Search for charm rare decays at BESIII

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On behalf of the BESIII Collaboration

中国物理学会高能物理分会第十二届全国会员代表大会暨学术年会

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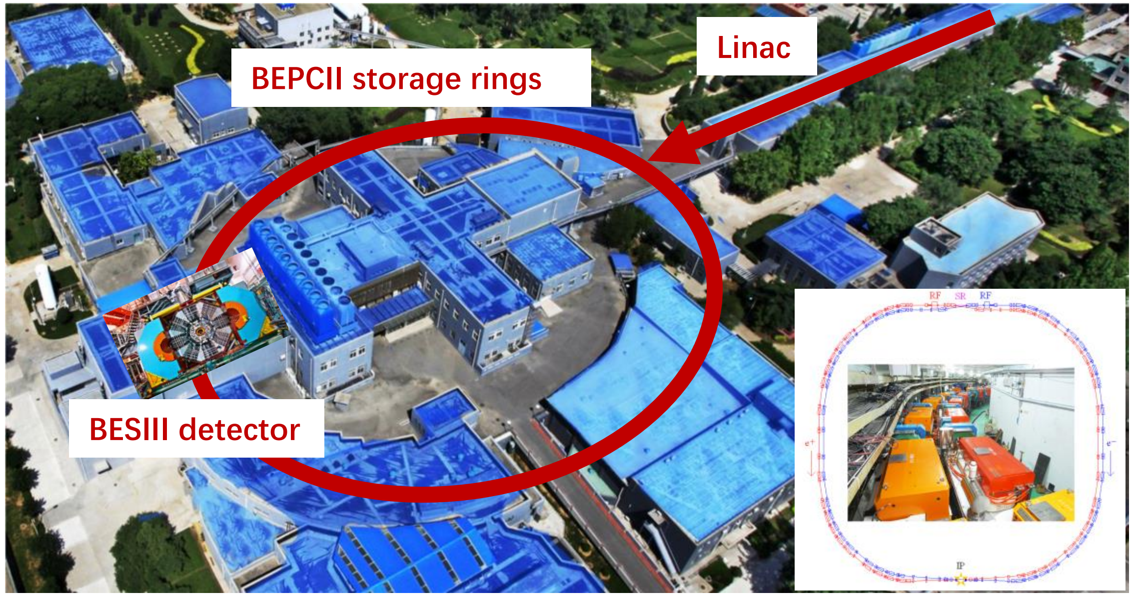
Outline

- BEPCII collider and BESIII detector
- New physics at BESIII
- Charm rare decays searches
  - Charged-lepton-flavor-violating (CLFV) decay
  - Charmonium weak decay
  - Flavor-changing-neutral-current (FCNC) process
- Summary

1. BEPCII collider and BESIII detector

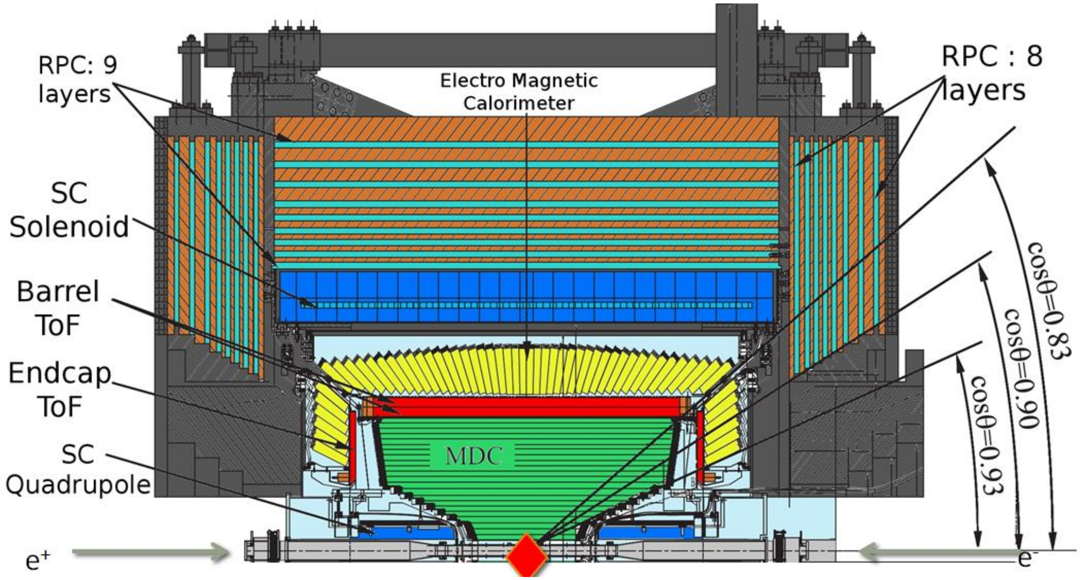
BEPCII collider



in Proceedings of IPAC2016, Busan, Korea (2016)

- Storage rings: a τ-charm factory, circumference: 237.5m
- Linac: 202m long, accelerate e^+e^- to 1.3 GeV
- Center of mass energy: 1.84~4.95 GeV
- Peak luminosity: $1.1 \times 10^{33} \mathrm{cm}^{-2}\mathrm{s}^{-1}$

BESIII detector



Nucl. Instrum. Meth. A. 614, 345 (2010)

Main drift chamber

- helium-based
- σ_p/p : 0.5% @ 1 GeV/c
- dE/dx : 6%

Time-of-flight system

- Plastic scintillator
- Barrel: $\sigma_T = 68\ ps$
- Endcap: $\sigma_T = 110\ ps$ (upgraded to 60 ps in 2015)

Electromagnetic calorimeter

- CsI(Tl) crystals
- Barrel: $\sigma_E = 2.5\%$
- Endcap: $\sigma_E = 5.0\%$

Muon chamber

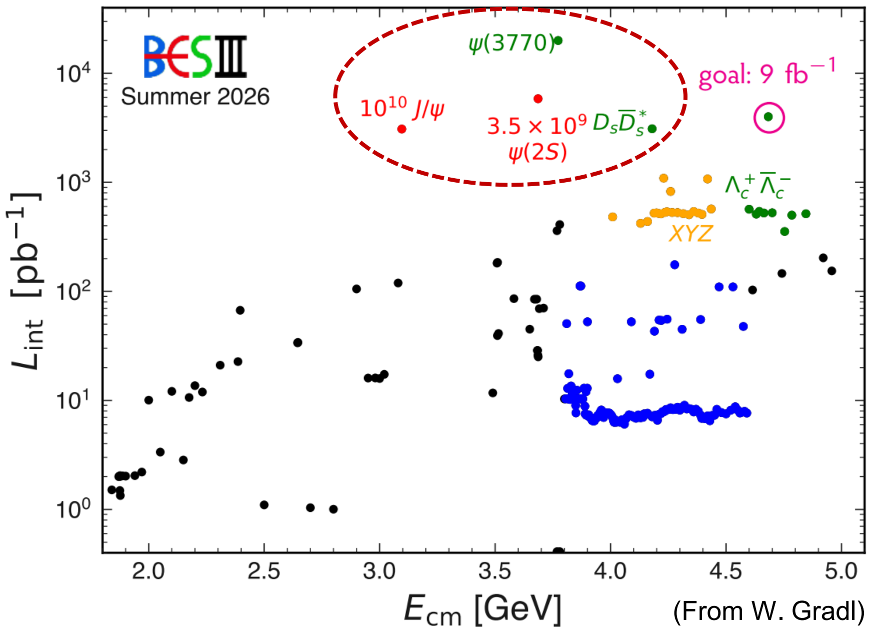
- RPC
- $\sigma_{\text{spatial}} = 1.48$ cm
- $p > 0.4$ GeV

Superconducting solenoid

- Magnetic field: 1T

2. New physics at BESIII

- World's largest on-threshold charmonium data sets
  - 10×10^9 J/ψ events
  - 3.5×10^9 $\psi(2S)$ events
  - $20.3\ \mathrm{fb}^{-1}$ on $\psi(3770)$ ($D\bar{D}$ pair)
- New physics (NP) at BESIII
  - Rare or forbidden processes searches
    - ✓ Charmonium weak decay
    - ✓ Flavor changing neutral current (FCNC)
    - ✓ Charged lepton flavor violation (CLFV)
    - ✓ Lepton number violation (LNV)
    - ✓ Bayon number violation (BNV), etc.
  - Exotic phenomena searches
    - ✓ Invisible decay, Dark photon, Light neutralino, Light Higgs, CP violation, etc.



