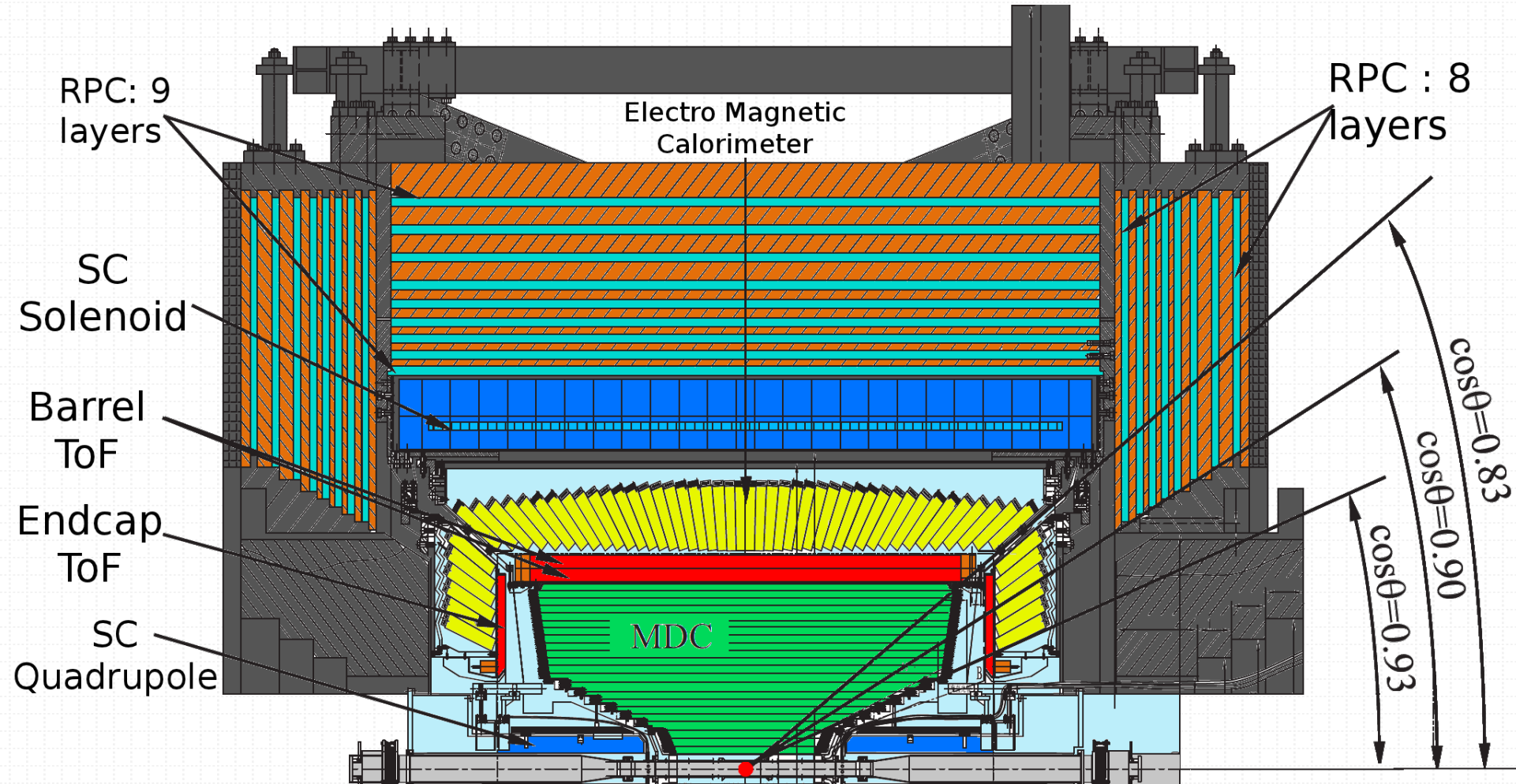
Peak luminosity: $1.1 \times 10^{33} / \text{cm}^2 \text{s}$

