BEPC

(Beijing Electron Positron Collider)

e^+e^- collisions from 2.0 to 4.6 GeV

Future Opportunities at BESIII

Ryan Mitchell (Indiana University)

QWG 2016 — June 10, 2016

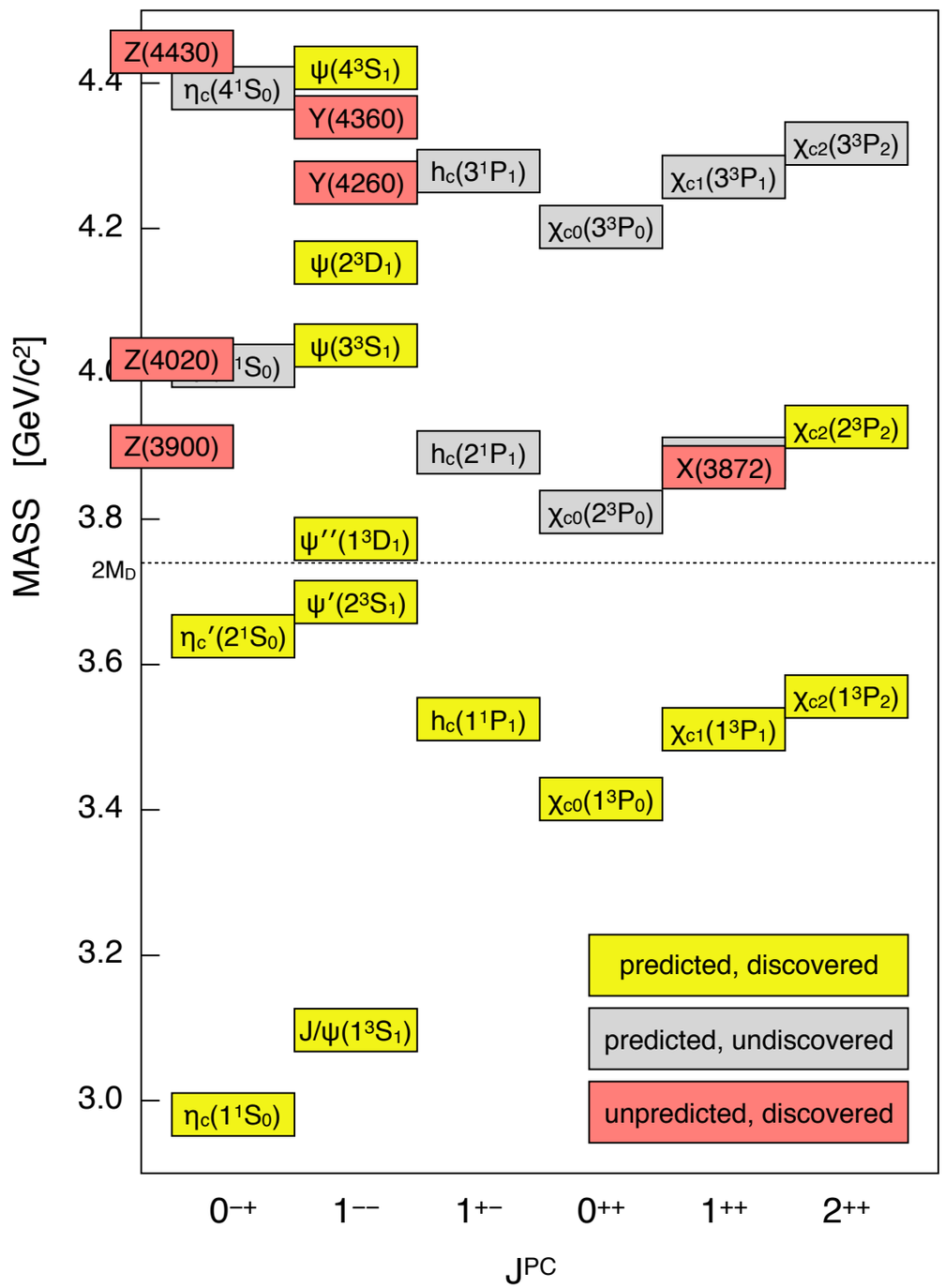
BESIII

(Beijing Spectrometer)

BESIII Overview and Future Prospects

Charmonium Spectrum

predictions based on PRD 72, 054026 (2005)
measurements from PDG 2014



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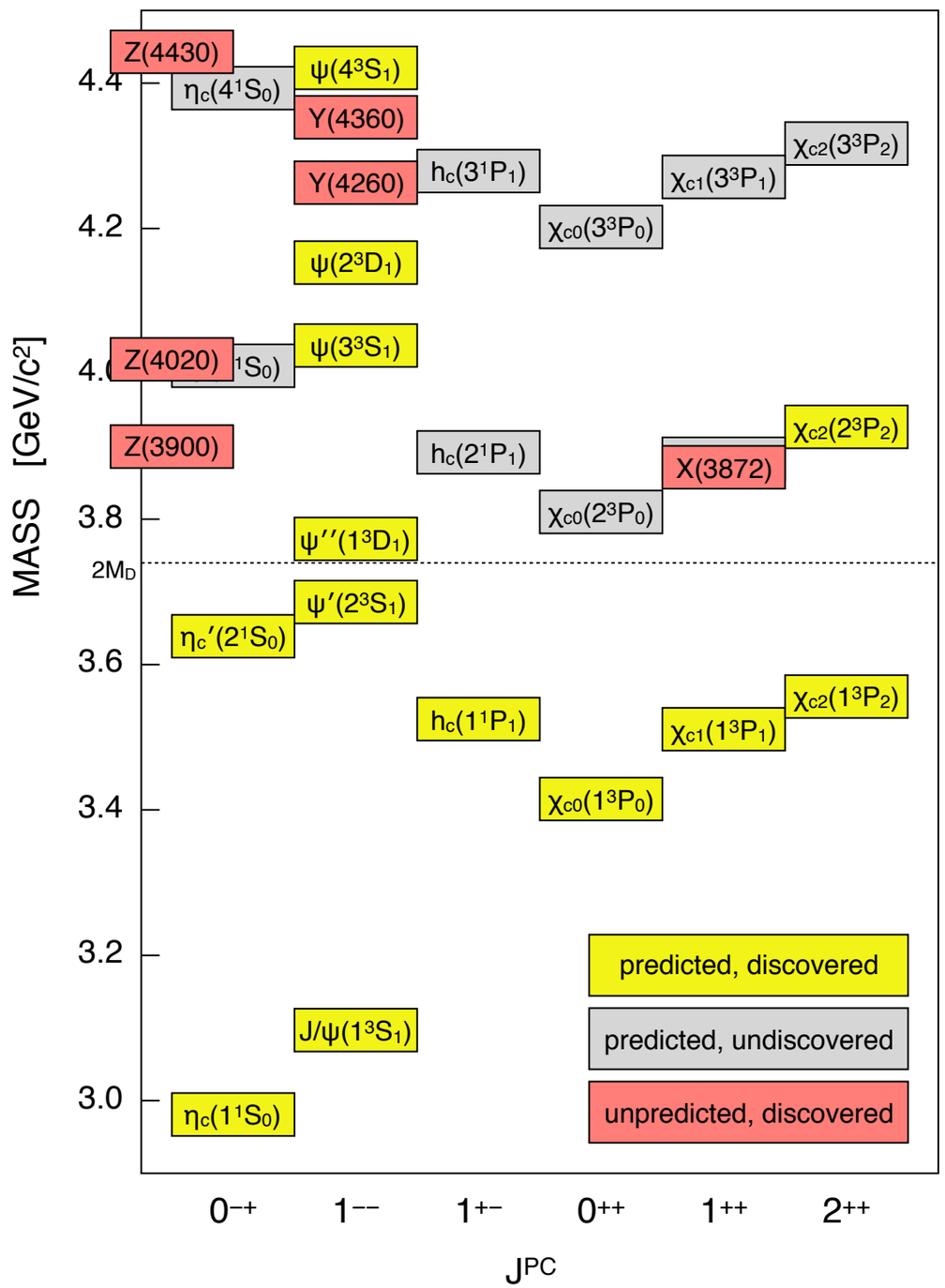