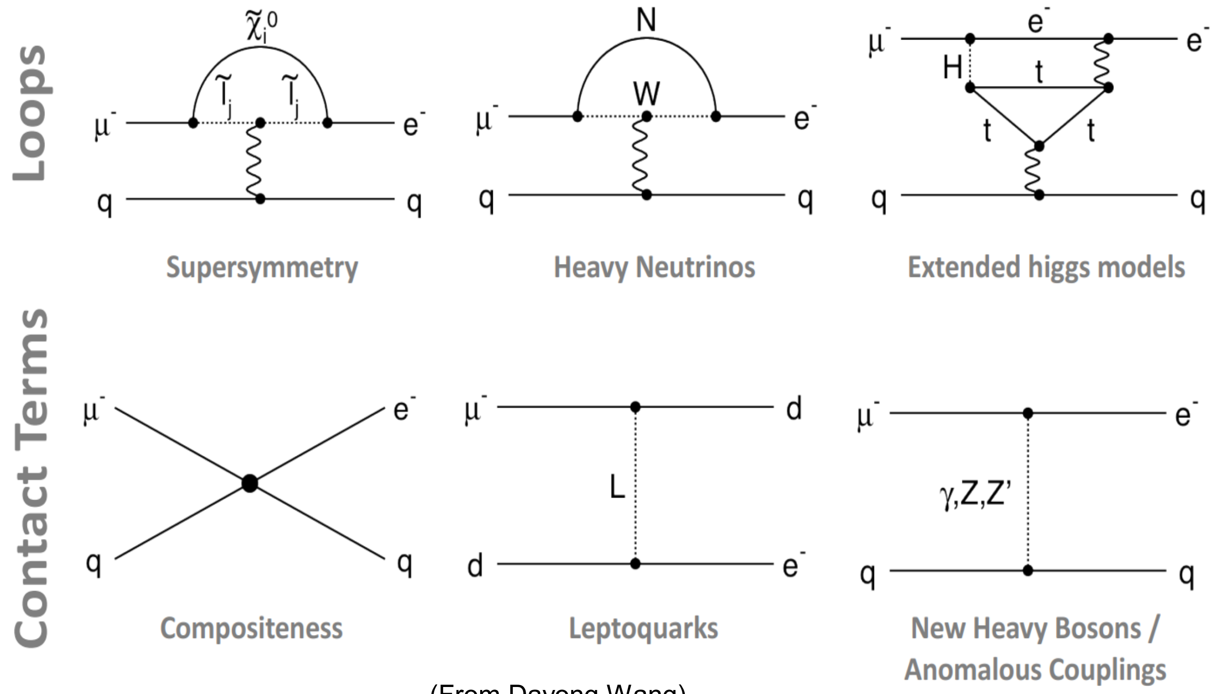
(From W. Gradl)

Rich physics with a clean environment and unique data sets

Chin. Phys. C 44, 040001 (2020)

3. Charged-lepton-flavor-violating (CLFV) decay

- LFV seen in neutrinos, not in charged leptons.
- Nonzero neutrino masses → CLFV in SM loops, but GIM-suppressed $\sim\mathcal{O}(10^{-54})$.
- Possible CLFV from new physics models



(From Dayong Wang)

- Experimental searches for CLFV
  - leptons (μ, τ), pseudoscalar (K, π, B), vector $(\varphi, J/\psi, \Upsilon)$, and bosons (Z, H).

Universe 8, 299 (2022)

Process	Experiment	Limit	C.L.
$\mu^+ \to e^+\gamma$	MEG	4.2×10^{-13} [101]	90%
$\mu^+ \to e^+e^-e^+$	SINDRUM	1.0×10^{-12} [136]	90%
$\mu^-\text{N} \to e^-\text{N}$	SINDRUM-II	$6.1(7.1) \times 10^{-13}$ Ti (Au) [137,138]	90%
$\mu^-\text{N} \to e^+\text{N}'$	SINDRUM-II	5.7×10^{-13} [139]	90%
$\tau\pm \to e^\pm\gamma$	BaBar	3.3×10^{-8} [140]	90%
$\tau^\pm \to \mu^\pm\gamma$	BaBar	4.4×10^{-8} [140]	90%
$\tau \to eee$	Belle	2.7×10^{-8} [141]	90%
$\tau \to \mu\mu\mu$	Belle	2.1×10^{-8} [141]	90%
$\tau \to \mu ee$	Belle	1.8×10^{-8} [141]	90%
$\tau \to e\mu\mu$	Belle	2.7×10^{-8} [141]	90%
$\tau \to \pi^0 e$	Belle	8.0×10^{-8} [142]	90%
$\tau \to \pi^0 \mu$	BaBar	1.1×10^{-7} [143]	90%
$\tau \to \eta e$	Belle	9.2×10^{-8} [142]	90%
$\tau \to \eta\mu$	Belle	6.5×10^{-8} [142]	90%
$\tau \to \rho^0 e$	Belle	1.8×10^{-8} [144]	90%
$\tau \to \rho^0 \mu$	Belle	1.2×10^{-8} [144]	90%
$\pi^0 \to \mu e$	KTeV	3.6×10^{-10} [145]	90%
$K_L^0 \to \pi^0\mu^+e^-$	kTeV	7.6×10^{-11} [145]	90%
$K_L^0 \to \mu e$	BNL E871	4.7×10^{-12} [107]	90%
$K^+ \to \pi^+\mu^+e^-$	BNL E865	1.3×10^{-11} [146]	90%
$J/\psi \to \mu e$	BESIII	1.5×10^{-7} [147]	90%
$J/\psi \to \tau e$	BESIII	7.5×10^{-8} [148]	90%
$J/\psi \to \tau\mu$	BESII	2.6×10^{-6} [149]	90%

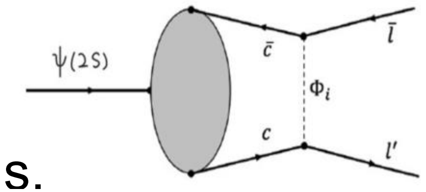
3.1 CLFV: $\psi(2S) \to e^{\pm}\mu^{\mp}$

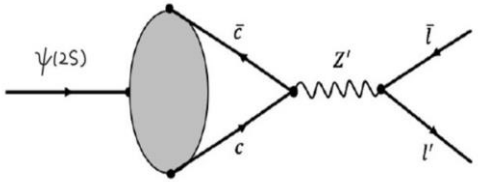
Sci. China-Phys. Mech. Astron. 69, 251012 (2026)

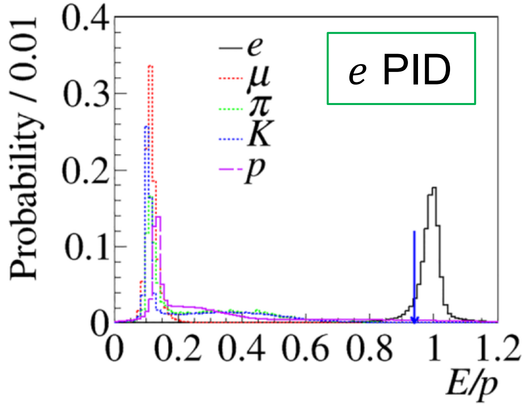
- First search for CLFV in $\psi(2S)$ decays
- Based on $(2367.0 \pm 11.1) \times 10^{6}$ $\psi(2S)$ events
- Charmonium CLFV: SUSY GUT, SUSY+new bosons. TC2 models predict rates $\sim\mathcal{O}(10^{-8}) - \mathcal{O}(10^{-16})$.
- Strict particle identification for e, μ.
- Result
  - No signal is observed ($N_{data} = 8, N_{bkg} = 6.2 \pm 1.4$)
  - Upper limit:

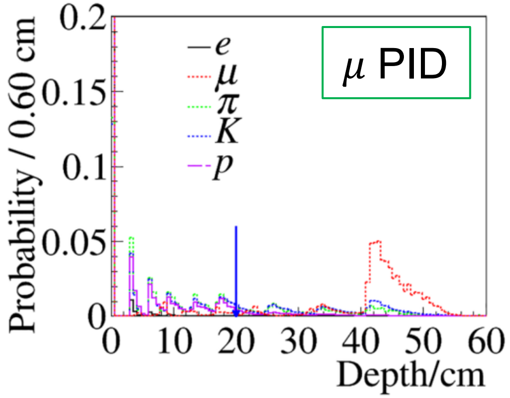
$$\mathcal{B}(\psi(2S) \to e^{\pm}\mu^{\mp}) < 1.4 \times 10^{-8} \text{ @ 90\% C.L.}$$