In operation: 2008-now

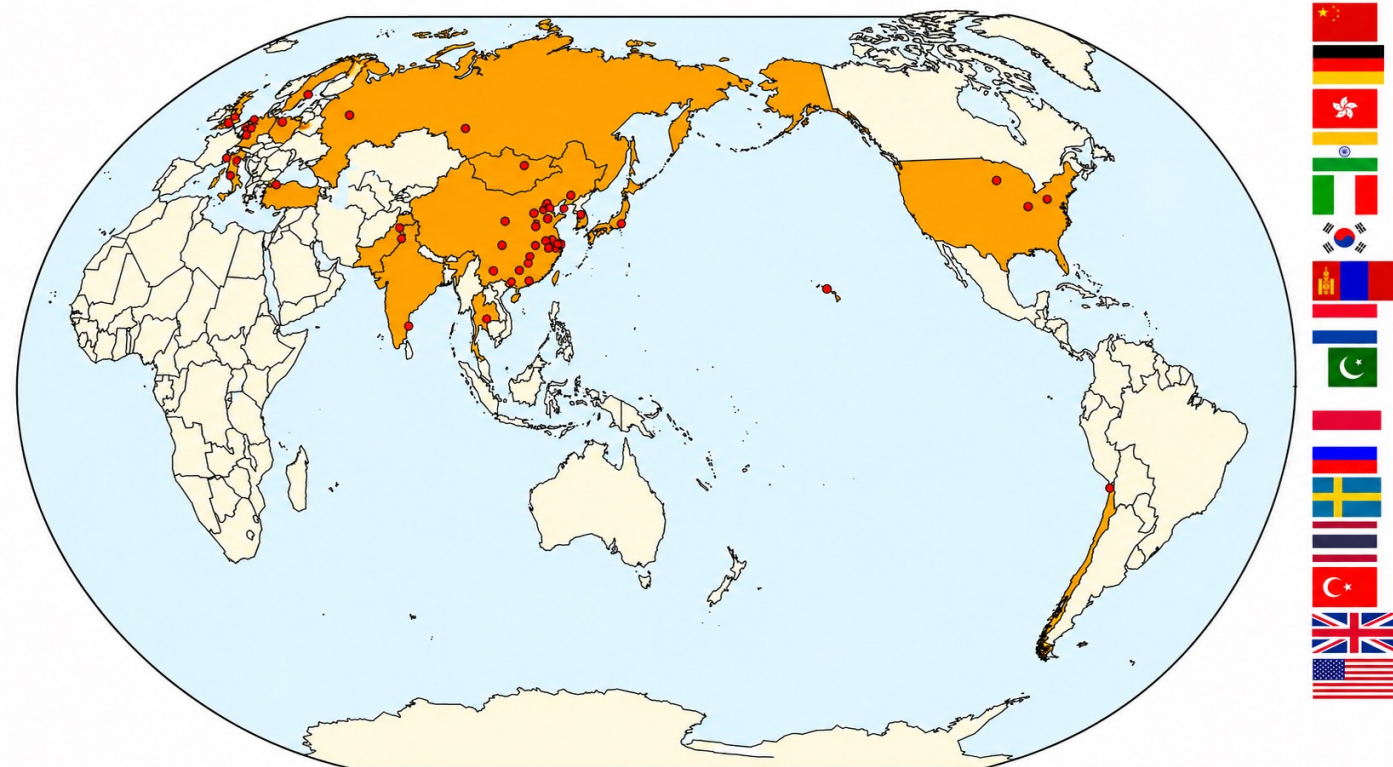


/// BESIII detector

Nearly 4π coverage

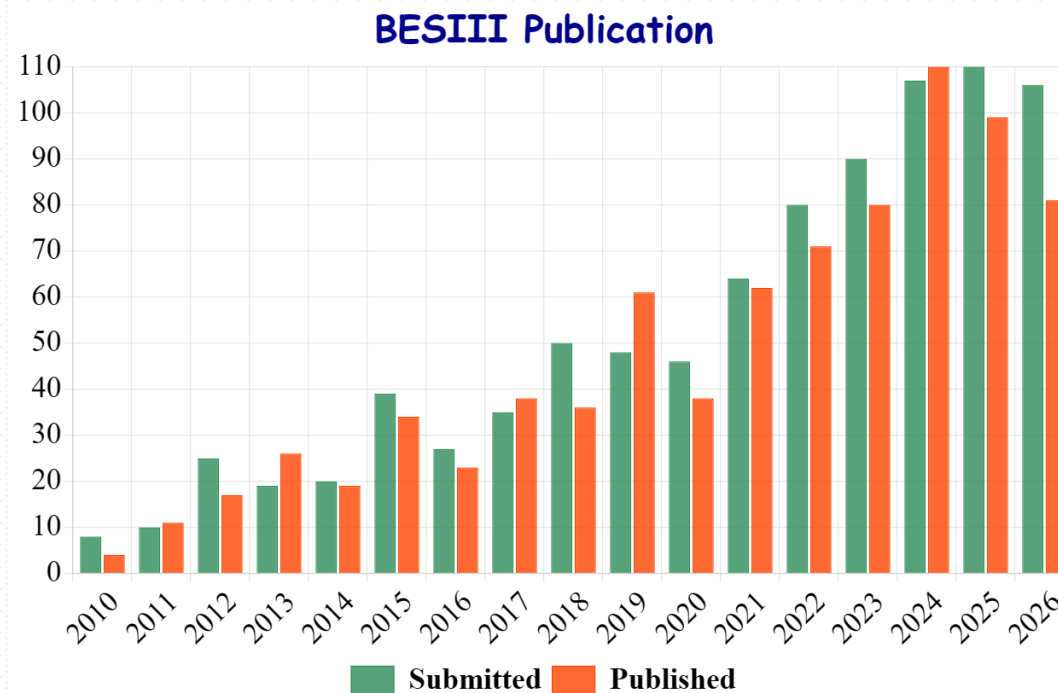


/// BESIII today



>700 members · 97 institutions · 15 countries

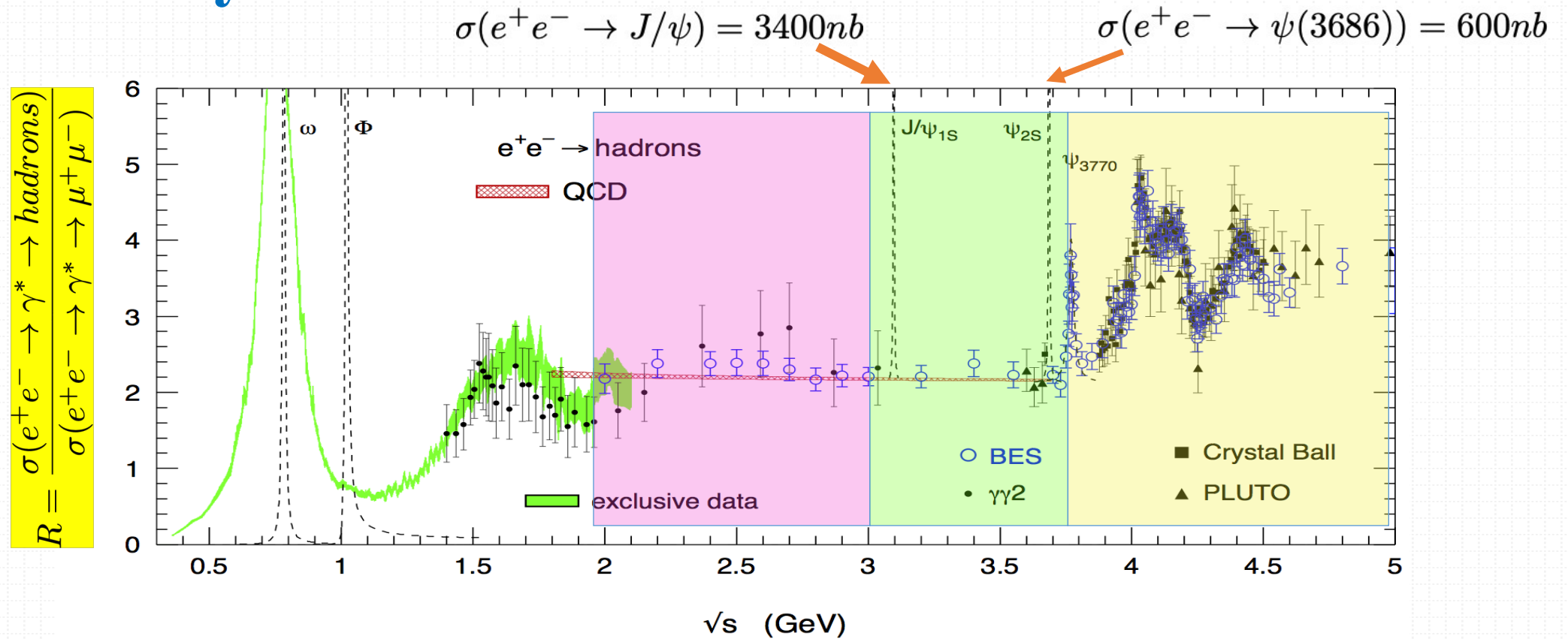
> 800 BESIII papers published
~160 in PRL



As of Oct. 18, 2026

~100 per year since 2023

Rich Physics at BESIII



The search for glueballs

- ✓ Huge J/ψ samples & gluon-rich radiative decays

Hyperons

- ✓ Abundant $J/\psi, \psi(3686) \rightarrow Y\bar{Y}$ samples

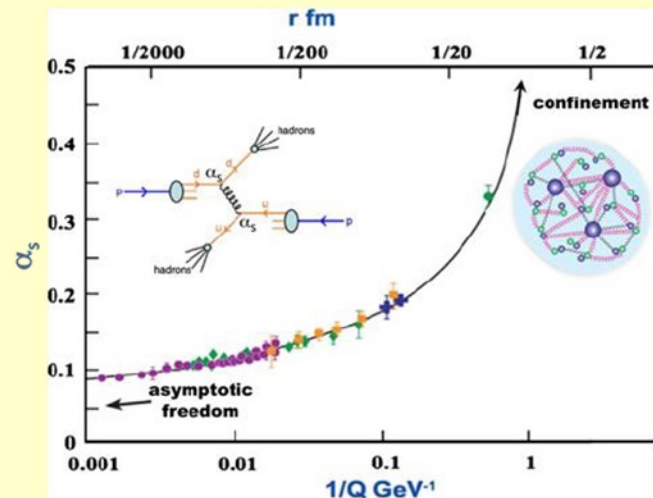
Charm

- ✓ Clean open-charm samples near threshold

/// Why glueballs? — A fundamental prediction of QCD

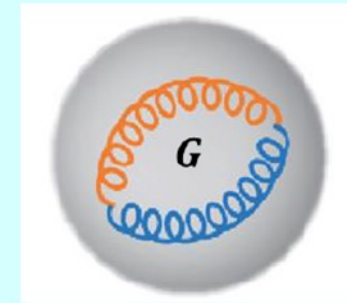
QCD — SU(3) non-Abelian gauge theory:

At high energy



- α_s running, widely confirmed experimentally
Asymptotic freedom — 2004 Nobel Prize

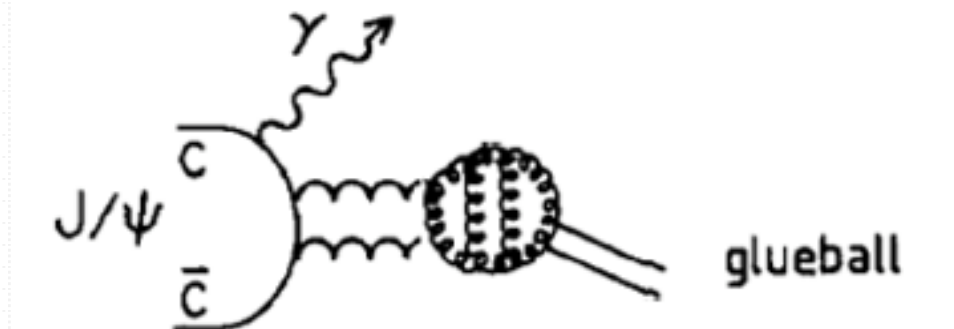
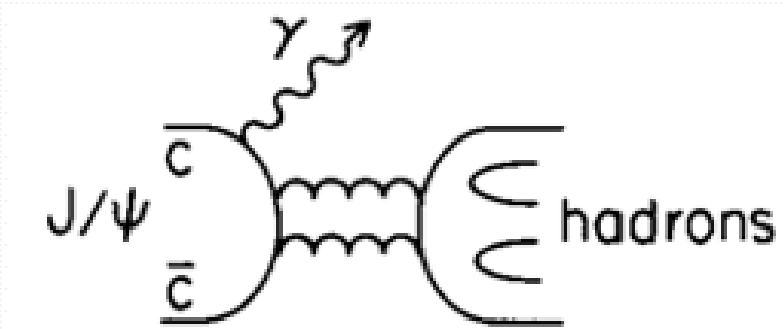
At low energy



- self-interaction of gluons → bound states of gluons — **Glueballs**
- Many candidates, not established yet

A long-standing prediction of QCD — still awaiting unambiguous experimental identification

/// Where to search? — Radiative J/ψ decays



Gluon-rich environment

- $J/\psi \rightarrow \gamma g g$

Clean and selective environment

- Isospin filter: final states dominated by $I = 0$
- C-parity filter: $C = +$

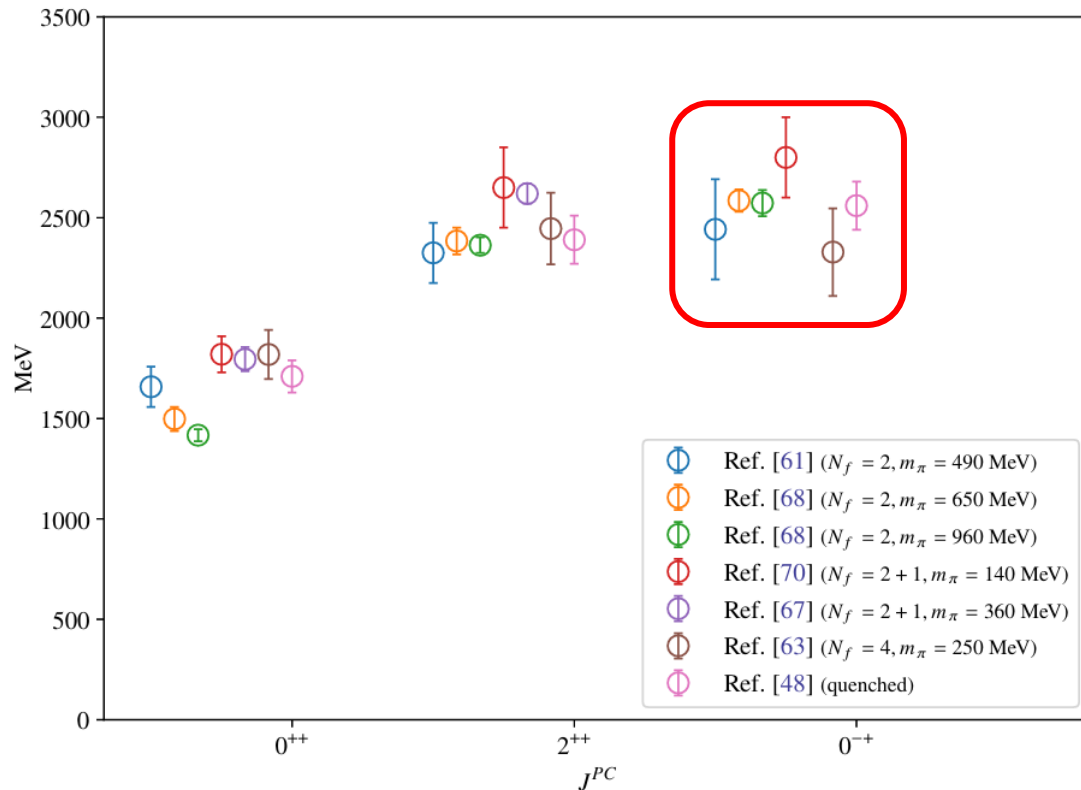
Unprecedented statistics at BESIII

- 10 billion J/ψ events

Radiative J/ψ decays provide an ideal laboratory for glueball searches

/// What to look for? — Lattice QCD predictions

arxiv:2305.04869



Lightest glueballs

$0^{++} \sim 1.3 - 2.0$ GeV

$2^{++} \sim 2.3 - 2.8$ GeV

$0^{-+} \sim 2.3 - 3.0$ GeV

Lattice QCD prediction:

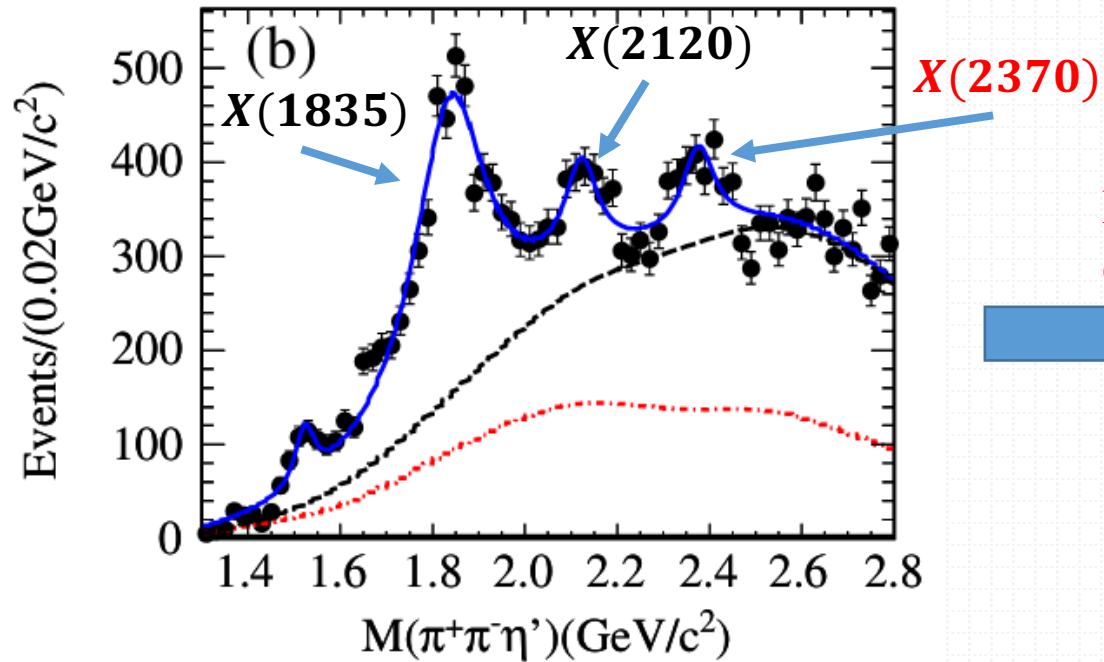
$M(0^{-+}) = 2395 \pm 14$ MeV

Phys. Rev. D 100, 054511 (2019)

The lightest pseudoscalar glueball is expected around 2.4 GeV

/// X(2370) — From discovery to a pseudoscalar state

2011 — Discovery



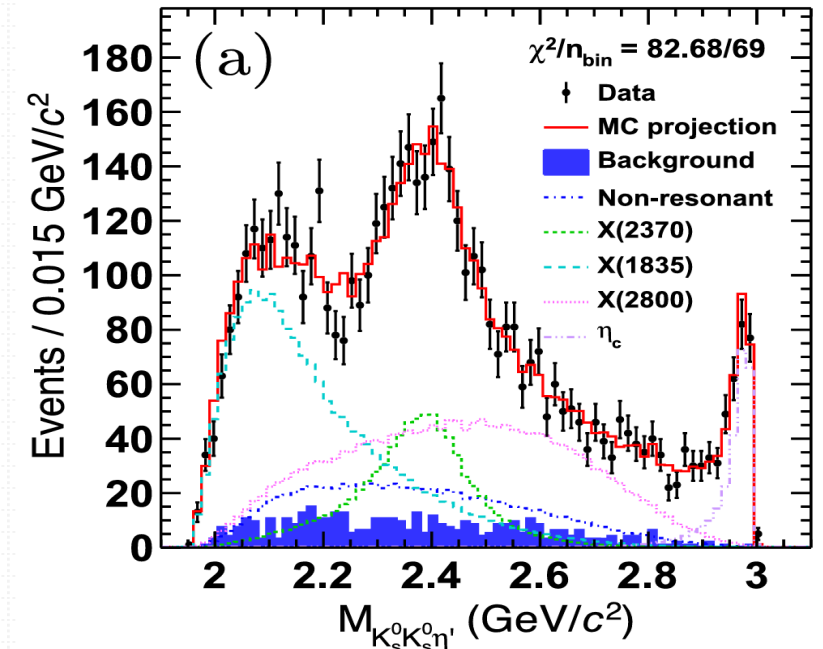
BESIII: Phys. Rev. Lett. 106 (2011) 072002

- Observed in $J/\psi \rightarrow \gamma \pi^+ \pi^- \eta'$
- Significance: 6.4σ
- $M \sim 2.38$ GeV

But what are its
quantum numbers?



2024 — J^{PC} determined



BESIII: Phys. Rev. Lett. 132 (2024) 18, 181901

- $J^{PC} = 0^{-+}$
- Significance: $> 9.8\sigma$
- $M = 2.395$ GeV

Its mass and quantum numbers place X(2370) in the
region expected for the lightest pseudoscalar glueball.

/// X(2370): Large production rate in radiative J/ψ decays

BESIII: arXiv 2607.20366

Decay channel	$\mathcal{B} (\times 10^{-4})$
$J/\psi \rightarrow \gamma X(2370) \rightarrow \gamma K \bar{K} \pi$	$3.25 \pm 0.25^{+0.73}_{-0.75}$
$J/\psi \rightarrow \gamma X(2370) \rightarrow \gamma \pi \pi \eta$	$3.2 \pm 0.1^{+0.9}_{-1.0}$
$J/\psi \rightarrow \gamma X(2370) \rightarrow \gamma \pi \pi \eta'$	$1.94 \pm 0.04^{+0.33}_{-0.88}$
$J/\psi \rightarrow \gamma X(2370) \rightarrow \gamma K \bar{K} \eta'$	$0.39 \pm 0.05 \pm 0.10$

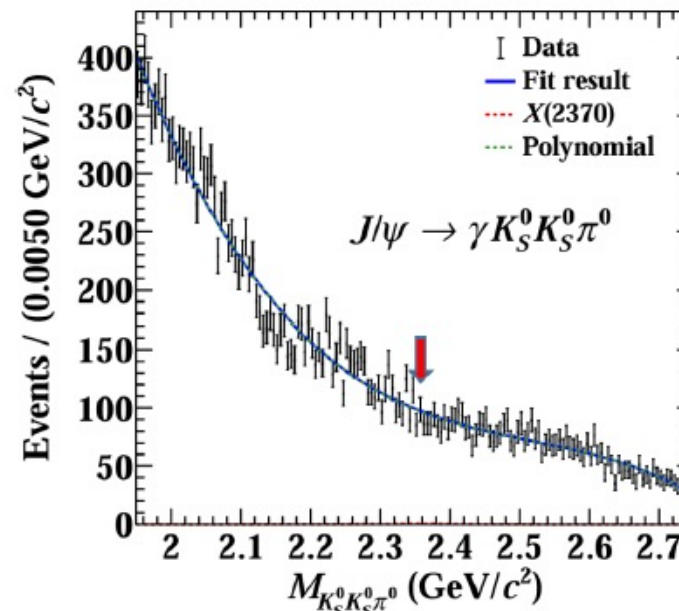
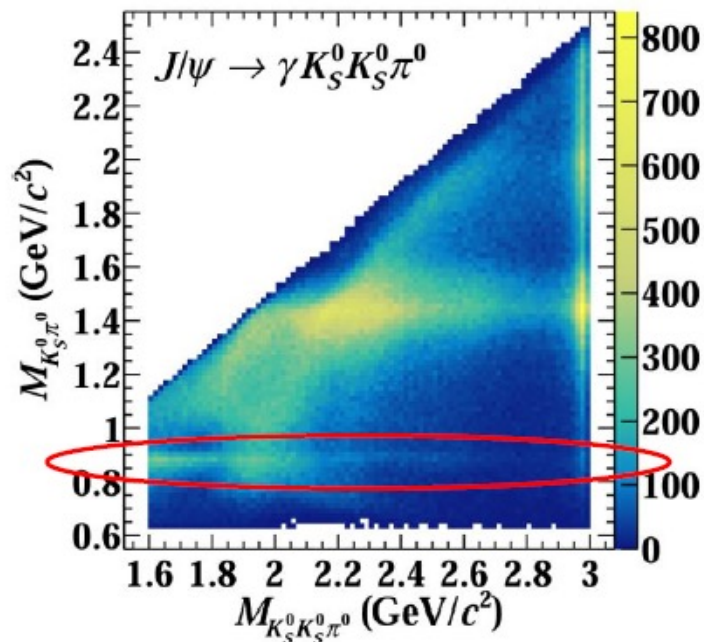
- The total sum from the left table is $\sim 0.9 \times 10^{-3}$
- Considering other unmeasured decay modes, it is reasonable to conclude:

$$B(J/\psi \rightarrow \gamma X(2370)) > 1 \times 10^{-3}$$

Large production in a gluon-rich process provides an intriguing clue to the nature of X(2370)

/// X(2370): Flavor-singlet behavior?