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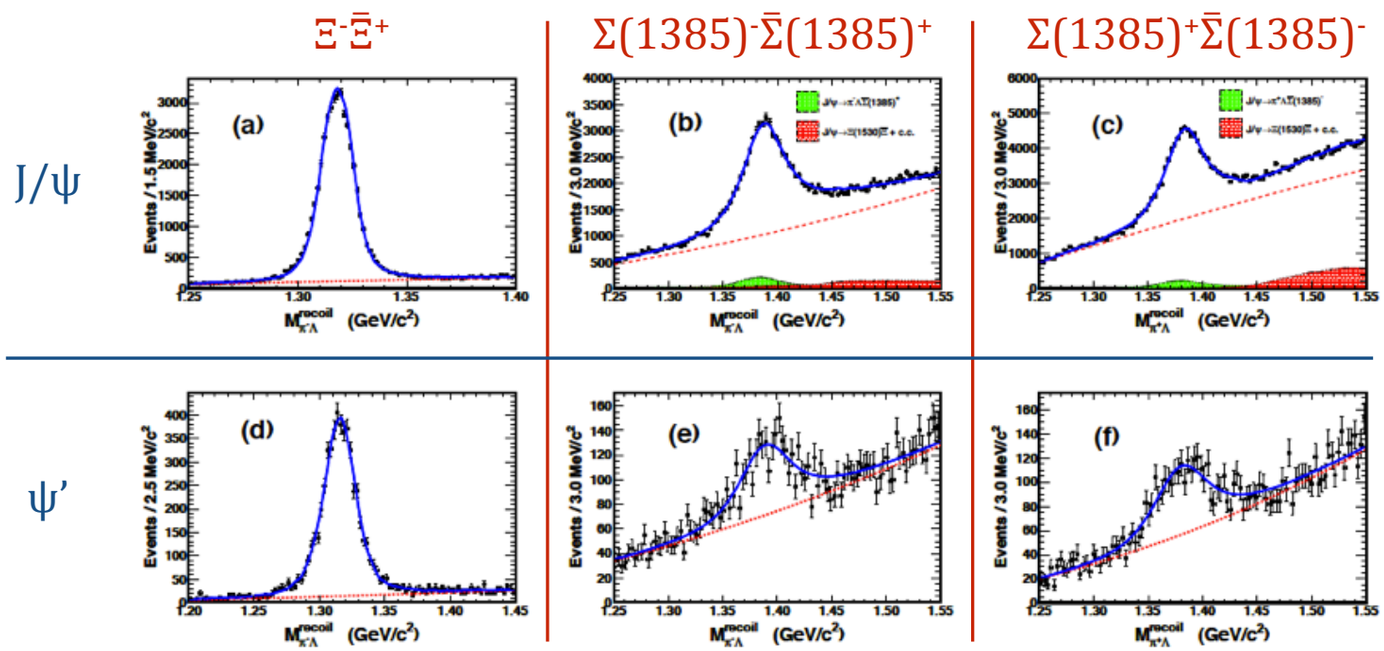
see Jake Bennett's talk:
Charmonium Decays into Light Hadrons from BESIII

Extensions of the "ϱπ Puzzle"…

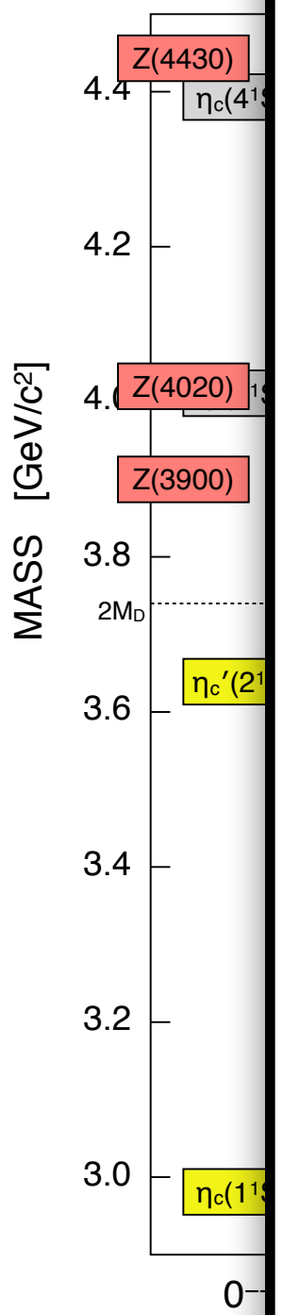


PRD 93, 072003 (2016)

$$\frac{\mathcal{B}(\psi(3686)\to\Xi^-\bar{\Xi}^+)}{\mathcal{B}(J/\psi\to\Xi^-\bar{\Xi}^+)} = (26.73 \pm 0.50 \pm 2.30)\%$$

$$\frac{\mathcal{B}(\psi(3686)\to\Sigma(1385)^-\bar{\Sigma}(1385)^+)}{\mathcal{B}(J/\psi\to\Sigma(1385)^-\bar{\Sigma}(1385)^+)} = (7.76 \pm 0.55 \pm 0.68)\%$$

$$\frac{\mathcal{B}(\psi(3686)\to\Sigma(1385)^+\bar{\Sigma}(1385)^-)}{\mathcal{B}(J/\psi\to\Sigma(1385)^+\bar{\Sigma}(1385)^-)} = (6.68 \pm 0.40 \pm 0.50)\%$$