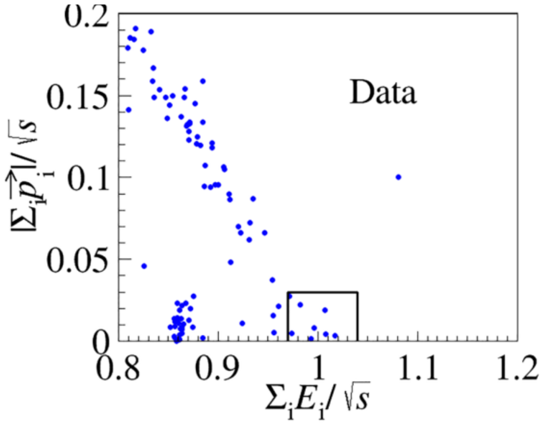
This is the first result in the search for CLFV in $\psi(2S)$ decays

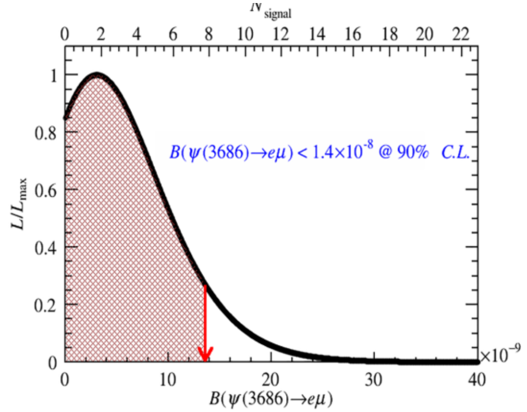












3.1 CLFV: $\psi(2S) \to e^{\pm}\mu^{\mp}$

Sci. China-Phys. Mech. Astron. 69, 251012 (2026)

- This result constrains Wilson coefficients of CLFV EFT operators.
  - $|C/\Lambda^2| \propto \sqrt{\mathcal{B}(V \to \ell_1\ell_2)}$
- Vector quarkonium states are relevant to
  - Dipole coefficients $\left|C^{\ell_1\ell_2}_{DL/DR}/\Lambda^2\right|$
  - Four-fermion coefficients (vector, tensor) $\left|C^{q\ell_1\ell_2}_{VL/VR}/\Lambda^2\right|$ $\left|C^{q\ell_1\ell_2}_{TL/TR}/\Lambda^2\right|$
- Stringent constraints on vector-quarkonium Wilson coeffs.

this work

Wilson coef./GeV^{-2}	$\ell_1\ell_2$	ϕ	J/ψ	$\psi(2S)$	$\Upsilon(1S)$	$\Upsilon(2S)$	$\Upsilon(3S)$
$\left\|C^{\ell_1\ell_2}_{DL/DR}/\Lambda^2\right\|$	$e\mu$	0.2	1.8×10^{-4}	1.77×10^{-4}	8.7×10^{-4}	—	8.0×10^{-4}
	$e\tau$	×	5.0×10^{-5}	—	1.4×10^{-4}	1.6×10^{-4}	1.6×10^{-4}
	$\mu\tau$	×	2.6×10^{-4}	—	1.4×10^{-4}	1.6×10^{-4}	1.4×10^{-4}
$\left\|C^{q\ell_1\ell_2}_{VL/VR}/\Lambda^2\right\|$	$e\mu$	2×10^{-3}	1.8×10^{-6}	1.72×10^{-6}	1.4×10^{-6}	—	1.2×10^{-6}
	$e\tau$	×	1.1×10^{-5}	—	3.8×10^{-6}	4.1×10^{-6}	4.1×10^{-6}
	$\mu\tau$	×	5.5×10^{-5}	—	3.8×10^{-6}	4.1×10^{-6}	3.5×10^{-6}
$\left\|C^{q\ell_1\ell_2}_{TL/TR}/\Lambda^2\right\|$	$e\mu$	1×10^{4}	0.80	7.75×10^{-1}	0.19	—	0.16
	$e\tau$	×	0.23	—	3.0×10^{-2}	3.2×10^{-2}	3.2×10^{-2}
	$\mu\tau$	×	1.2	—	3.0×10^{-2}	3.3×10^{-2}	2.8×10^{-2}

4. Charmonium weak decay

- Charmonium (J/ψ) decays mainly via strong & EM, weak decays are exceptionally rare in SM.
- Charmonium weak decays: CC vs FCNC
  - CC (Charged Current)

    $c \to s(d)\, W^{+}$:

    -SM: tree-level, BF ~$\mathcal{O}(10^{-9})$–$\mathcal{O}(10^{-11})$

    -NP (top-color, MSSM, 2HDM): enhance by 2–3 orders
  - FCNC (Flavor Changing Neutral Current)

    $c \to u\, \gamma/\ell^+\ell^-/q\bar{q}/\nu\bar{\nu}$:

    -SM: loop/GIM-suppressed, BF ~$10^{-13}(J/\psi \to D^0\ell^+\ell^-)$

    -NP: enhanced to exceed the SM prediction
- Charmonium weak decays are an excellent probe of potential new physics effects.

Experimental results and SM predictions for the BFs of J/ψ weak decays

J. High Energ. Phys. 2026, 126 (2026)

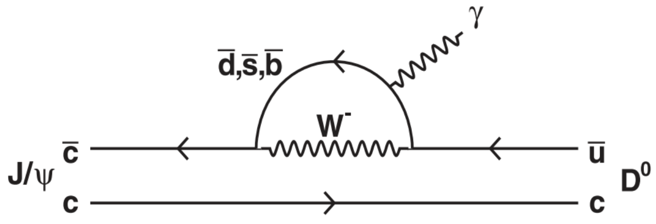
Decay type	Decay mode	$N_{J/\psi}$ ($\times10^6$)	UL at 90% CL	$\mathcal{B}_{\rm SM}$ ($\times10^{-10}$)
$c \to s$				[4, 5, 7, 8]
PP	$J/\psi \to D_s^-\pi^+$	58	1.4×10^{-4} [13]	2.00~8.74
	$J/\psi \to \bar{D}^0\bar{K}^0$	58	1.7×10^{-4} [13]	0.36~2.80
PV	$J/\psi \to D_s^-\rho^+$	225.3	1.3×10^{-5} [14]	12.60~50.50
	$J/\psi \to \bar{D}^0\bar{K}^{*0}$	225.3	2.5×10^{-6} [14]	1.54~10.27
$c \to d$				[4, 5, 7, 8]
PP	$J/\psi \to D^-\pi^+$	10087	7.0×10^{-8} [18]	$0.08 \sim 0.55$
	$J/\psi \to D^0\pi^0$	10087	4.7×10^{-7} [18]	$0.024 \sim 0.055$
	$J/\psi \to D^0\eta$	10087	6.8×10^{-7} [18]	$0.016 \sim 0.070$
PV	$J/\psi \to D^-\rho^+$	10087	6.0×10^{-7} [18]	$0.42 \sim 2.20$
	$J/\psi \to D^0\rho^0$	10087	5.2×10^{-7} [18]	$0.18 \sim 0.22$
Semi-leptonic				[6–10, 12]
$c \to s$	$J/\psi \to D_s^-e^+\nu_e$	225.3	1.3×10^{-6} [15]	$1.8 \sim 10.4$
	$J/\psi \to D_s^{*-}e^+\nu_e$	225.3	1.8×10^{-6} [15]	~100 or below
$c \to d$	$J/\psi \to D^-e^+\nu_e$	10087	7.1×10^{-8} [17]	$0.073 \sim 0.60$
	$J/\psi \to D^-\mu^+\nu_\mu$	10087	9.3×10^{-7} [19]	$0.071 \sim 0.58$
$c \to u$	$J/\psi \to D^0e^+e^-$	1310.6	8.5×10^{-8} [16]	—
	$J/\psi \to D^0\mu^+\mu^-$	10087	1.1×10^{-7} [20]	—