Pure glueball $\rightarrow$ no quark flavor $\rightarrow$ flavor singlet



BESIII: arXiv 2607.20366

Experimental observation

No significant $X(2370) \rightarrow K^*(892)K$ signal

Significance of the $X(2370) = 0.1\sigma$

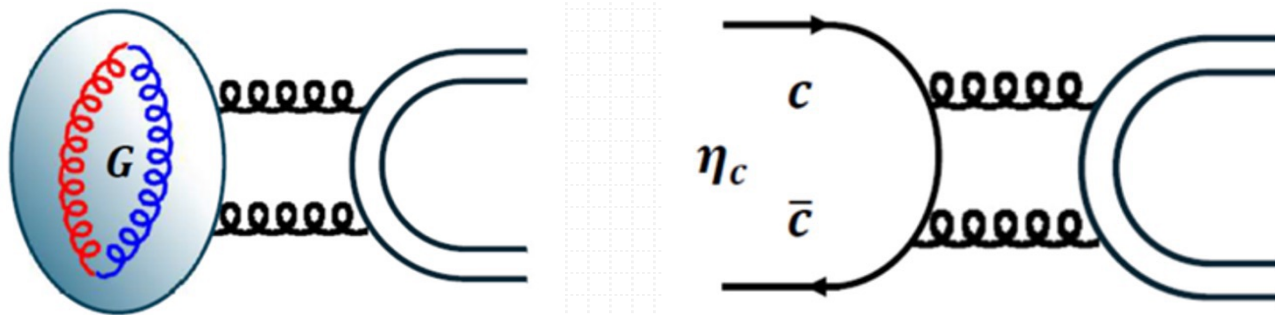
$$\frac{B[X(2370) \rightarrow K^*(892)^0 K_S^0 + c.c. \rightarrow K_S^0 K_S^0 \pi^0]}{B[X(2370) \rightarrow K_S^0 K_S^0 \pi^0]} < 0.081 @ 90\% \text{ C.L.}$$

Interpretation

For a 0^{-+} flavor-singlet state, $K^* K$ is forbidden by generalized G-parity.

Consistent with flavor-singlet behavior, but not a unique glueball signature.

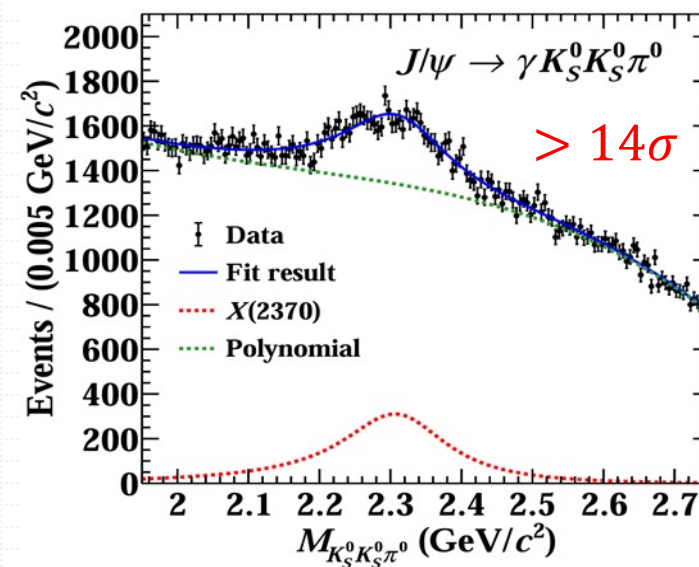
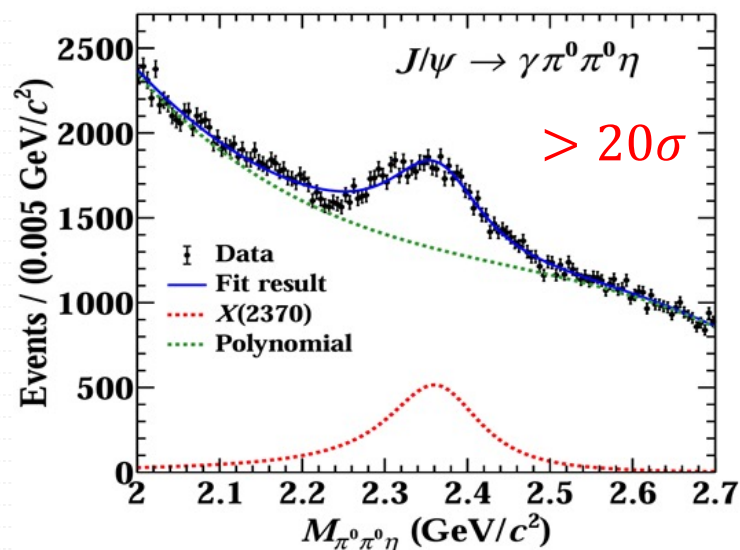
/// X(2370): Decay patterns similar to η_c



Different internal structures, but gluon-driven hadronic decays
→ Qualitative similarities in decay patterns are expected

**X(2370) observed in all five golden PPP
 η_c decay channels**

- ✓ $\pi\pi\eta$
- ✓ $\pi\pi\eta'$
- ✓ $KK\eta$
- ✓ $KK\eta'$
- ✓ $KK\pi$



Decay-pattern similarities to η_c provide another intriguing clue to the nature of X(2370)

/// X(2370): Further clues from its decays

Narrow partial decay widths

Observed S-wave two-body modes:

BESIII: arXiv 2607.20366

$K\bar{K}\eta'$: $f_0(980)\eta'$...

$\pi\pi\eta'$: $f_0(980)\eta'$, $f_0(500)\eta'$...

$\pi\pi\eta$: $a_0(980)\pi^0 f_0(500)\eta$, $f_0(1500)\eta f_0(1710)\eta$...

$K\bar{K}\pi$: $K_0^*(1430)\bar{K}$, $K_0^*(800)\bar{K}$, $a_0(980)\pi^0$...

$B(\text{each mode}) \sim 1\text{--}10\%$

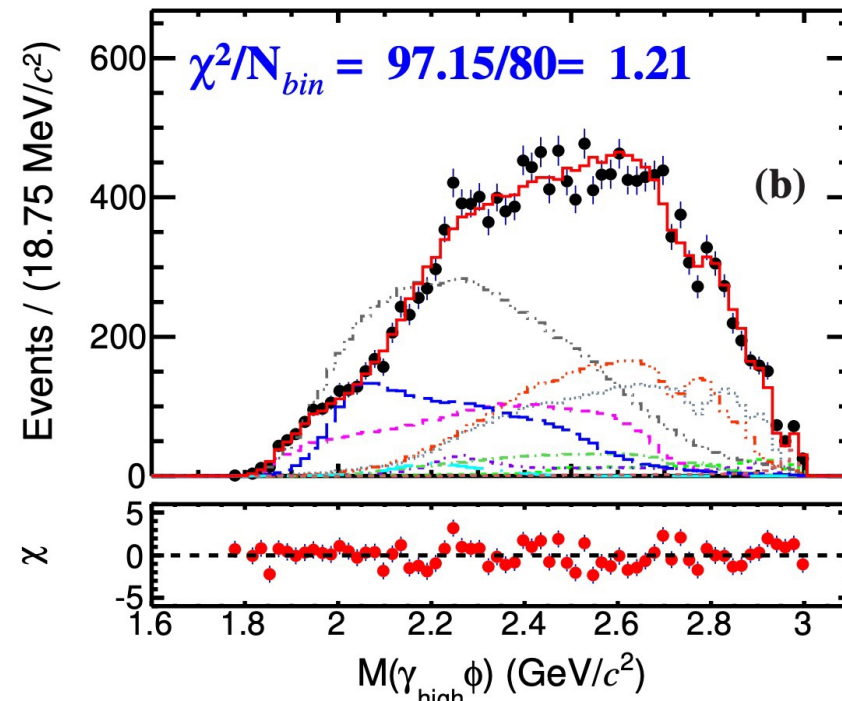
- $\Gamma(X2370) \sim 170 \text{ MeV}$



partial width: a few MeV

Compatible with expectations for
gluon-driven decays

Suppressed $\gamma\omega/\gamma\phi$



BESIII: PRD111(2025) 052011

No significant X(2370) in $\gamma\omega/\gamma\phi$

Suggests small light-quark content

These decay features provide further clues consistent with significant gluonic content in X(2370)

/// X(2370): Putting the pieces together

Properties of X(2370):

- ✓ Mass and J^{PC} consistent with LQCD expectations
- ✓ Large production in radiative J/ψ decays
- ✓ Flavor-singlet-like behavior
- ✓ Decay-pattern similarities to η_c
- ✓ Narrow partial decay widths
- ✓ Suppressed $\gamma\omega/\gamma\phi$ decays

These properties are consistent with the expected signatures of a pseudoscalar glueball.

BESIII interpretation:

The lightest 0^{-+} glueball is the dominant constituent of X(2370)

BESIII Collaboration, arXiv:2607.20366

Recent theoretical discussion

An alternative interpretation has recently been proposed, including a $\Sigma\bar{\Sigma}$ molecular picture.

Di, Yang & Zou, arXiv:2609.01342

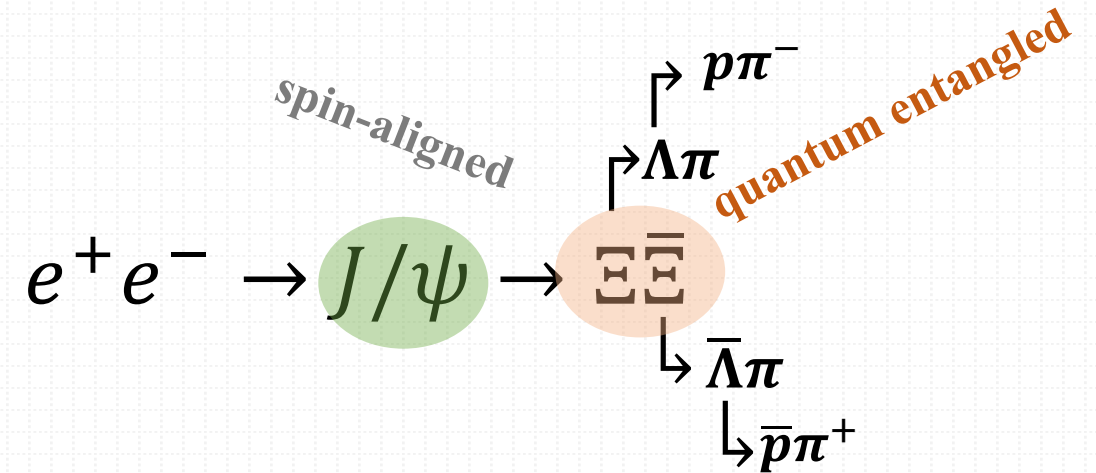
“X(2370): the strongest glueball candidate yet”
—— F. Canelli, ICHEP 2026 Summary