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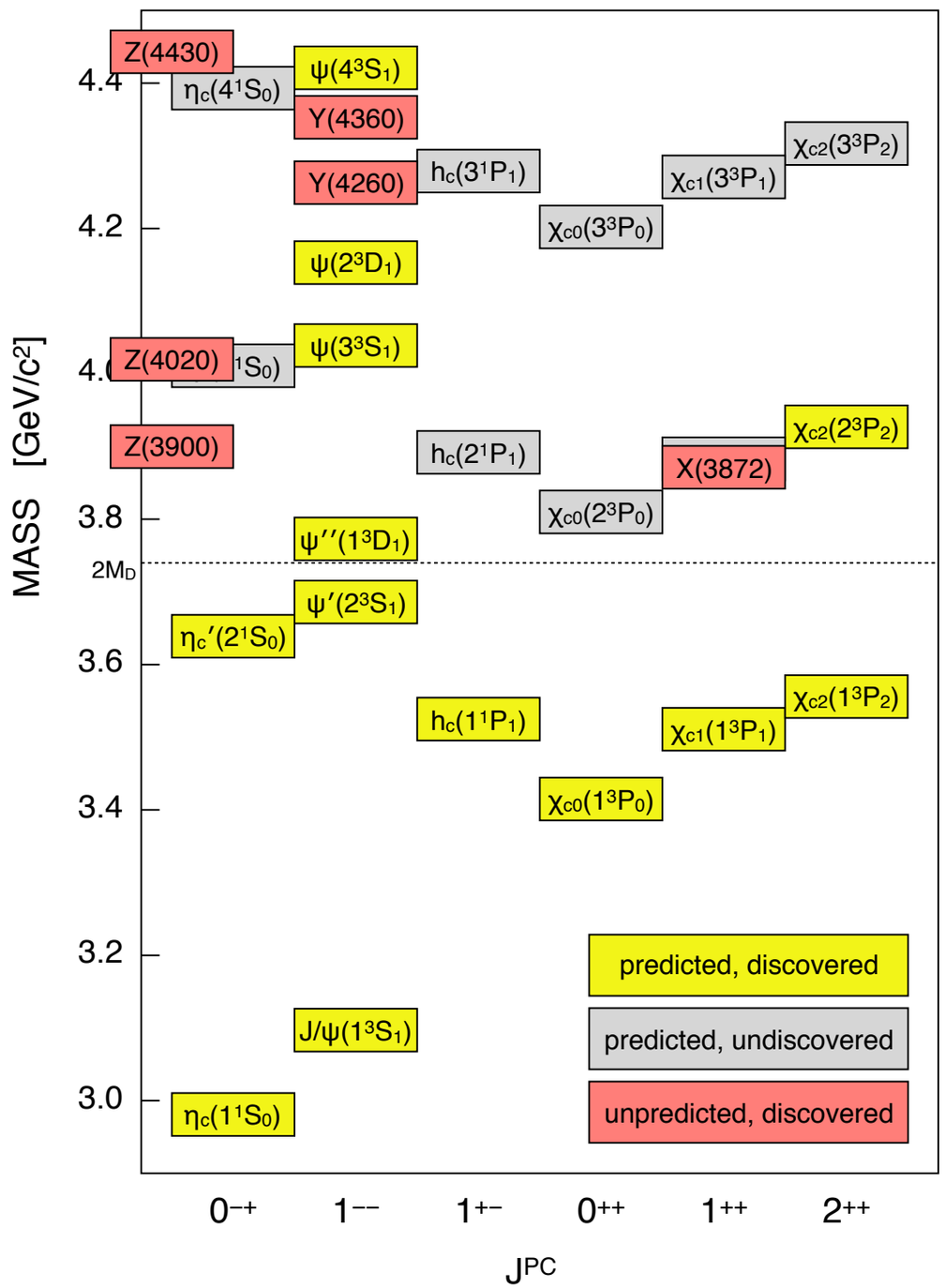

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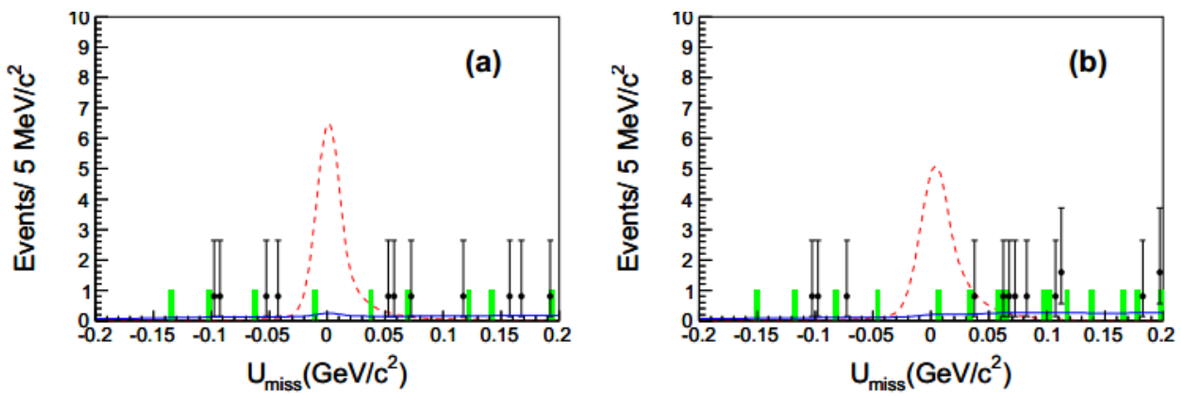
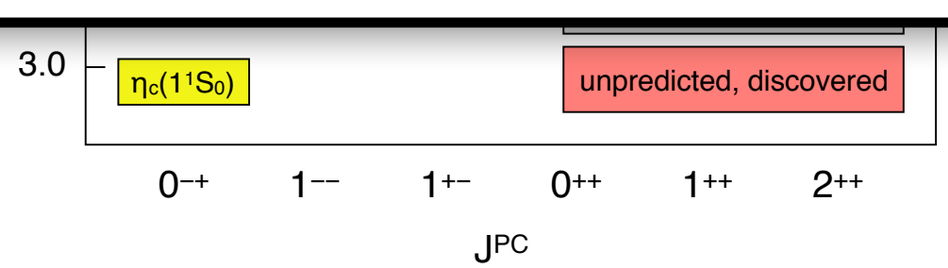
see Junhao YIN's talk:
Charmonium Rare Decays at BESIII

Semileptonic J/ψ Decays…



Phys. Rev. D **90**, 112014

	$J/\psi \to D_s^- e^+ \nu_e$	$J/\psi \to D_s^{*-} e^+ \nu_e$
$\bar{N}^{up}_{total}$	244	335
σ_{total}	31	43
$N^{up\,\prime}_{total}$	275	378
σ^{sys}_{common}	3.3%	3.9%
$N_{J/\psi}$	2.25×10^8	
$\mathcal{B}(90\%\text{C.L.})$	$< 1.3 \times 10^{-6}$	$< 1.8 \times 10^{-6}$



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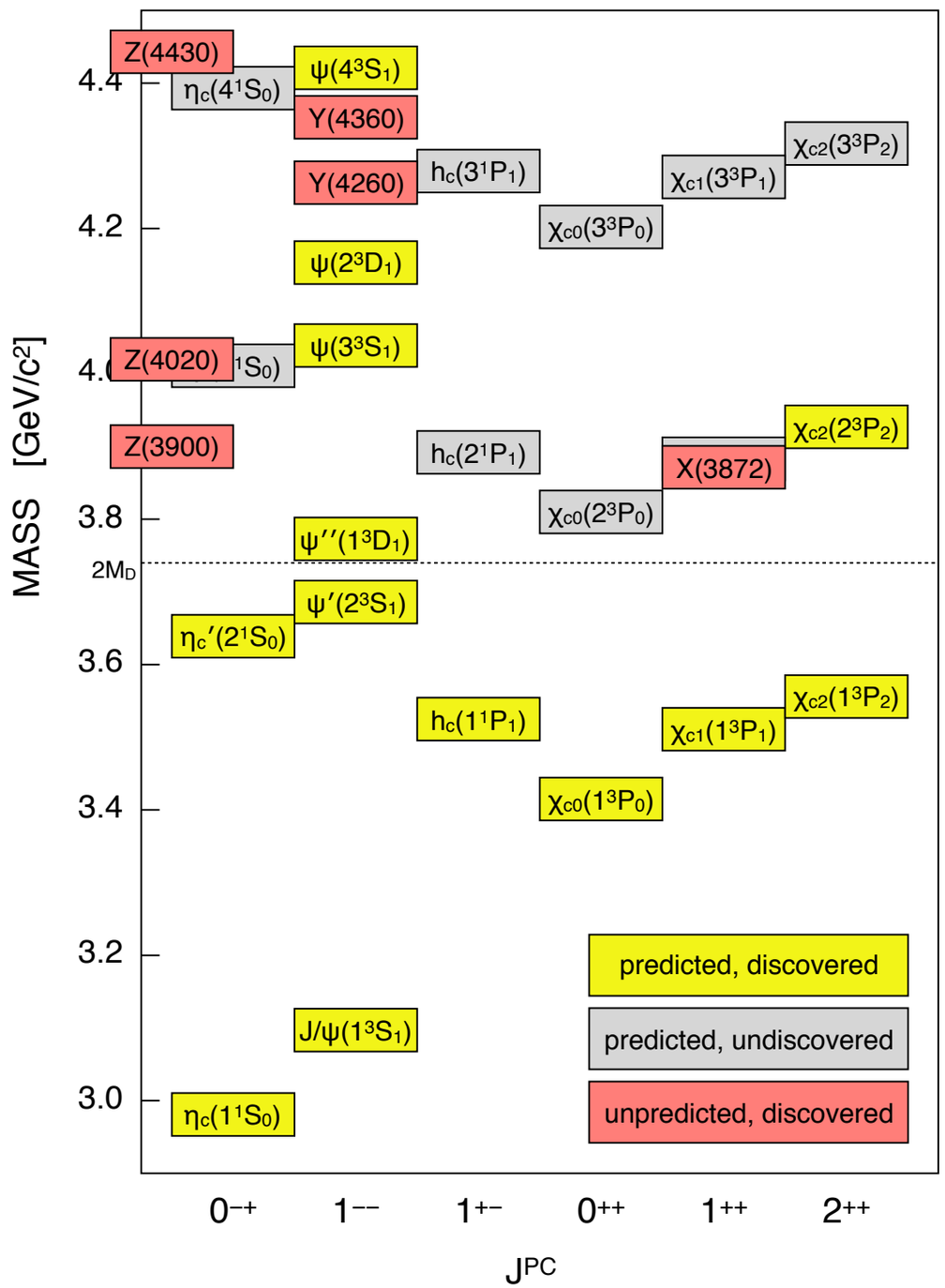