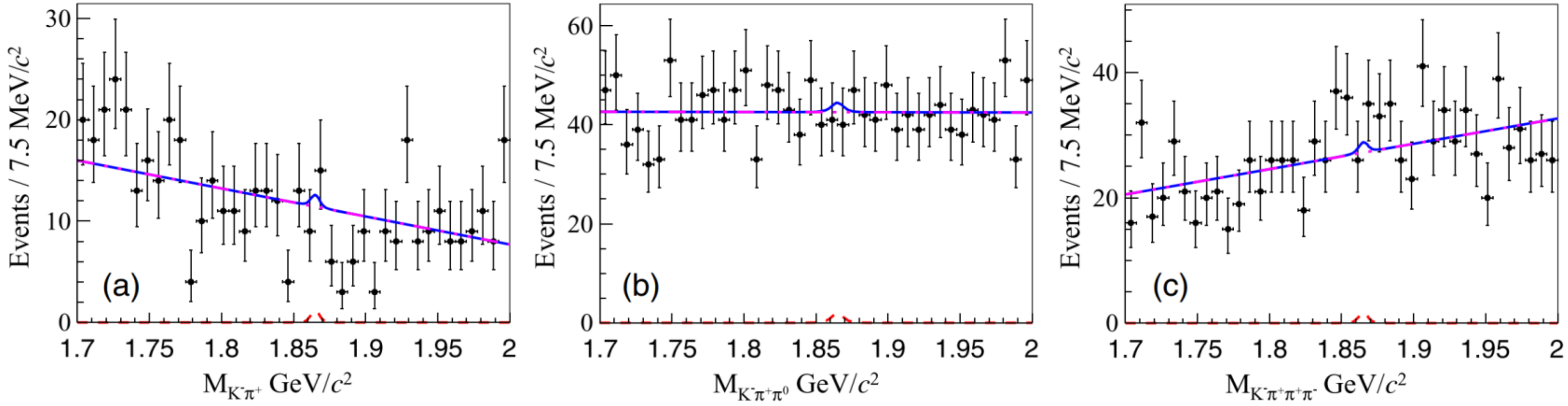
4.1 Charmonium weak decay: $J/\psi \to \gamma D^0 + c.c.$

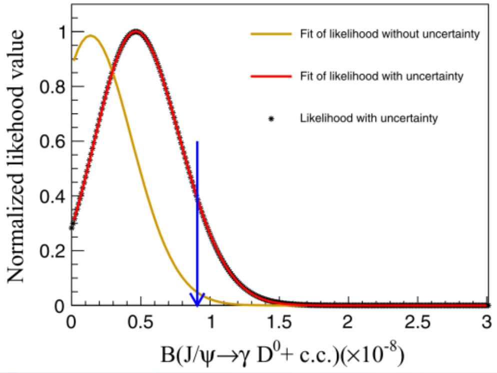
Phys. Rev. D 110, 112012 (2024)

- $J/\psi \to \gamma D^0$: FCNC-mediated J/ψ weak decay ($c \to u\,\gamma$)
- SM prediction: loop-level, GIM-suppressed,
  BF~$\mathcal{O}(10^{-12}) - \mathcal{O}(10^{-11})$
- Any BF enhancement over SM indicates NP.
- Based on 10 billion J/ψ events
- D^0 reconstruction:
  - Mode I: $D^0 \to K^-\pi^+$
  - Mode II: $D^0 \to K^-\pi^+\pi^0$
  - Mode III: $D^0 \to K^-\pi^+\pi^+\pi^-$
- No significant signal is observed.
- Upper limit:

  $\mathcal{B}(J/\psi \to \gamma D^0 + c.c.) < 9.1 \times 10^{-8}$ @ 90% C.L.





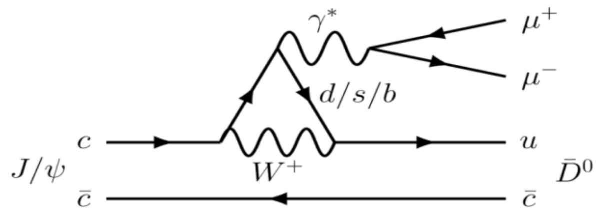


First experimental limit

4.2 Charmonium weak decay: $J/\psi \to D^0\mu^+\mu^- + c.c.$

J. High Energ. Phys. 2025, 61 (2025)

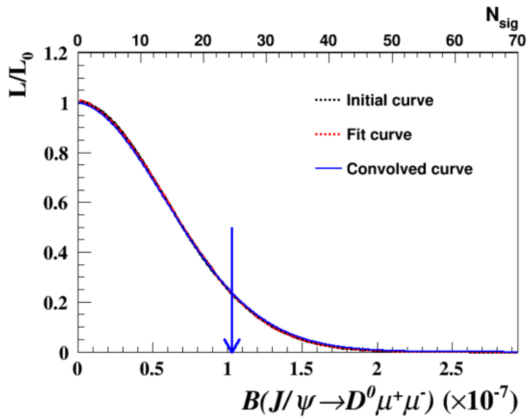
- $J/\psi \to D^0\mu^+\mu^-$: FCNC-mediated J/ψ weak decay ($c \to u\ell^+\ell^-$)
- SM prediction: BF~ $\mathcal{O}(10^{-13})$
- Charmonium FCNC searches at BESIII



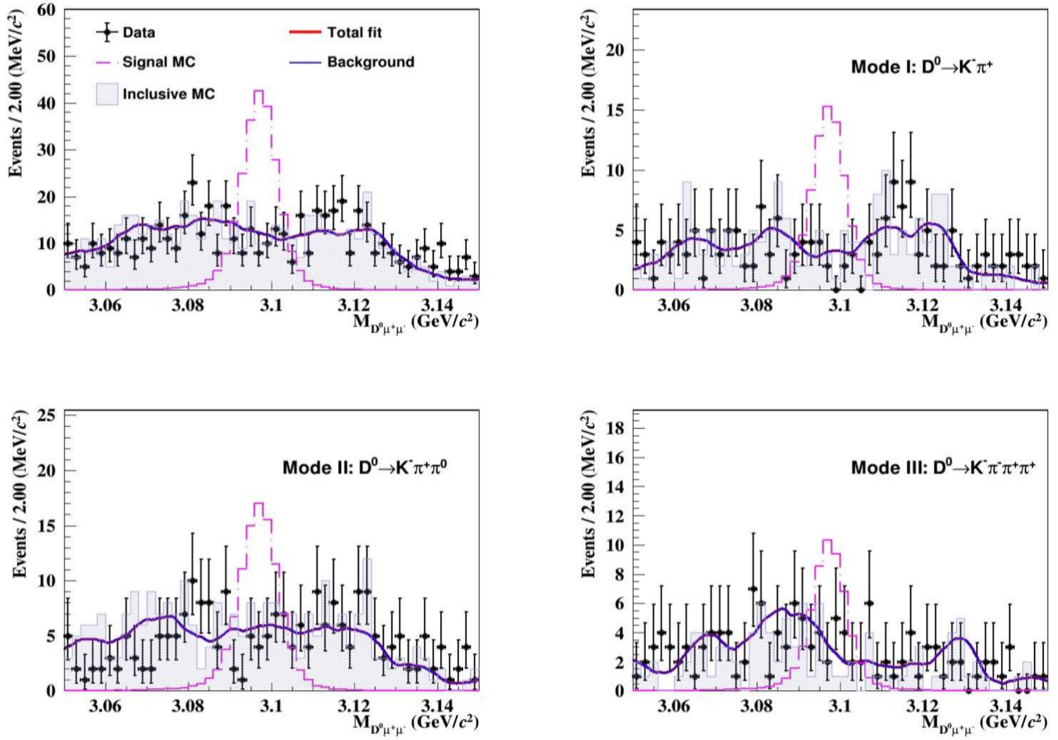
Experiment	Decay mode	$N_{J/\psi}$ or $N_{\psi(3686)}$	UL	Year
BESIII	$J/\psi \to D^0e^+e^-$	1310.6×10^6	8.5×10^{-8}	2017 [28]
BESIII	$\psi(3686) \to D^0e^+e^-$	447.9×10^6	1.4×10^{-7}	2017 [28]
BESIII	$J/\psi \to \gamma D^0$	10087×10^6	9.1×10^{-8}	2024 [29]

J. High Energ. Phys. 2025, 61 (2025)

- Based on 10 billion J/ψ events
- D^0 reconstruction:
  - Mode I: $D^0 \to K^-\pi^+$
  - Mode II: $D^0 \to K^-\pi^+\pi^0$
  - Mode III: $D^0 \to K^-\pi^+\pi^+\pi^-$
- No significant signal



$\mathcal{B}(J/\psi \to D^0\mu^+\mu^- + c.c.) < 1.1 \times 10^{-7}$ @ 90% C.L.