Hyperons at BESIII — A quantum-entangled laboratory

Front. Phys. 12(5), 121301 (2017)

Decay mode	$B(\times 10^{-3})$	$N_B(\times 10^6)$
$J/\psi \rightarrow \Lambda \bar{\Lambda}$	1.89 ± 0.09	~ 18.9
$J/\psi \rightarrow \Sigma^0 \bar{\Sigma}^0$	1.172 ± 0.032	~ 11.7
$J/\psi \rightarrow \Sigma^+ \bar{\Sigma}^-$	1.07 ± 0.04	~ 10.7
$J/\psi \rightarrow \Xi^0 \bar{\Xi}^0$	1.17 ± 0.04	~ 11.7
$J/\psi \rightarrow \Xi^- \bar{\Xi}^+$	0.97 ± 0.08	~ 9.7

$\sim 10^7$ hyperon–antihyperon pairs



Large samples

Polarization

Quantum entanglement

Access to spin information enables precision tests of fundamental symmetries

Hyperon decays as probes of CP symmetry

Nonleptonic hyperon decay $Y(s = \frac{1}{2}) \rightarrow B(s = \frac{1}{2})\pi$:

$$\mathcal{A} \sim S\sigma_0 + P\boldsymbol{\sigma} \cdot \hat{\mathbf{n}}$$

$$\alpha_Y = \frac{2\operatorname{Re}(S^*P)}{|S|^2 + |P|^2}, \quad \beta_Y = \frac{2\operatorname{Im}(S^*P)}{|S|^2 + |P|^2}, \quad \gamma_Y = \frac{|S|^2 - |P|^2}{|S|^2 + |P|^2}$$

$$\beta_Y = (1 - \alpha_Y^2)^{\frac{1}{2}} \sin\phi_Y, \quad \gamma_Y = (1 - \alpha_Y^2)^{\frac{1}{2}} \cos\phi_Y$$

Parity violation makes the daughter baryon an analyzer of the parent spin

CP conservation:

$$\alpha_Y = -\bar{\alpha}_Y, \quad \beta_Y = -\bar{\beta}_Y, \quad \phi_Y = -\bar{\phi}_Y$$

CP observables:

$$A_{CP} = \frac{\alpha + \bar{\alpha}}{\alpha - \bar{\alpha}}$$

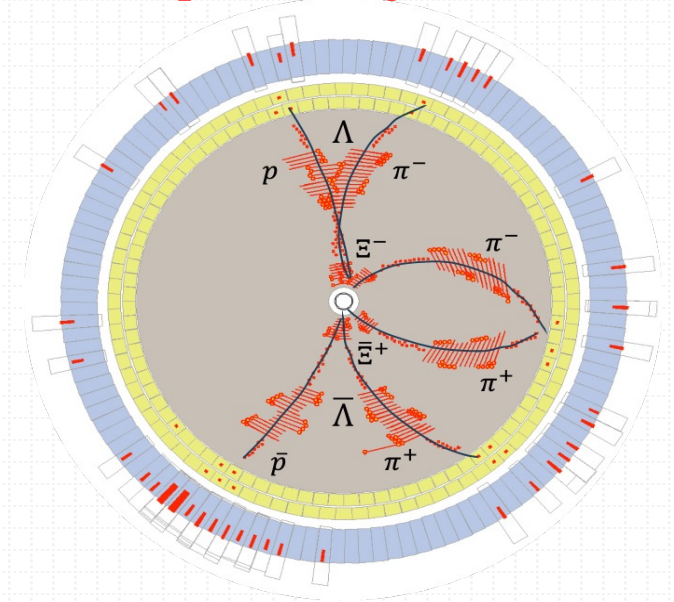
$$\Delta\phi_{CP} = \frac{\phi + \bar{\phi}}{2}$$

Weak-phase difference

$$B_{CP} = \frac{\beta + \bar{\beta}}{\alpha - \bar{\alpha}} \approx \tan(\xi_P - \xi_S)$$

Experimental access

spin-entangled $\Xi\bar{\Xi}$



$$\begin{aligned} J/\psi &\rightarrow \Xi\bar{\Xi}, \\ \Xi(\bar{\Xi}) &\rightarrow \Lambda(\bar{\Lambda})\pi, \\ \Lambda(\bar{\Lambda}) &\rightarrow p\pi^-(\bar{p}\pi^+) \end{aligned}$$

Sequential Ξ decays provide direct access to the CP-violating weak phase

/// Precision CP tests with entangled $\Xi - \bar{\Xi}$ pairs

320k $\Xi^0 \bar{\Xi}^0$ pairs (<2% bkg)

Three CP tests:

BESIII: Phys. Rev. D 108, L031106 (2023), Editors' Suggestion

$$A_{CP}^{\Xi^0} := \frac{\alpha_{\Xi^0} + \bar{\alpha}_{\Xi^0}}{\alpha_{\Xi^0} - \bar{\alpha}_{\Xi^0}} = (-5.4 \pm 6.5 \pm 3.1) \times 10^{-3}$$

$$\Delta\phi_{CP}^{\Xi^0} := \frac{\phi_{\Xi^0} + \bar{\phi}_{\Xi^0}}{2} = (-0.1 \pm 6.9 \pm 0.9) \times 10^{-3} \text{ rad}$$

$$A_{CP}^{\Lambda} := \frac{\alpha_{\Lambda} + \bar{\alpha}_{\Lambda}}{\alpha_{\Lambda} - \bar{\alpha}_{\Lambda}} = (6.9 \pm 5.8 \pm 1.8) \times 10^{-3}$$

weak CP and strong phase differences:

Weak: $(\xi_P - \xi_S) = (0.0 \pm 1.7 \pm 0.2) \times 10^{-2} \text{ rad}$

Strong: $(\delta_P - \delta_S) = (-1.3 \pm 1.7 \pm 0.4) \times 10^{-2} \text{ rad}$

580k $\Xi^- \bar{\Xi}^+$ pairs (0.4% bkg)

Three CP tests:

BESIII: Phys. Rev. Lett. 136, 201802 (2026)

$$A_{CP}^{\Xi^-} := \frac{\alpha_{\Xi^-} + \bar{\alpha}_{\Xi^-}}{\alpha_{\Xi^-} - \bar{\alpha}_{\Xi^-}} = (-7.8 \pm 4.8 \pm 0.8) \times 10^{-3}$$

$$\Delta\phi_{CP}^{\Xi^-} := \frac{\phi_{\Xi^-} + \bar{\phi}_{\Xi^-}}{2} = (0.6 \pm 5.1 \pm 0.2) \times 10^{-3} \text{ rad}$$

$$A_{CP}^{\Lambda} := \frac{\alpha_{\Lambda} + \bar{\alpha}_{\Lambda}}{\alpha_{\Lambda} - \bar{\alpha}_{\Lambda}} = (-2.9 \pm 4.3 \pm 0.7) \times 10^{-3}$$

weak CP and strong phase differences:

Weak: $(\xi_P - \xi_S) = (-0.2 \pm 1.2 \pm 0.1) \times 10^{-2} \text{ rad}$

Strong: $(\delta_P - \delta_S) = (0.3 \pm 1.2 \pm 0.2) \times 10^{-2} \text{ rad}$

All CP observables are consistent with CP symmetry
→ Most precise determinations of weak CP phases in hyperon decays

/// Quantum entanglement as a precision tool

HyperCP Phys. Rev. Lett. 93 (2004) 011802
144 million Ξ^- decays

BESIII Phys. Rev. Lett. 136, 201802 (2026)
580 k entangled $\Xi^- - \bar{\Xi}^+$ pairs

$$144 \text{ M} \rightarrow 0.58 \text{ M}$$

~250 times fewer events, yet better precision

$$\phi_{\Xi} = -0.032 \pm 0.011 \pm 0.011 \text{ rad}$$

$$\langle \phi_{\Xi} \rangle = -0.001 \pm 0.005 \pm 0.001 \text{ rad}$$

Fixed-target experiment
polarized Ξ^- sample

Spin-entangled $\Xi^- - \bar{\Xi}^+$ pairs
more information to be extracted
single-event sensitivity: $\times \sim 1000$

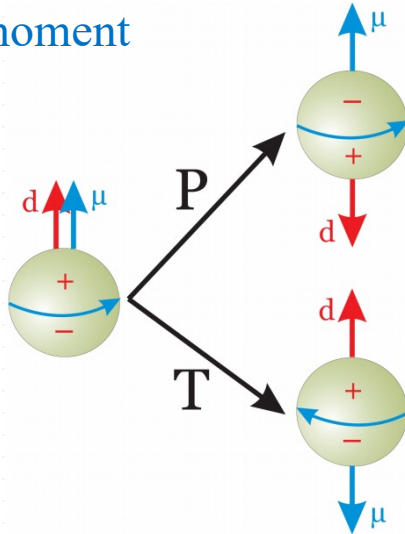
Spin correlations dramatically enhance the information carried by each event

/// Electric dipole moments — Precision probes of CP violation

Why EDM?

μ : magnetic moment

d : EDM



A non-zero intrinsic EDM violates both parity (P) and time-reversal (T) symmetries.

- When CPT symmetry is conserved, T violation is equivalent to CP violation.

Why is it difficult for hyperons?