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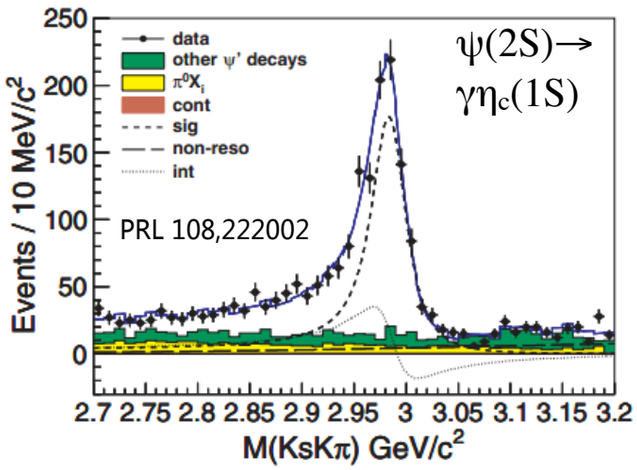
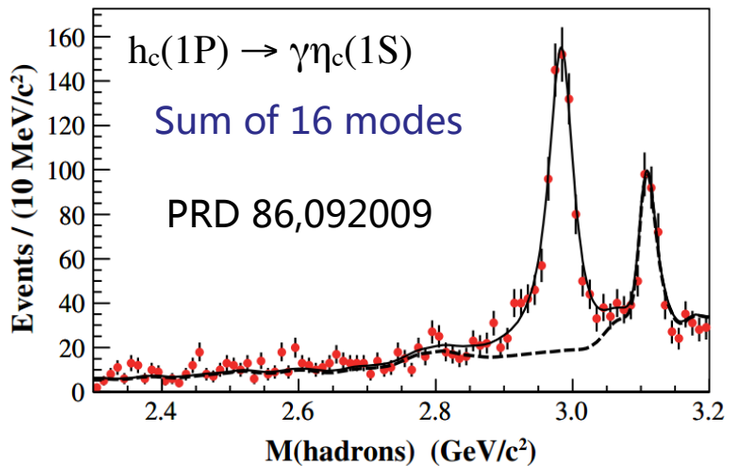
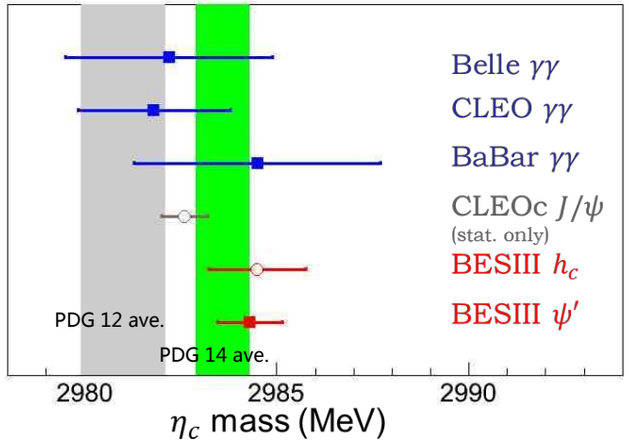
e Prospects

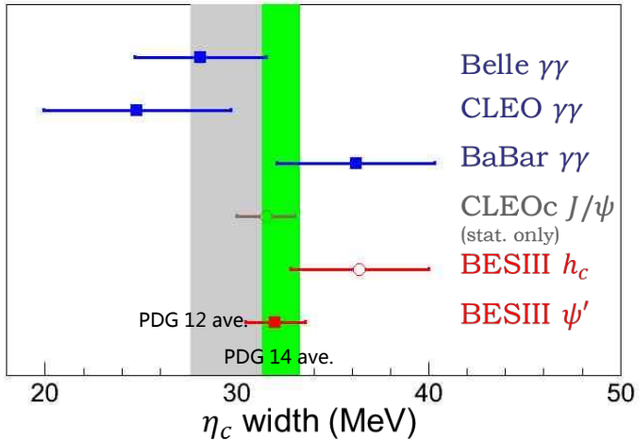
see Jielei ZHANG's talk:
Charmonium Radiative Transitions from BESIII

Improve Measurements of the $\eta_c(1S)$ Parameters…









Study $\psi(1S,2S) \to \gamma\eta_c(1S)$ in two steps:
get $\eta_c(1S)$ BF's using $h_c(1P) \to \gamma\eta_c(1S)$ decays;
measure $\psi(1S,2S) \to \gamma\eta_c(1S)$ using those BF's.
(active working group)