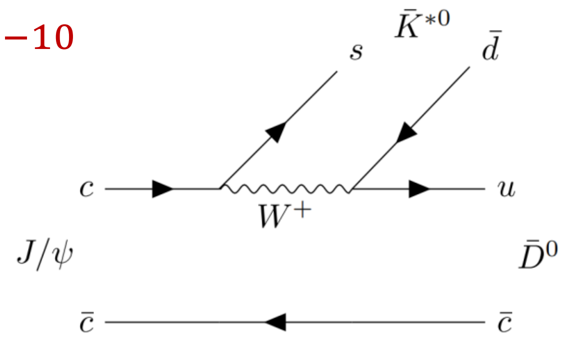
First search

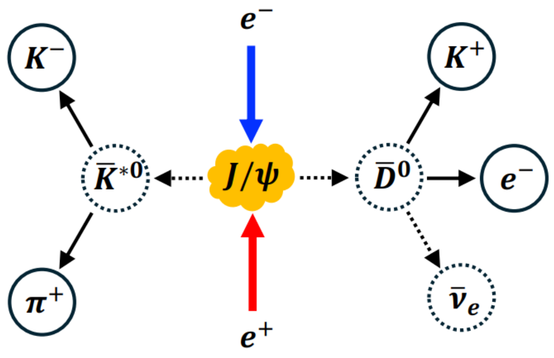
4.3 Charmonium weak decay: $J/\psi \to \bar{D}^0 \bar{K}^{*0} + c.c.$

J. High Energ. Phys. 2026, 126 (2026)

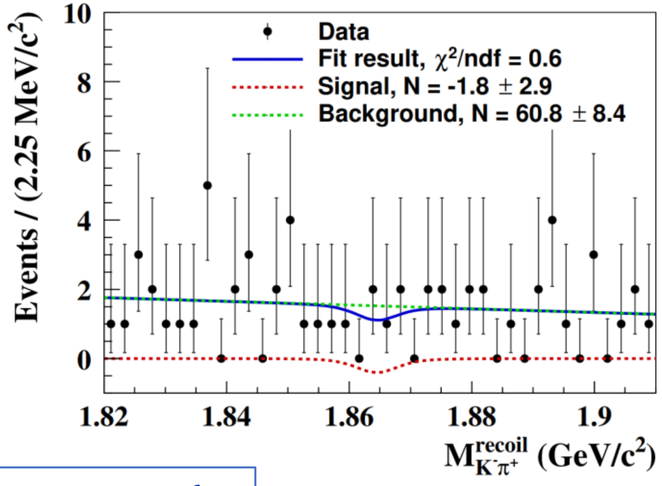
- CC-mediated J/ψ weak decay ($c \to s\, W^+$, Cabibbo flavored)
- SM prediction: tree-level, BF~$(1.54 \sim 10.27) \times 10^{-10}$
- Based on 10 billion J/ψ events
- Reconstruct $\bar{D}^0$ via semileptonic $\bar{D}^0 \to K^+ e^- \bar{\nu}_e$ with a low background.
- $\bar{K}^{*0}$ reconstructed via $K^-\pi^+$, $\bar{D}^0$ identified by recoil mass of $K^-\pi^+$ (neutrino undetected)
- No significant signal is observed.
- Upper limit @ 90% C.L.

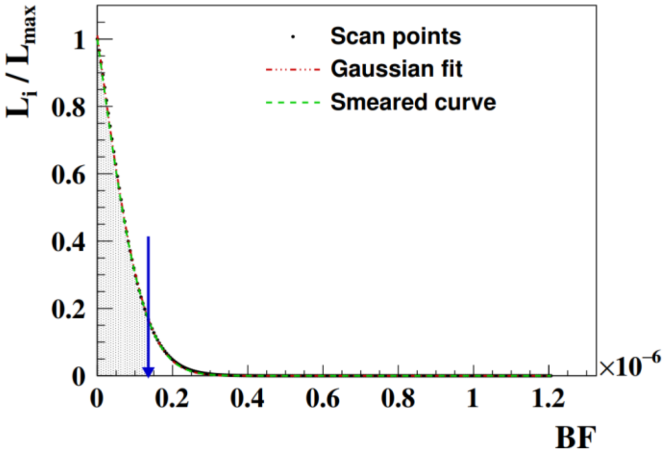
$$\mathcal{B}(J/\psi \to \bar{D}^0 \bar{K}^{*0} + c.c.) < 1.4 \times 10^{-7}$$





(From Xiaokang Li)



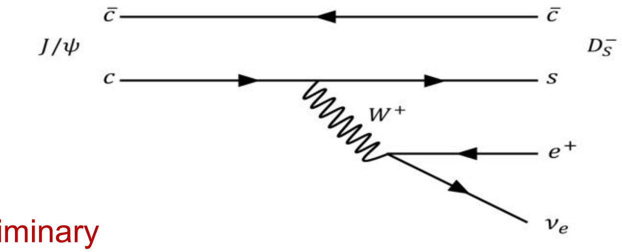


This UL is one order lower than previous best (2.5×10^{-6})

4.4 Charmonium weak decay: $J/\psi \to D_s^- e^+ \nu_e + c.c.$

arxiv:2510.25100, Accepted by JHEP

- CC-mediated J/ψ weak decay ($c \to s\, W^+$, Cabibbo flavored)
- SM prediction: BF up to $\mathcal{O}(10^{-9})$
- Based on 10 billion J/ψ events



- D_s^- reconstruction:

$$\begin{array}{l} \text{(a)}\ D_s^- \to K_S^0 K^- \\ \text{(b)}\ D_s^- \to K^+ K^- \pi^- \\ \text{(c)}\ D_s^- \to K^+ K^- \pi^- \pi^0 \\ \text{(d)}\ D_s^- \to K_S^0 K^- \pi^+ \pi^- \end{array}$$

- Missing neutrino:

$$\boxed{U_{\text{miss}} = E_{\text{miss}} - \left|\vec{P}_{\text{miss}}\right| c}$$

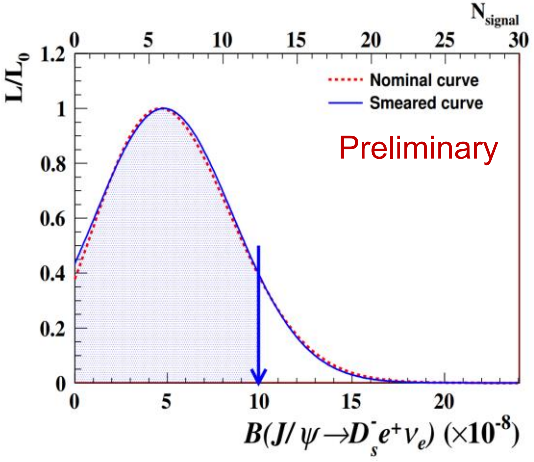
$$E_{\text{miss}} = 2E_{\text{beam}} - E_{D_s^-} - E_{e^+}$$

$$|\vec{P}_{\text{miss}}| = |\vec{0} - \vec{P}_{D_s^-} - \vec{P}_{e^+}|$$

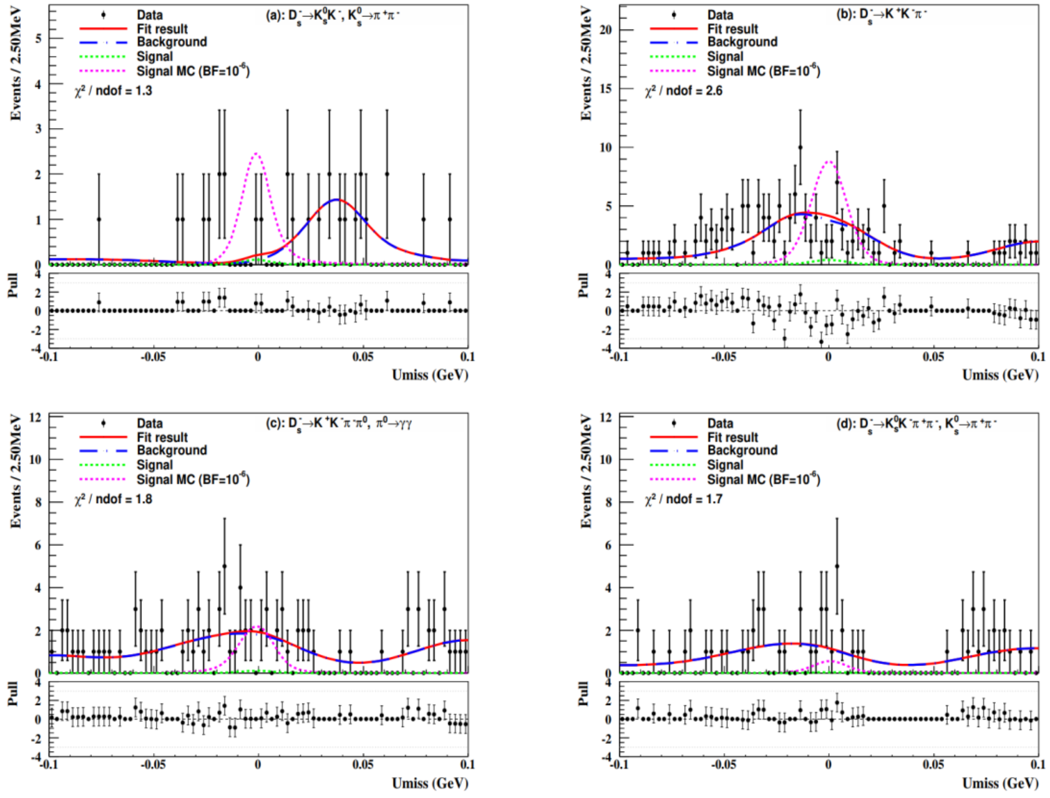
- No significant signal
- Upper limit @ 90% C.L.