Traditional approach:

spin precession in an external electromagnetic field

limitation:

Short lifetime: $\sim 10^{-10}$ s

Difficult to obtain highly polarized hyperon beams

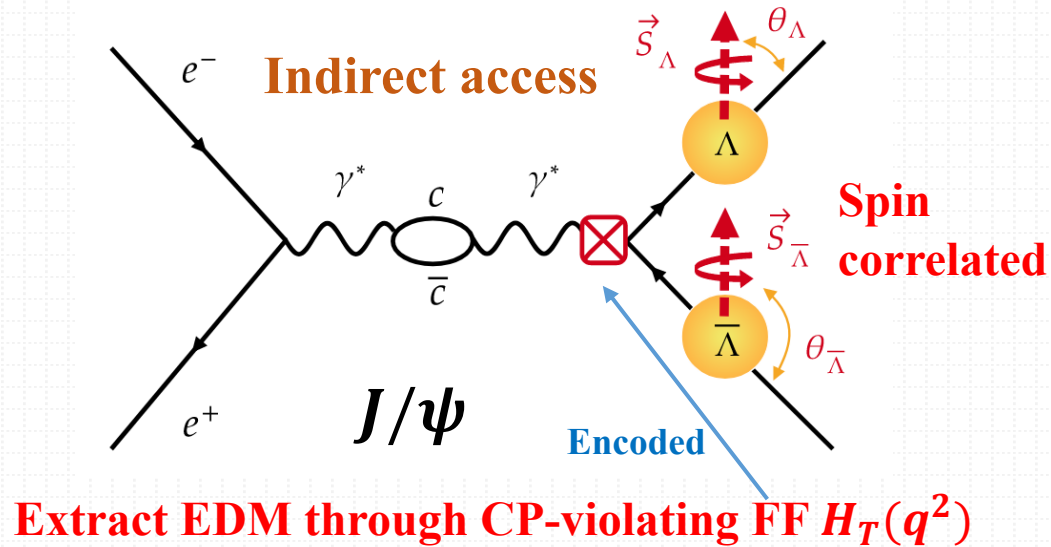
Prior direct Λ EDM limit (Fermilab, 1981):

$$|d_{\Lambda}| < 1.5 \times 10^{-16} e \cdot cm.$$

Can quantum entanglement provide a new way to probe the Λ EDM, and do better?

/// Lambda EDM — A new approach with quantum entanglement

A new method



$$H_T(q^2) = \frac{2e}{3m_{J\psi}^2} g_V d_B(q^2)$$

Phys. Rev. D 108 L091301

The EDM is encoded in the spin correlations of the $\Lambda - \bar{\Lambda}$ system

Result

BESIII: Science 393, 1027 (2026)

$$\text{Re}(d_\Lambda) = (-3.1 \pm 3.2 \pm 0.5) \times 10^{-19} e \cdot \text{cm}$$

$$\text{Im}(d_\Lambda) = (2.9 \pm 2.6 \pm 0.6) \times 10^{-19} e \cdot \text{cm}$$

$$|d_\Lambda| < 7.0 \times 10^{-19} e \cdot \text{cm} \quad (95\% \text{ C.L.})$$

Fermilab 1981

$$|d_\Lambda| < 1.5 \times 10^{-16} e \cdot \text{cm}$$

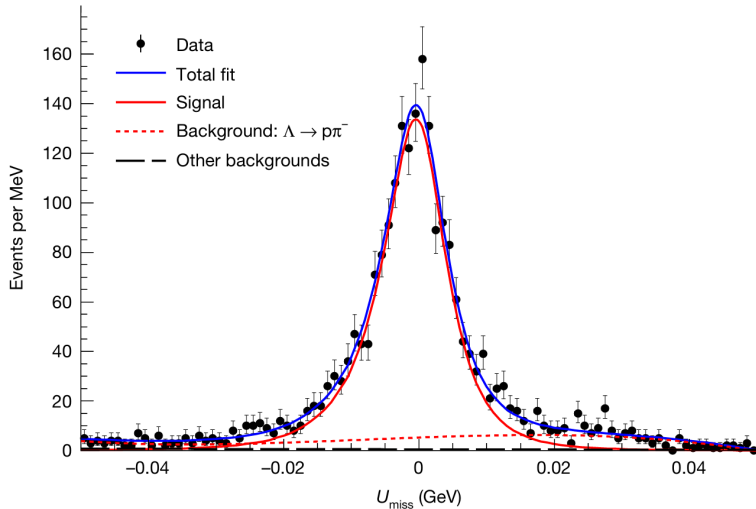
Improved by >2 orders of magnitude

World's most stringent limit on the Λ EDM

Quantum entanglement opens a new route to EDM searches for short-lived baryons

/// Λ semileptonic decay with quantum entanglement

What changes experimentally?



$$J/\psi \rightarrow \Lambda \bar{\Lambda}, \bar{\Lambda} \rightarrow \bar{p} \pi^+, \\ \Lambda \rightarrow p e^- \bar{\nu}_e$$

$\bar{\Lambda}$ tag $\rightarrow$ reconstructs Λ kinematics
polarization + entanglement $\rightarrow$
more information on decay dynamics

1854 $\pm$ 49 signal events

What is measured?

First absolute BF measurement

$$\mathcal{B}(\Lambda \rightarrow p e^- \bar{\nu}_e) \\ = (8.16 \pm 0.22 \pm 0.15) \times 10^{-4}$$

Axial-vector coupling

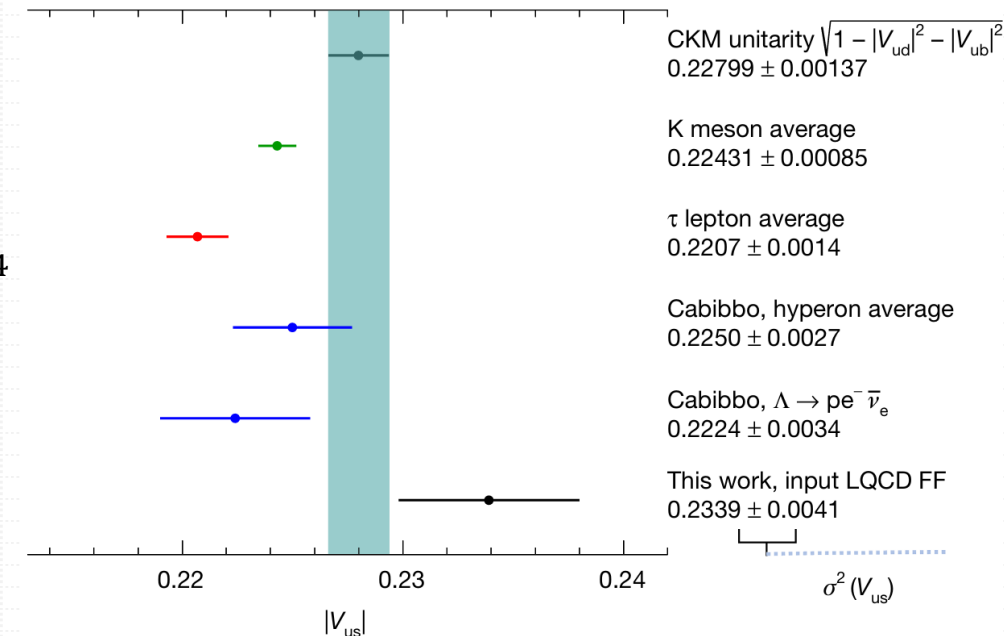
Weak-magnetism coupling

Weak-electricity coupling

— first measurement in Λ decay

BESIII: Nature 657, 92 (2026)

Physics impact



$$|V_{us}| = 0.2339 \pm 0.0041$$

Consistent with CKM unitarity at 1.4 sigma

An independent hyperon route to V_{us}

Quantum entanglement unlocks new information on baryon structure and CKM unitarity

/// Antihyperon–nucleon interactions at BESIII

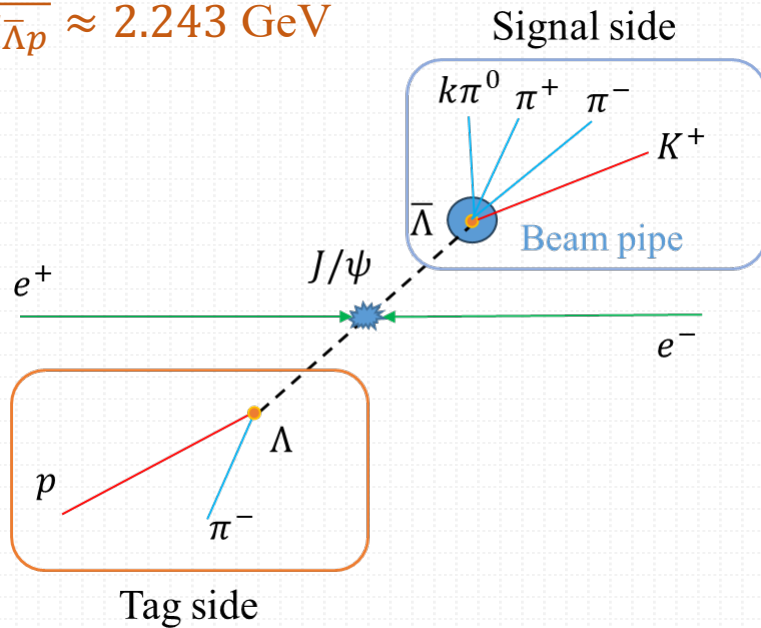
$$J/\psi \rightarrow \Lambda \bar{\Lambda}, \quad \bar{\Lambda} + p \rightarrow \text{mesons}$$

Monoenergetic $\bar{\Lambda}$ beam: $P_{\bar{\Lambda}} \approx 1.074 \text{ GeV}/c$

Proton target:

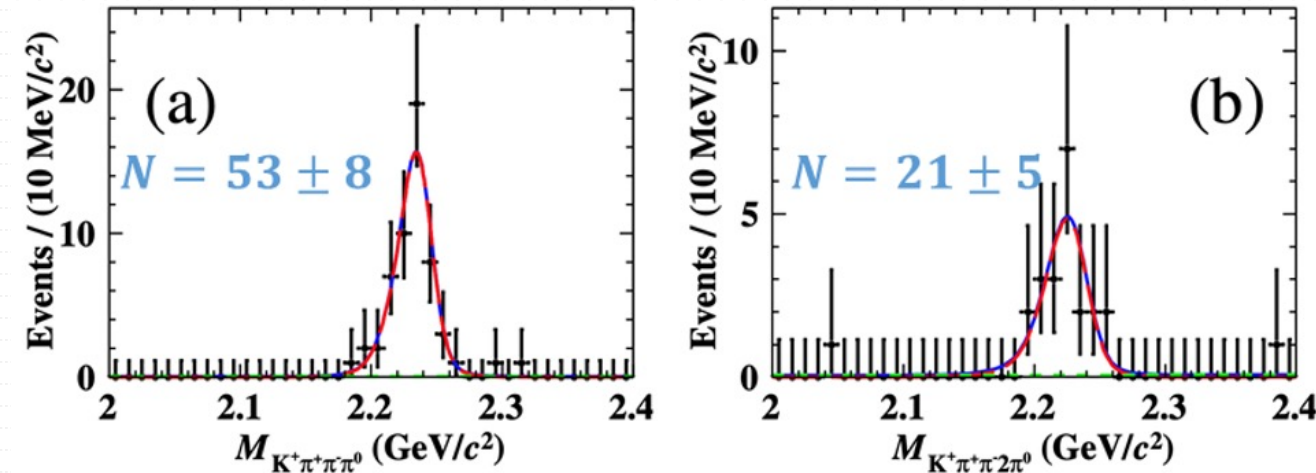
hydrogen in the beam-pipe cooling oil (protons at rest)

$$\sqrt{s_{\bar{\Lambda}p}} \approx 2.243 \text{ GeV}$$



J/ψ decays provide a secondary antihyperon beam at BESIII

First observations



$$\bar{\Lambda}p \rightarrow K^+ \pi^+ \pi^- \pi^0$$

$$\sigma = 8.5_{-1.1}^{+1.2} \pm 0.4 \text{ mb}$$

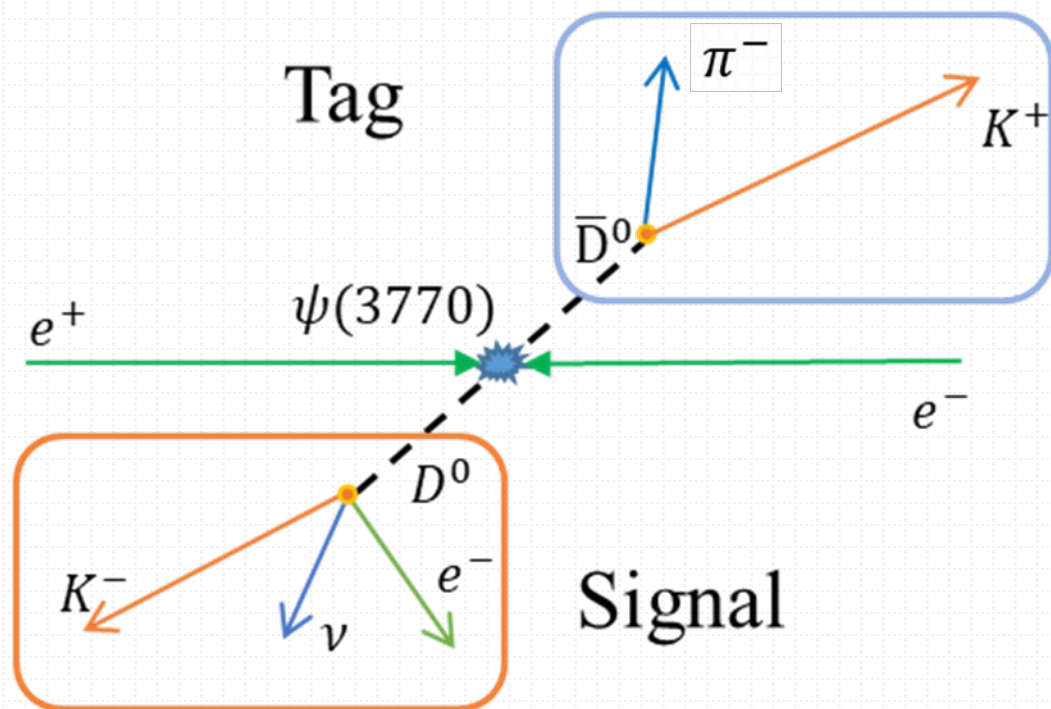
$$\bar{\Lambda}p \rightarrow K^+ \pi^+ \pi^- 2\pi^0$$

$$\sigma = 7.9_{-1.7}^{+1.9} \pm 0.4 \text{ mb}$$

BESIII, Phys. Rev. Lett. 136, 171904 (2026)

First experimental input on antihyperon–nucleon annihilation dynamics

/// Charm at threshold — Precision with double tags



Threshold production

$D\bar{D}$ pairs with well-constrained kinematics

Double-tag technique

Absolute branching fractions without luminosity or production cross section

Clean threshold environment

Low backgrounds and controlled systematics

For neutral D mesons

Quantum-correlated $D^0\bar{D}^0$ pairs
→ access to strong phases

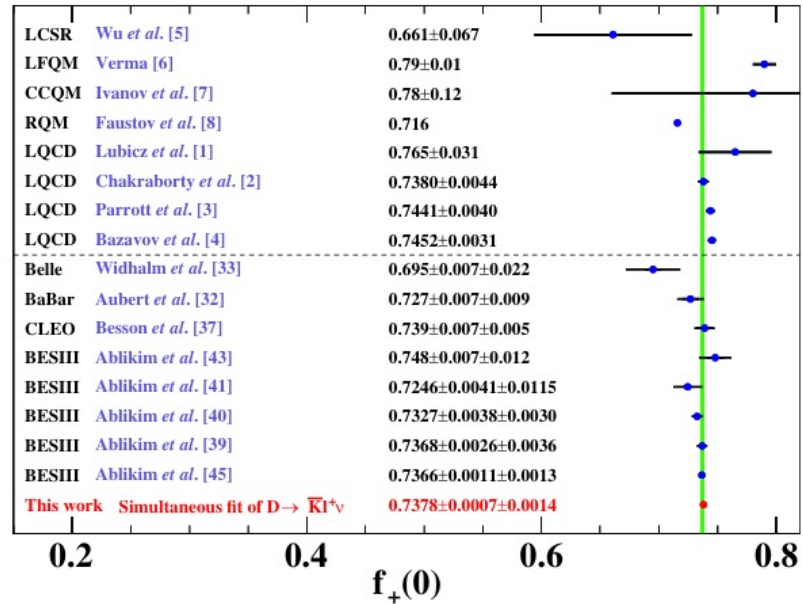
Clean threshold charm data enable precision tests of the Standard Model

/// Precision charm decays — Probing V_{cs} and V_{cd}

$$V_{cs}: D \rightarrow K l \nu$$

BESIII: Phys. Rev. Lett. 137 (2026) 091803

BESIII: Phys. Rev. D 114 (2026), 033008



20.3 fb^{-1} at $\psi(3770)$

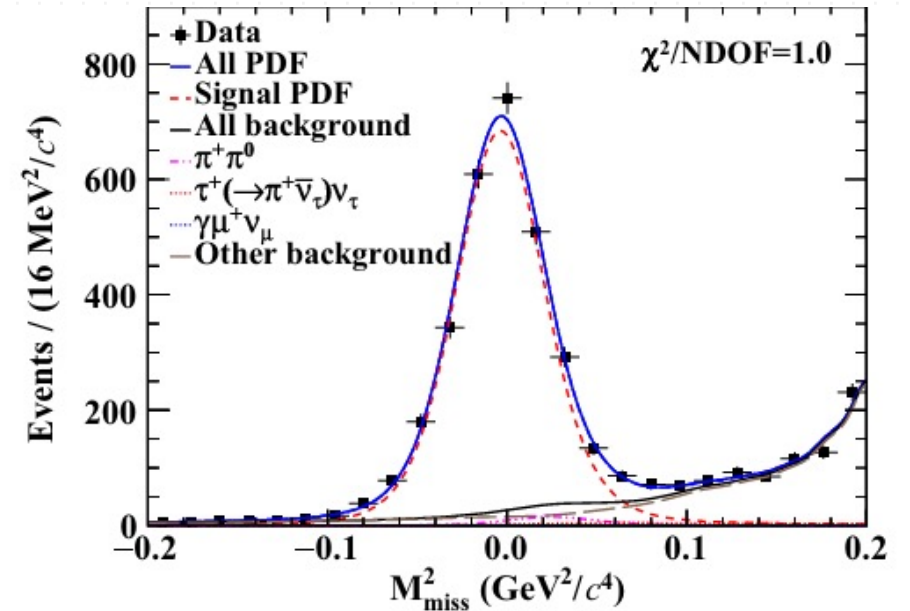
$$f_+(0)|V_{cs}| = 0.7183 \pm 0.0007 \pm 0.0014 \text{ (precision: } \sim 0.2\%)$$

$$\text{LQCD input: } f_+(0) = 0.7452 \pm 0.0031$$

$$|V_{cs}| = 0.9639 \pm 0.0020_{\text{exp.}} \pm 0.0040_{\text{LQCD}}$$

$$V_{cd}: D^+ \rightarrow \mu^+ \nu_\mu$$

BESIII: Phys. Rev. Lett. 135, 061801 (2025)



$$f_{D^+}|V_{cd}| = (48.02 \pm 0.54_{\text{exp.}} \pm 0.12_{\text{input}} \pm 0.15_{\text{EM}}) \text{ MeV}$$

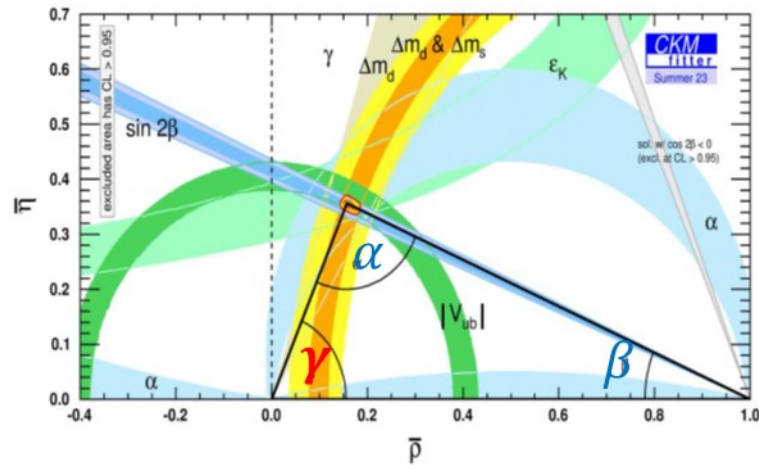
$$\text{LQCD input: } f_{D^+} = 212.0 \pm 0.7 \text{ MeV}$$

$$|V_{cd}| = 0.2265 \pm 0.0025_{\text{exp.}} \pm 0.0009_{\text{input}} \pm 0.0007_{\text{EM}}$$

Precision charm measurements are reaching the precision of lattice-QCD calculations

Quantum-correlated D decays — Strong phases for CKM γ

Why gamma?