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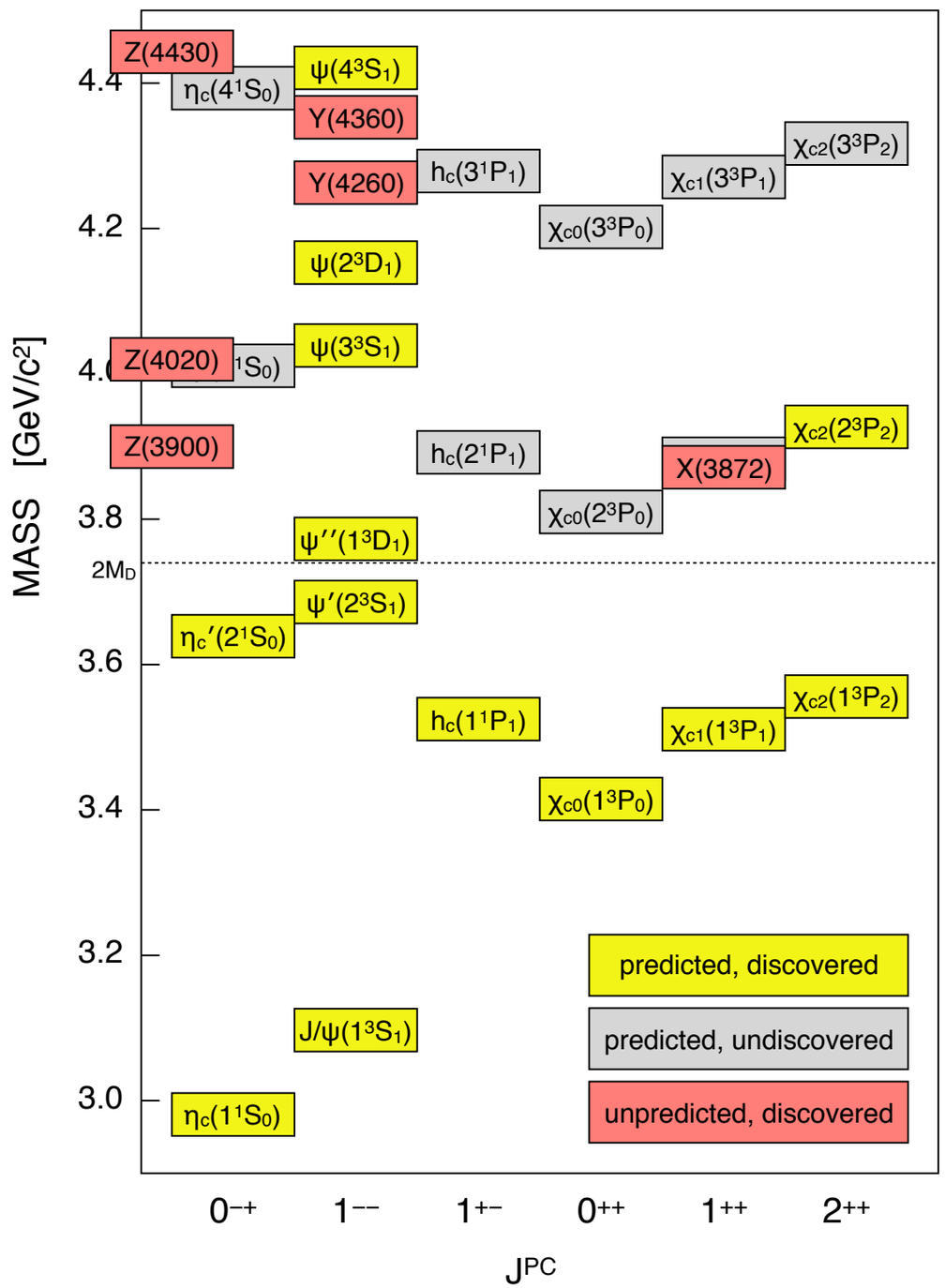

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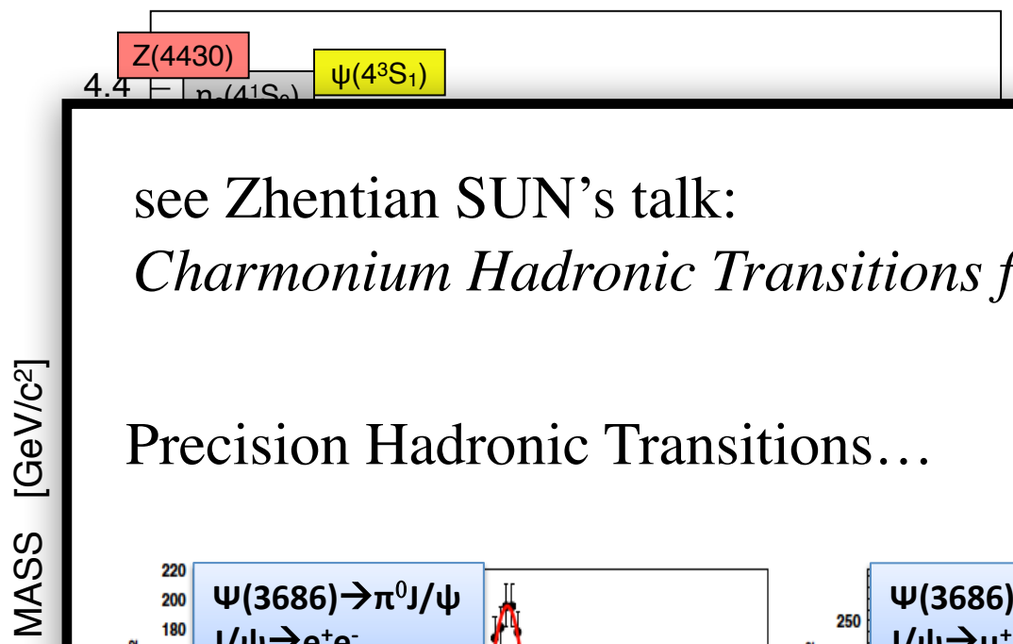
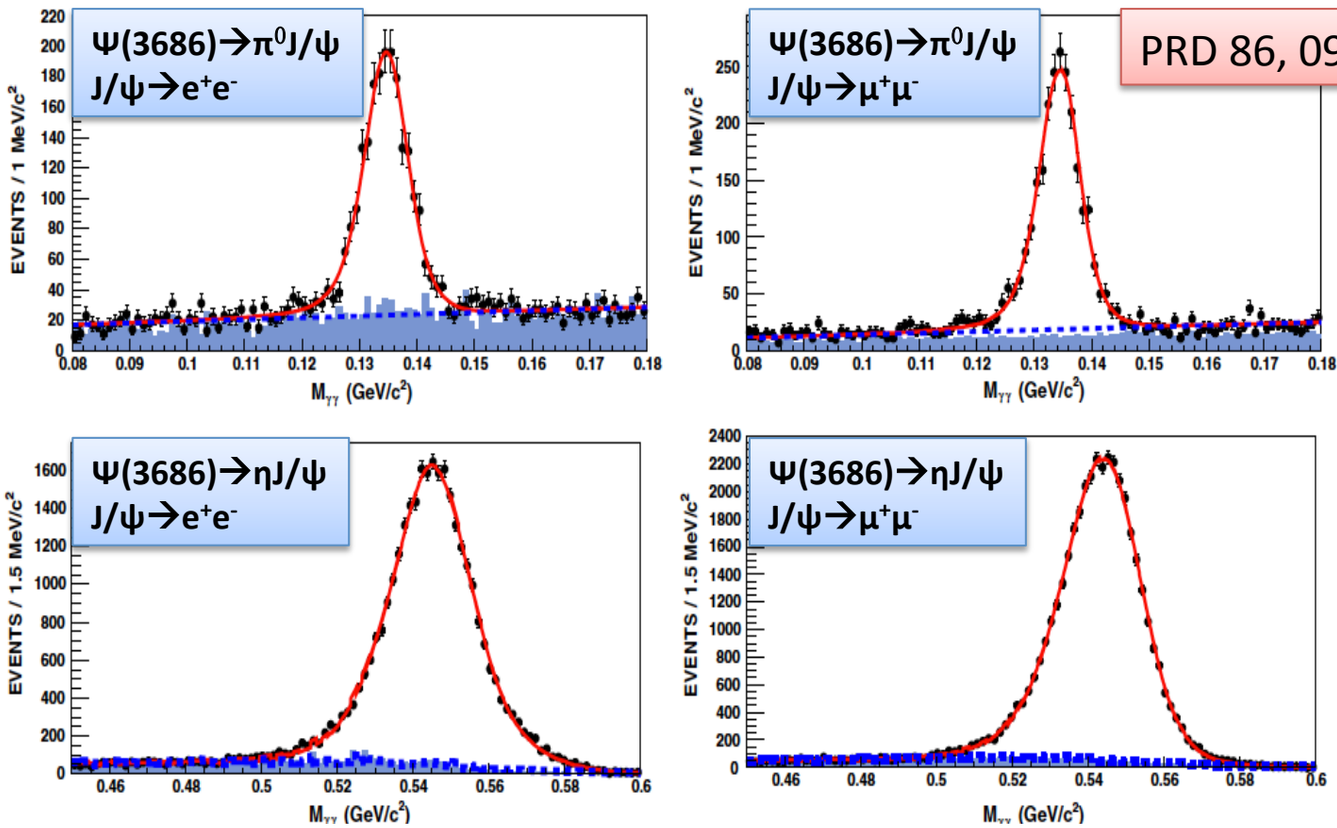