$$\mathcal{B}(J/\psi \to D_s^- e^+ \nu_e + c.c.) < 9.9 \times 10^{-8}$$

UL improved by one order vs previous best (1.3×10^{-6})



Preliminary

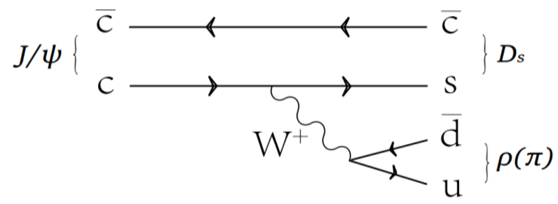


4.5 Charmonium weak decay: $J/\psi \to D_s^- \rho^+ / D_s^- \pi^+ + c.c.$

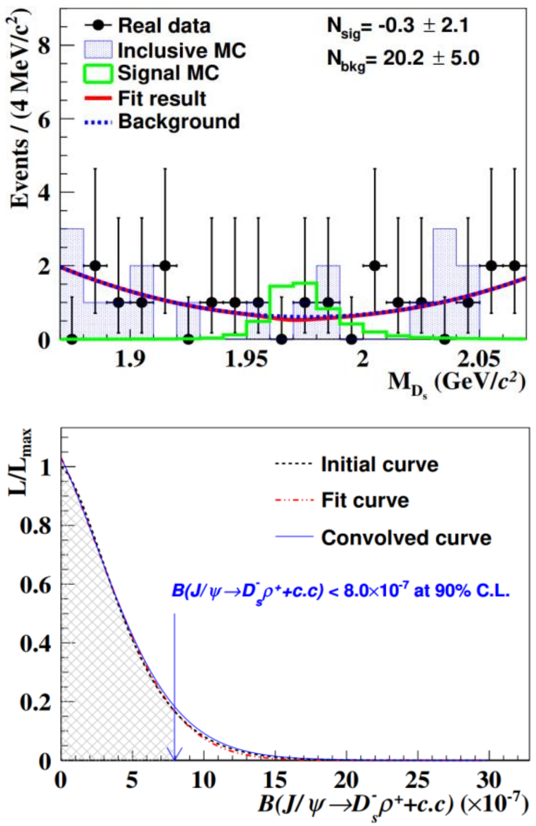
J. High Energ. Phys. 2025, 77 (2025)

- CC-mediated J/ψ weak decay ($c \to s\, W^+$, Cabibbo flavored)
- SM BF prediction: $(1.26{\sim}5.11) \times 10^{-9}$ ($J/\psi \to D_s^- \rho^+$),
  $(2.0{\sim}7.5) \times 10^{-10}$ ($J/\psi \to D_s^- \pi^+$)
- Based on 10 billion J/ψ events
- Reconstruction: $D_s^- \to \phi e^- \bar{\nu}_e \quad \phi \to K^+K^- \quad \rho^+ \to \pi^+\pi^0$
- D_s^- identified by recoil mass of ρ^+ (π^+) (neutrino undetected)
- No significant signal is observed.
- Upper limit @ 90% C.L.
  - $\mathcal{B}(J/\psi \to D_s^- \rho^+ + c.c.) < 8.0 \times 10^{-7}$
  - $\mathcal{B}(J/\psi \to D_s^- \pi^+ + c.c.) < 4.1 \times 10^{-7}$

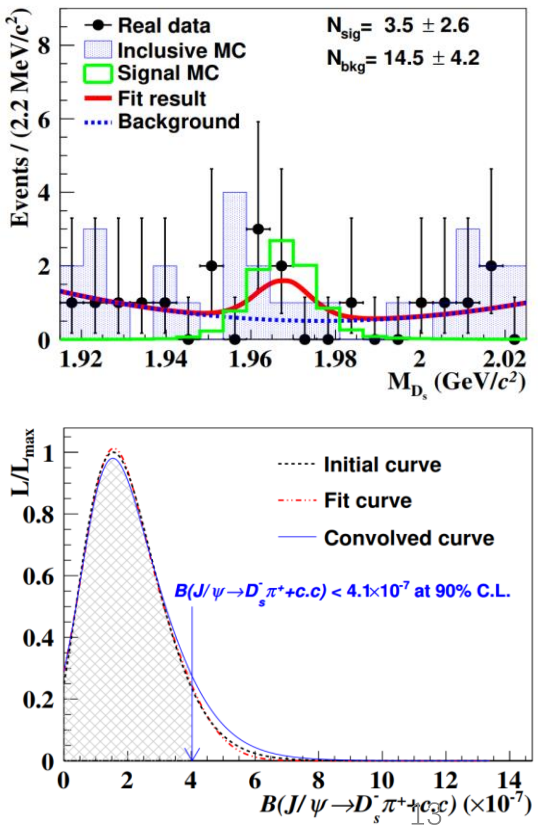
Most stringent experimental constraints



$J/\psi \to D_s^- \rho^+$



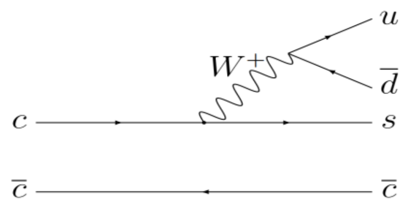
$J/\psi \to D_s^- \pi^+$



4.6 Charmonium weak decay: $\psi(2S) \to D_s^- \rho^+ / D_s^- \pi^+ + c.c.$

arXiv:2603.01777, Submitted to JHEP

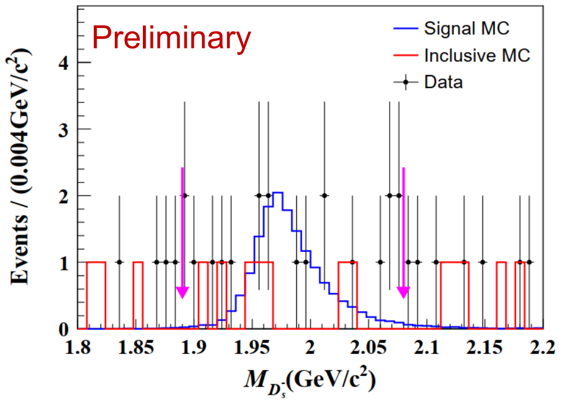
- CC-mediated $\psi(2S)$ weak decay ($c \to s\, W^+$, Cabibbo flavored)
- SM BF prediction: $1.22^{+0.45}_{-0.32} \times 10^{-9}$ ($\psi(2S) \to D_s^- \rho^+$),
  $1.23^{+0.70}_{-0.72} \times 10^{-10}$ ($\psi(2S) \to D_s^- \pi^+$)

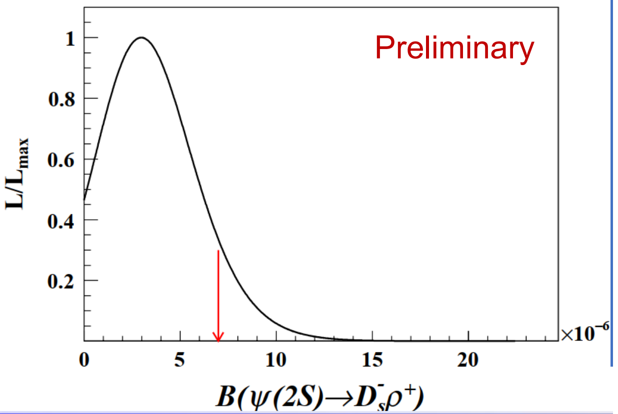


- Based on 27 billion $\psi(2S)$ events
- Reconstruction: $D_s^- \to \phi e^- \bar{\nu}_e \quad \phi \to K^+K^- \quad \rho^+ \to \pi^+\pi^0$
- D_s^- identified by recoil mass of ρ^+ (π^+) (neutrino undetected)
- No signal excess above the background.
- Upper limit @ 90% C.L.
  - $\mathcal{B}(\psi(2S) \to D_s^- \rho^+ + c.c.) < 7.0 \times 10^{-6}$
  - $\mathcal{B}(\psi(2S) \to D_s^- \pi^+ + c.c.) < 1.4 \times 10^{-6}$