CKM angle γ

theoretically very clean

measured through interference in $B \rightarrow DK$

requires knowledge of $D^0 - \bar{D}^0$ strong phases

$$B^- \rightarrow D^0 K^-, B^- \rightarrow \bar{D}^0 K^-,$$

$D^0/\bar{D}^0 \rightarrow$ same final state f

D strong-phase information is an essential input to the extraction of γ

Why BESIII?

$$\psi(3770) \rightarrow D^0 \bar{D}^0$$

$C = -1$ quantum-correlated state

Tag side	
Flavour	$K^- e^+ \nu_e, K^- \pi^+, K^- \pi^+ \pi^0, K^- \pi^+ \pi^+ \pi^-$
CP	Even $K^+ K^-, \pi^+ \pi^-, K_S^0 \pi^0 \pi^0, \pi^+ \pi^- \pi^0, K_L^0 \pi^0, K_L^0 \omega$
	Odd $K_S^0 \pi^0, K_S^0 \omega, K_S^0 \eta, K_S^0 \eta', K_L^0 \pi^0 \pi^0$
Self-conjugate	$K_S^0 \pi^+ \pi^-, K_L^0 \pi^+ \pi^-$

Double-tag method

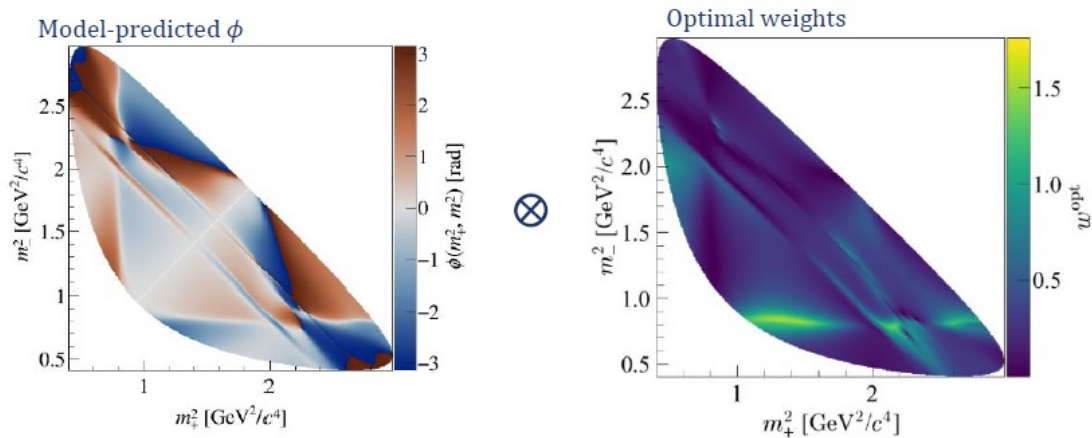
Reconstruct the signal D together with flavor, CP or self-conjugate tags

Quantum correlations give direct access to strong-phase differences

BESIII provides model-independent strong-phase inputs for precision γ measurements

/// An unbinned measurement of CKM γ with BESIII + LHCb

Model-independent unbinned approach



Strong phase varies continuously across phase space

Binned approach

average strong-phase information within each bin



Unbinned approach

fully exploit the continuous strong-phase variation

Model-independent measurement without Dalitz binning

BESIII + LHCb

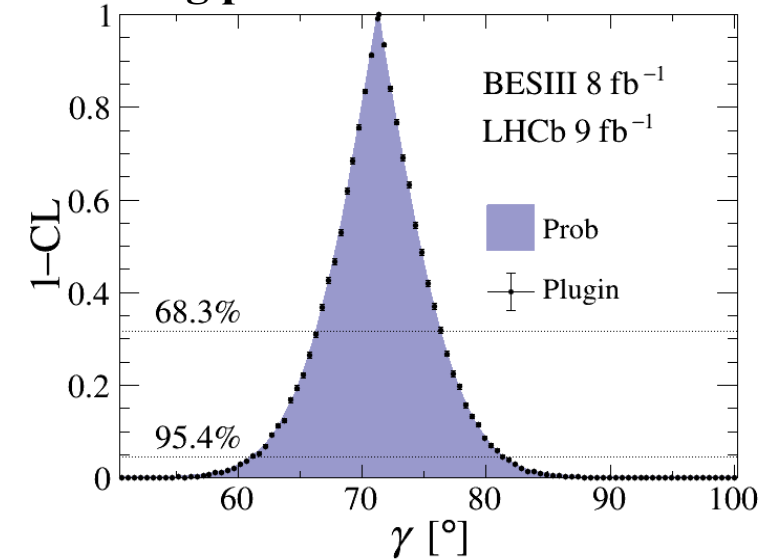
BESIII

Quantum-correlated $D^0 \bar{D}^0$
→ charm strong phases



LHCb

$B^\pm \rightarrow DK^\pm$
→ sensitivity to γ



$$\gamma = (71.3 \pm 5.0)^\circ$$

Strong-phase contribution: $\sim 0.6^\circ$

Most precise single measurement of γ

BESIII & LHCb: arXiv 2604.05712, 2604.05701

Quantum-correlated charm data enables precision measurements of CKM angle γ

Testing lepton flavor universality and nonstandard currents

LFU

BESIII: Phys. Rev. Lett. 137 (2026) 091803

BESIII: Phys. Rev. D 114 (2026), 033008

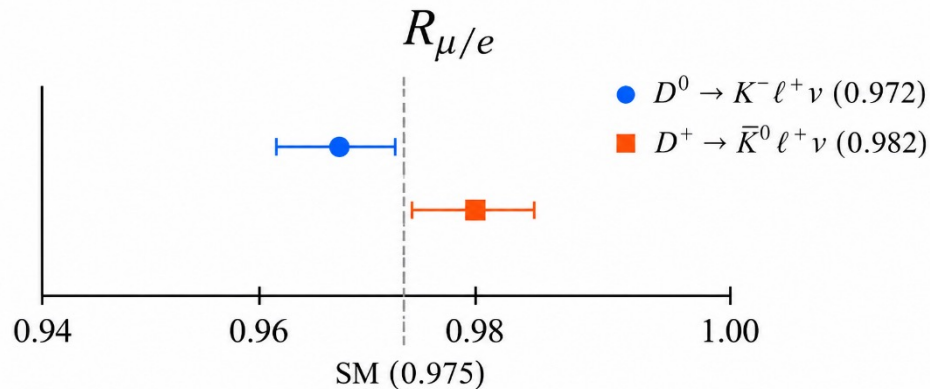
$$D^0 \rightarrow K^- \ell^+ \nu: R_{\mu/e} = 0.972 \pm 0.003 \pm 0.004$$

$$D^+ \rightarrow \bar{K}^0 \ell^+ \nu: R_{\mu/e} = 0.982 \pm 0.004 \pm 0.002$$

SM prediction: $R_{\mu/e} = 0.975 \pm 0.001$

LFU Precision: $\sim 0.5\%$

No significant LFU violation

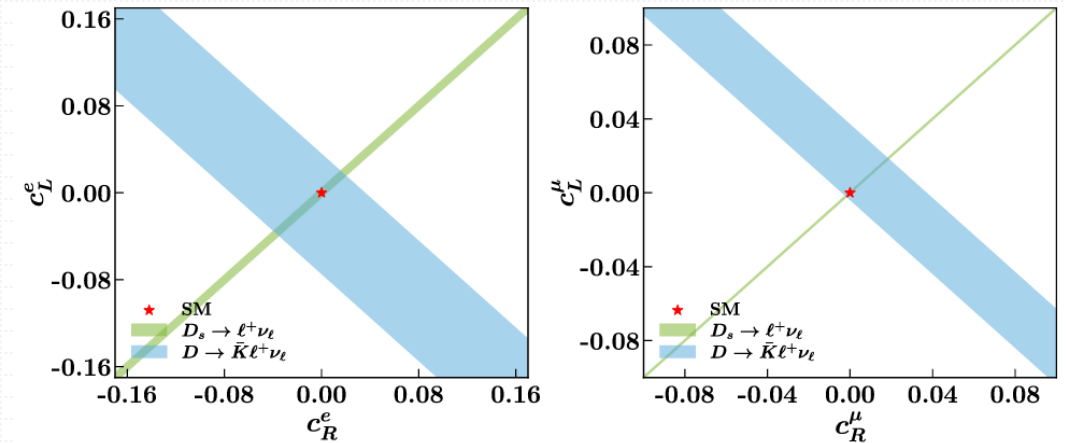


Search for a nonstandard scalar current

A_{FB} probes helicity interference

A scalar current modifies the scalar helicity amplitude

$\rightarrow A_{FB}$ becomes sensitive to scalar couplings c_S^e and c_S^μ



First measurement of A_{FB}

First constraint on a scalar current

Consistent with the SM within current precision

No significant evidence for a scalar contribution

Precision charm decays probe both LFU and nonstandard charged currents

/// Summary

Search for the lightest pseudoscalar glueball

- $X(2370)$: $J^{PC} = 0^{-+}$ and mass consistent with LQCD expectations
- Strongly produced in radiative J/ψ decays, with properties expected for a pseudoscalar glueball
- A compelling pseudoscalar-glueball candidate, while alternative interpretations remain under discussion

Hyperon physics — Quantum entanglement and strong interactions

- $\Xi\bar{\Xi}$ pairs provide direct access to weak CP phases
- Quantum entanglement enables the most stringent Λ EDM constraint and a new hyperon route to V_{us}
- Secondary antihyperon beams enable first observations of exclusive $\bar{\Lambda}p$ annihilation channels

Precision tests of the Standard Model at open-charm threshold

- Double tags enable precise absolute branching fractions and determinations of V_{cs} and V_{cd}
- Quantum-correlated $D^0\bar{D}^0$ data provide strong phases for precision γ measurements
- Sub-percent measurements test LFU and nonstandard charged currents

BESIII combines unprecedented data samples, unique production environments and quantum correlations for precision tests of QCD and the Standard Model.