see Zhentian SUN's talk:
Charmonium Hadronic Transitions from BESIII

Precision Hadronic Transitions…



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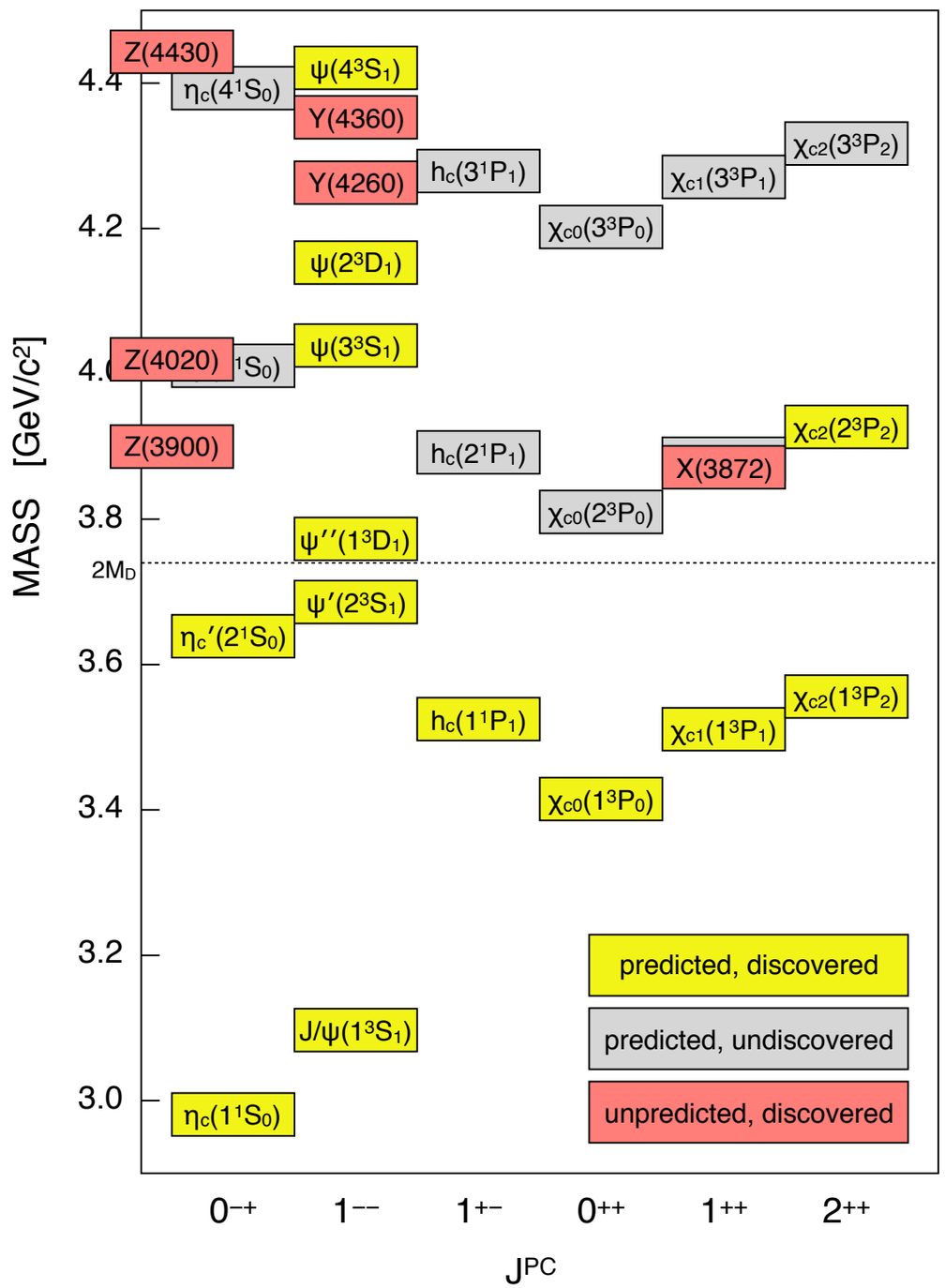

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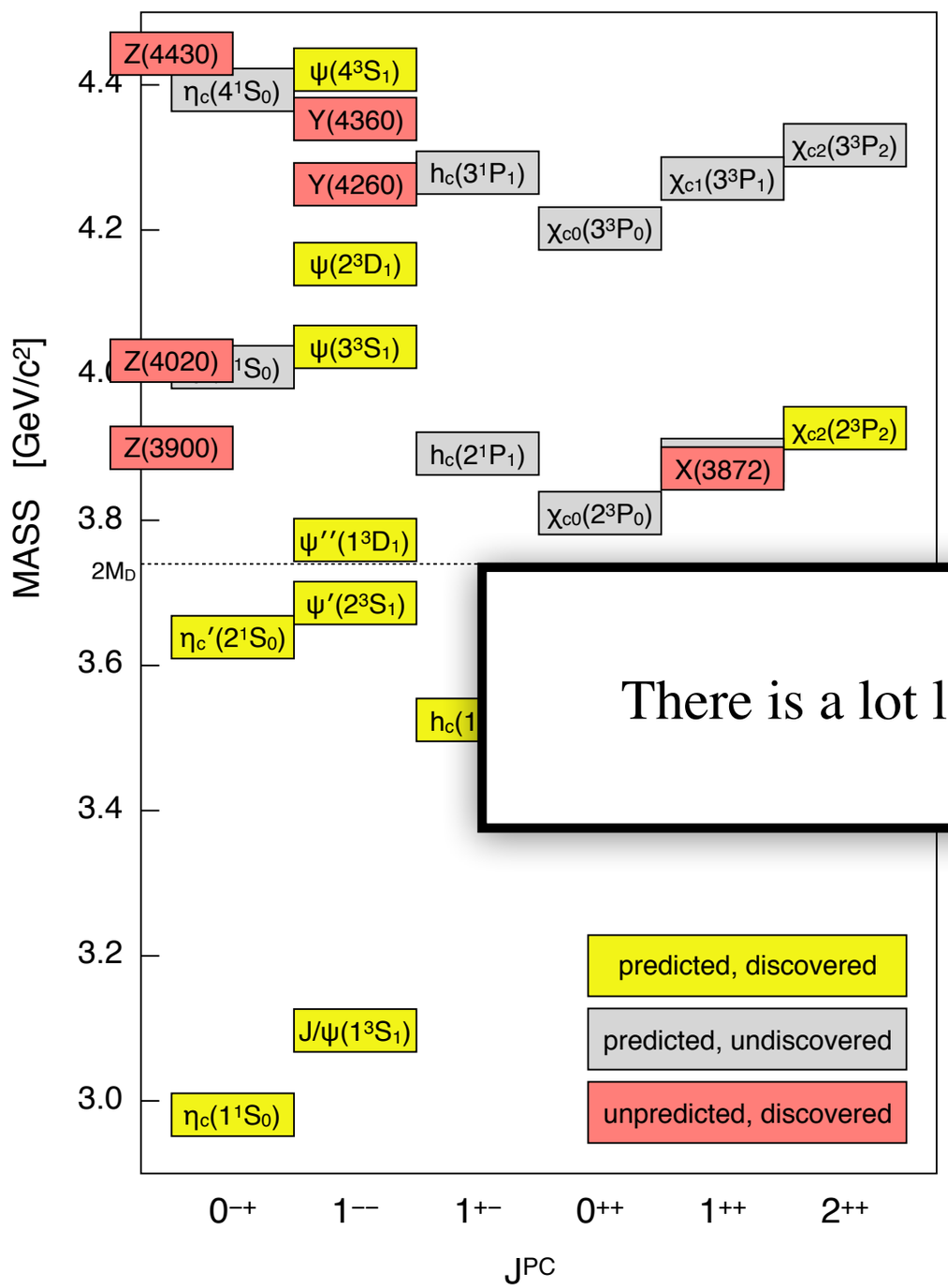

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There is a lot left to do with the J/ψ and ψ(2S) data!!