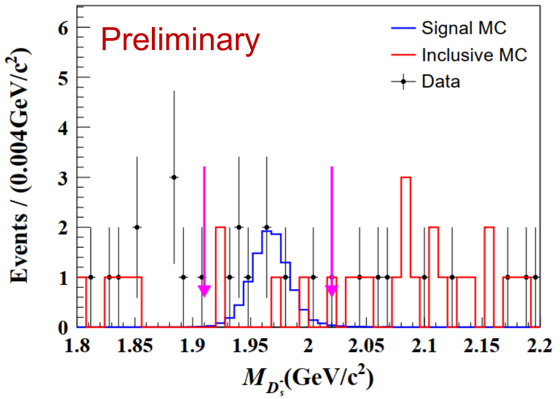
First experimental constraints on these decays

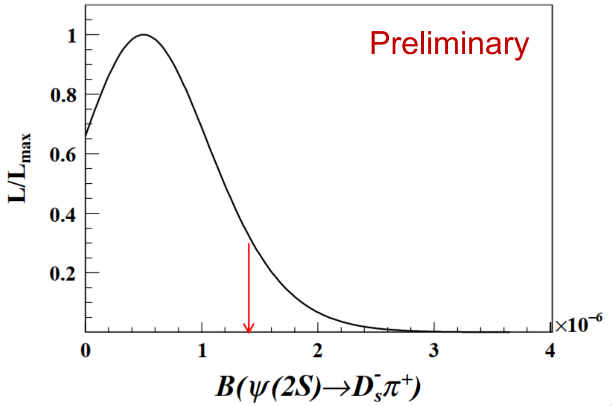
$\psi(2S) \to D_s^- \rho^+$





$\psi(2S) \to D_s^- \pi^+$





5. Flavor-changing-neutral-current (FCNC) process

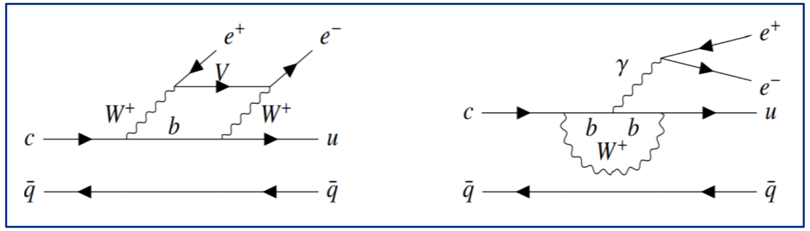
➢ FCNC in SM: Charm vs K/B

- **FCNC:** loop-only, GIM-suppressed.
- **K/B:** observed (heavy virtual quarks like top in loop enhances).
- **Charm:** no heavy quarks like top → stronger GIM, BF $\leq 10^{-9}$.
- **NP sensitivity:** can enhance rates → clean NP probes.
- **LFU test:** e vs μ channels (SM predicts $R \approx 1$; deviation → NP).

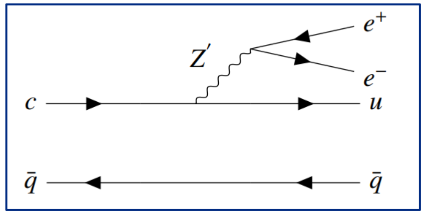
➢ Charm ($c \to u\ell^+\ell^-$): short-distance (SD) vs long-distance (LD)

- **SD (FCNC, $c \to u$):** quark-level, perturbative, BF~$\mathcal{O}(10^{-9})$, sensitive to NP (enhance).
- **LD ($\gamma^*/V \to \ell^+\ell^-$):** hadronic-level, non-perturbative, BF~$\mathcal{O}(10^{-6})$, irreducible backgrounds.
- **Extract SD**:
  - ✓ Probe dilepton mass regions away from V resonances
  - ✓ Use angular distributions & CP asymmetry as SM null tests

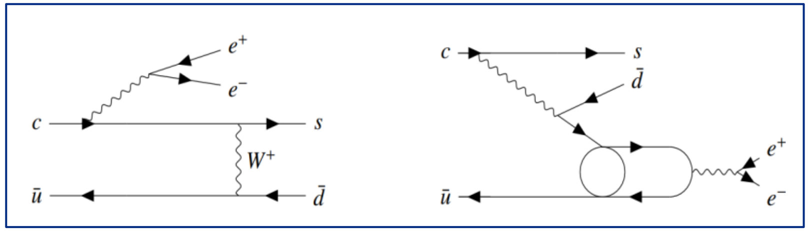
SD FCNC



BSM



LD contribution



(From Qiang Lan)

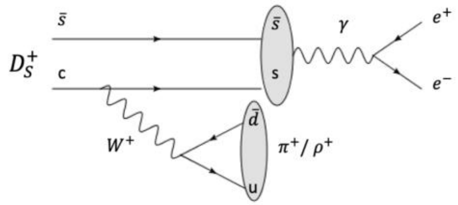
5.1 FCNC: $D_s^+ \to h^+(h^0)e^+e^-$

Phys. Rev. Lett. 133, 121801 (2024)

- $D_s^+ \to h^+(h^0)e^+e^-,\ h = K\ or\ \pi$
  - LD contributions

    $D_s^+ \to \pi^+\phi,\ \phi \to e^+e^-$

    $D_s^+ \to \rho^+\phi,\ \phi \to e^+e^-$

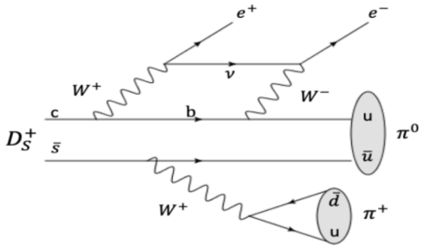


  - FCNC (four-body decays)