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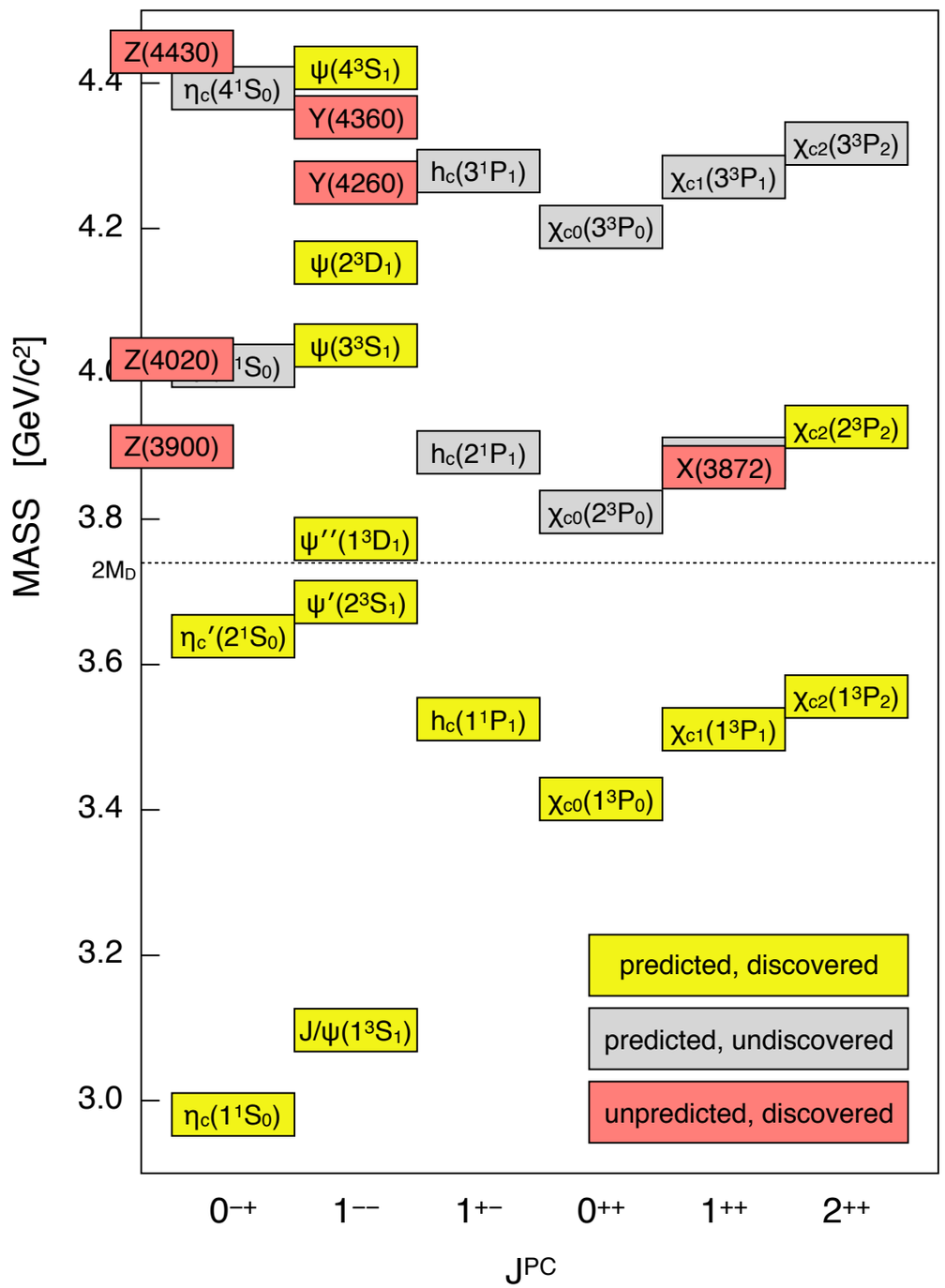

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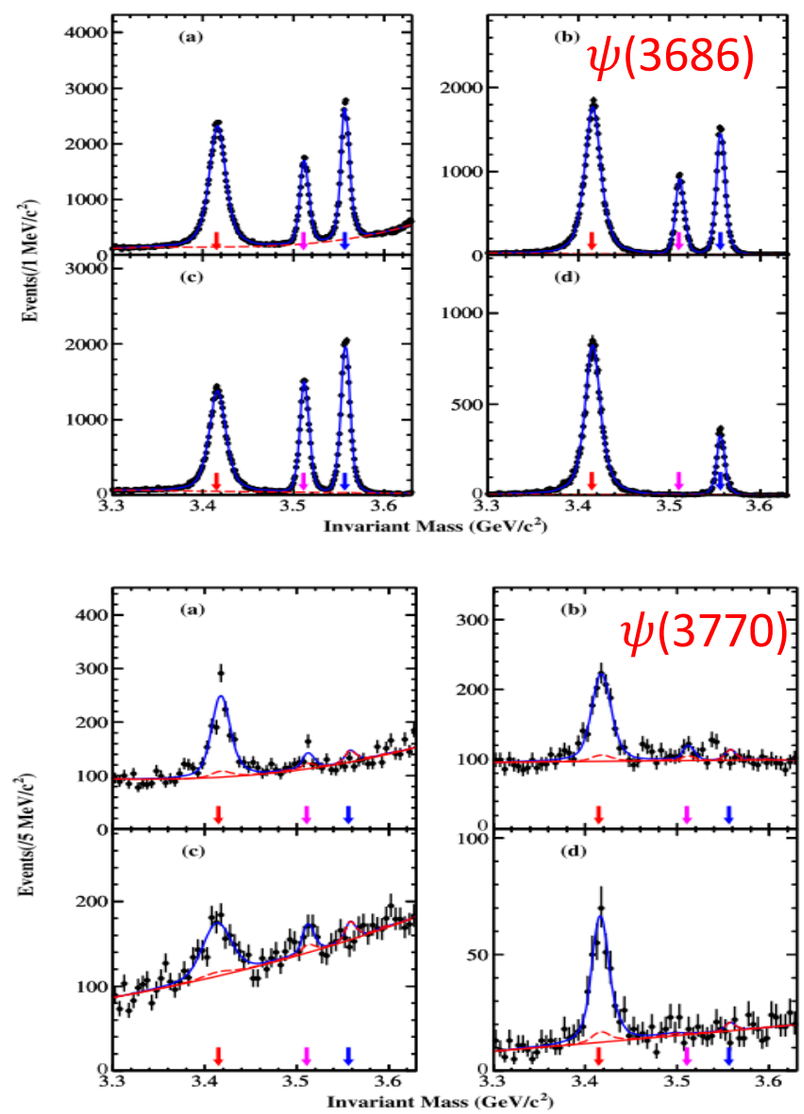
see Yu HU's talk:
Non-DDbar Decays of the psi(3770) at BESIII

Measurement of the $\mathcal{B}(\psi(3770) \rightarrow \gamma\chi_{c0})$

PLB 753 (2016) 103–109

Experiment Method:

- The analysis is based on the 2.92 fb^{-1} $\psi(3770)$ data and 106 million $\psi(3686)$ data .
- χ_{cJ} is reconstructed via $LH(2(\pi^+\pi^-)$, $K^+K^-\pi^+\pi^-$, $3(\pi^+\pi^-)$, K^+K^-.
- Obtained the Br by taking the relative strength to the $\psi(3686)$ E1 transition, avoiding introducing large uncertainties of the branching fractions for $\chi_{cJ} \rightarrow LH$.