    $D_s^+ \to \pi^+\pi^0e^+e^-$

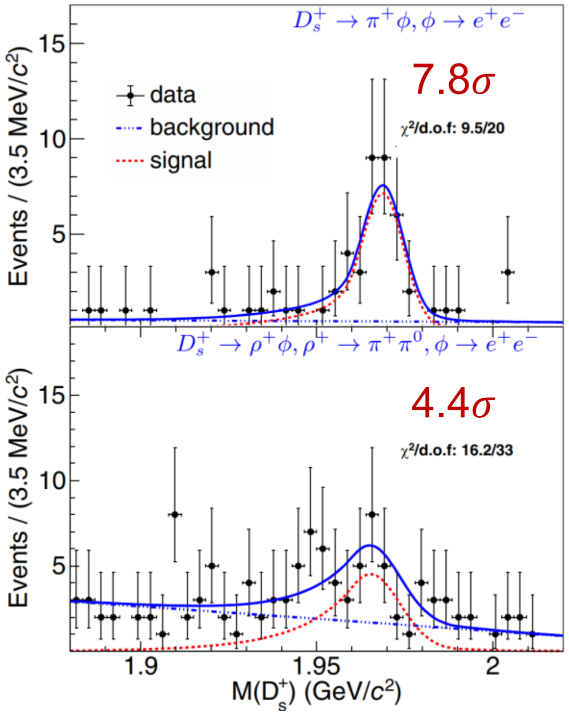
    $D_s^+ \to K^+\pi^0e^+e^-$

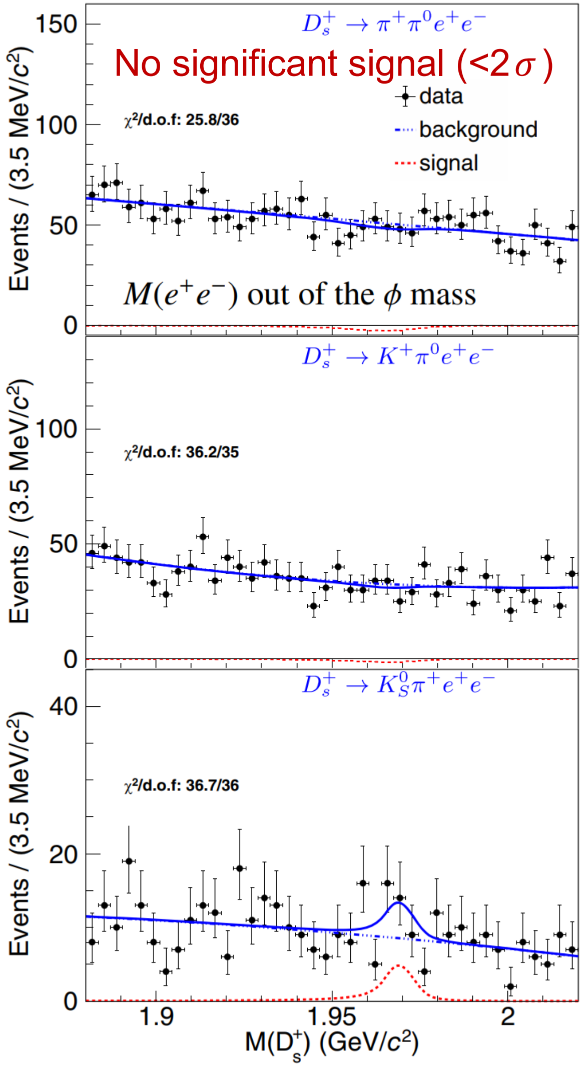
    $D_s^+ \to K_S^0\pi^+e^+e^-$



- Data: $\sqrt{s} = 4.128 - 4.226\ \mathrm{GeV},\ \mathcal{L} = 7.33\ fb^{-1}$
- D_s^+ candidates: $e^+e^- \to D_s^{*\pm}(\to D_s^\pm\gamma)D_s^\mp$
  - A single-tag method: one D_s^+ reconstructed via the signal mode

$$M_{\rm rec} = \sqrt{\left(E_{\rm cm} - \sqrt{|\vec{P}_{D_s^+}|^2 + m_{D_s^+}^2}\right)^2 - |P_{D_s^+}|^2},$$
$$\Delta M = M(D_s^+\gamma) - M(D_s^+),$$





Decay	$N_{\rm sig}$	ϵ (%)	$\mathcal{B}(\times 10^{-5})$
Precision improved by 3× $D_s^+ \to \pi^+\phi,\ \phi \to e^+e^-$	$38.2^{+7.8}_{-6.8}$	25.1	$1.17^{+0.23}_{-0.21} \pm 0.03$
First evidence $D_s^+ \to \rho^+\phi,\ \phi \to e^+e^-$	$37.8^{+10.3}_{-9.6}$	12.1	$2.44^{+0.67}_{-0.62} \pm 0.16$
First limits $D_s^+ \to \pi^+\pi^0e^+e^-$	...	7.4	<7.0
$D_s^+ \to K^+\pi^0e^+e^-$	...	5.3	<7.1
$D_s^+ \to K_S^0\pi^+e^+e^-$	...	6.7	<8.1

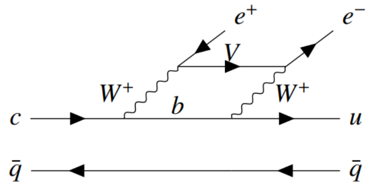
5.2 FCNC: $D \to h\,(h^{(\prime)})e^+e^-$

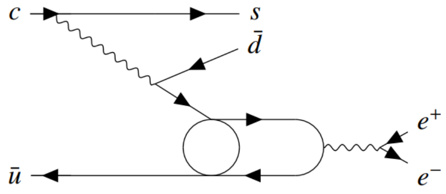
Phys. Rev. D 113, 092010 (2026)

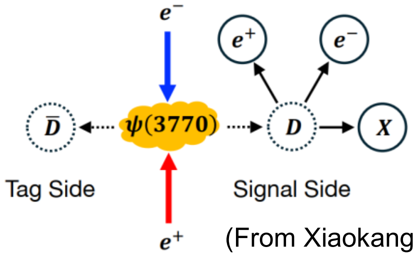
- $D \to h\,(h^{(\prime)})e^+e^-,\ h = \mathrm{hadron}$, 15 rare decays
- Data: $\sqrt{s} = 3.773\ \mathrm{GeV},\ \mathcal{L} = 20.3\ fb^{-1}$
- D candidates:
  - A double-tag method:

    one tagged $\bar{D}(D^0/D^+)$reconstructed via hadronic decays, and one signal D reconstructed via signal decays.

  - $M_{e^+e^-}$ out of the ϕ mass region





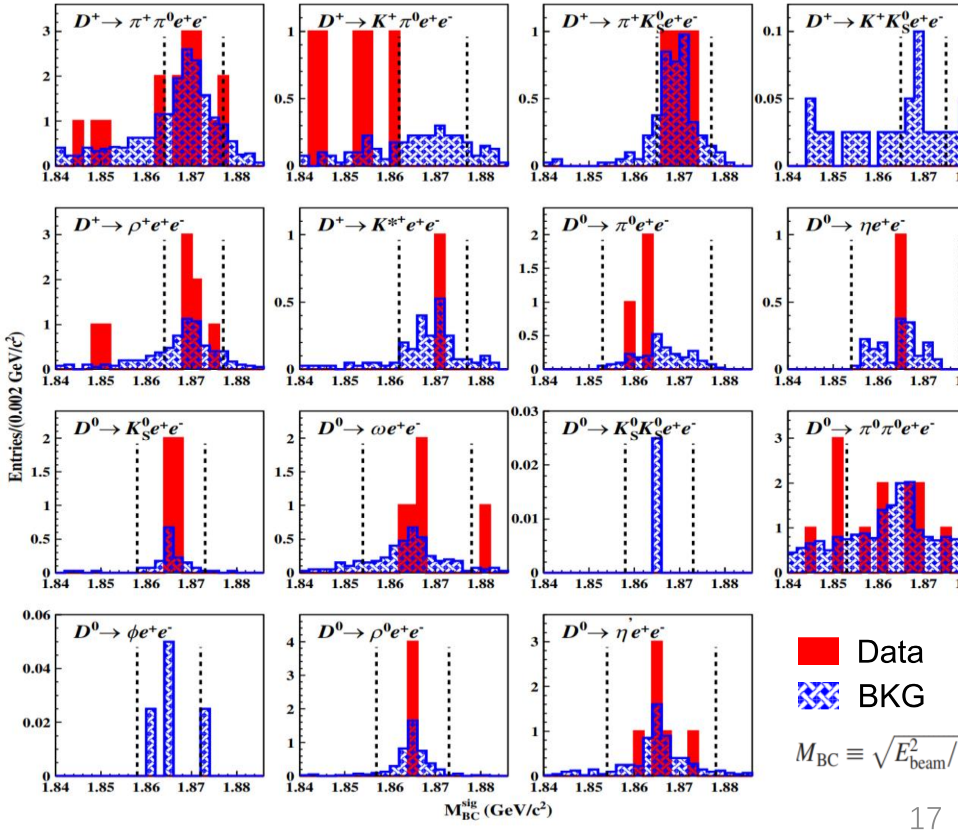


(From Xiaokang Li)

Process	$\mathcal{B}(\times10^{-6})$	PDG [26] $(\times10^{-5})$
$D^+ \to \pi^+\pi^0e^+e^-$	<2.4	<1.4
$D^+ \to K^+\pi^0e^+e^-$	<1.1	<1.5
$D^+ \to \pi^+K^0_Se^+e^-$	<4.8	<2.6
$D^+ \to K^+K^0_Se^+e^-$	<3.7	<1.1
$D^+ \to \rho^+e^+e^-$	<2.1	...
$D^+ \to K^{*+}e^+e^-$	<2.5	...
$D^0 \to \pi^0e^+e^-$	<0.7	<0.4
$D^0 \to \eta e^+e^-$	<1.4	<0.3
$D^0 \to \omega e^+e^-$	<1.6	<0.8
$D^0 \to K^0_Se^+e^-$	<2.6	<1.2
$D^0 \to K^0_SK^0_Se^+e^-$	<7.8	...
$D^0 \to \pi^0\pi^0e^+e^-$	<1.9	...
$D^0 \to \phi e^+e^-$	<4.6	<5.2
$D^0 \to \rho^0e^+e^-$	<0.7	<10.0
$D^0 \to \eta' e^+e^-$	<2.5	...

- No significant signal

- 5 first measurements;
- 8 ULs improved by a factor of 4–14 vs PDG.



$M_{\rm BC} \equiv \sqrt{E^2_{\rm beam}/c^4 - |\vec{p}_{\bar{D}}|^2/c^2}$

Summary

- With huge charmonium sample (10B J/ψ and 2.7B $\psi(2S)$ events), BESIII explores charm rare decays.
  - CLFV decay
  - Charmonium weak decay
  - FCNC
- No significant signal observed in the searched modes.
- First constraints / strongest limits / improved ULs at 90% C.L. reported.
- More results of different charm rare decays will come in the near future.

Thanks for your attention!