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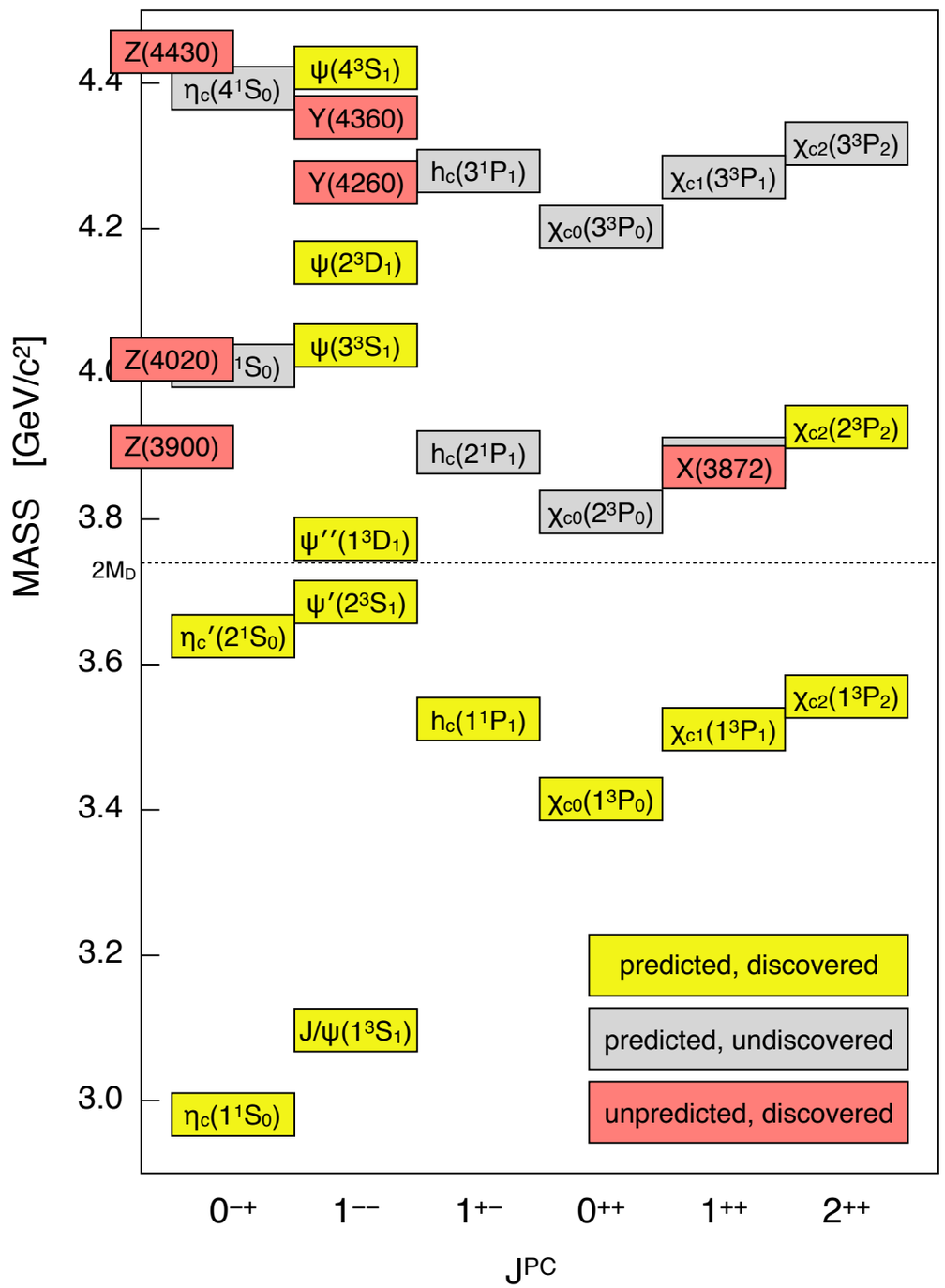

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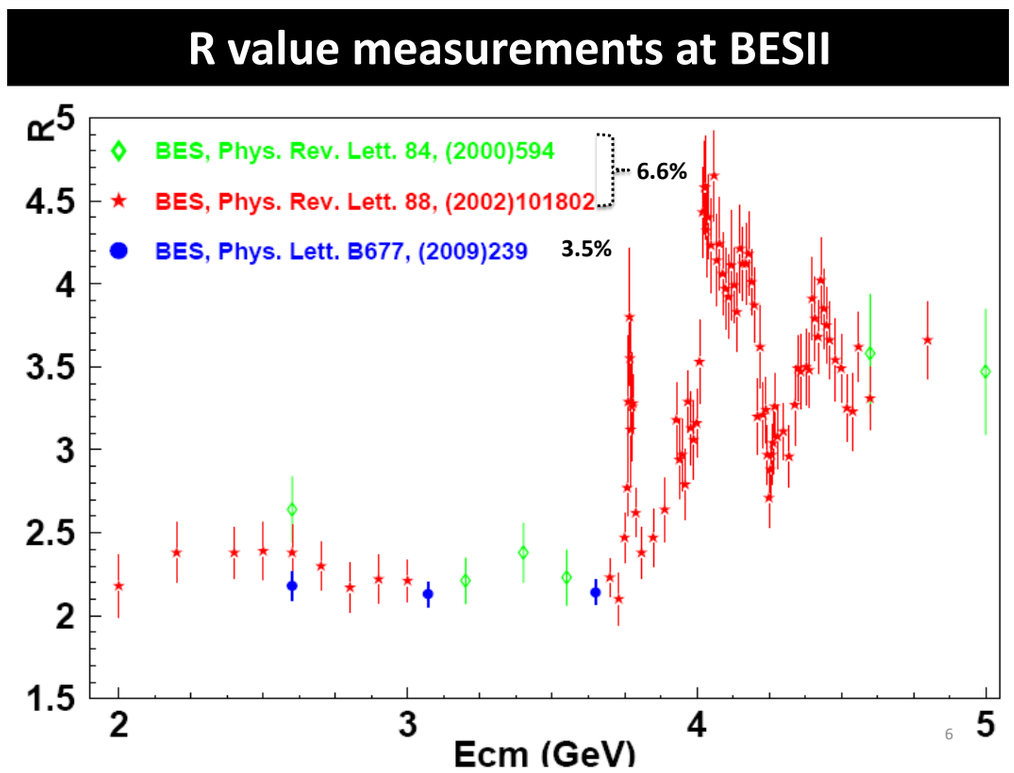
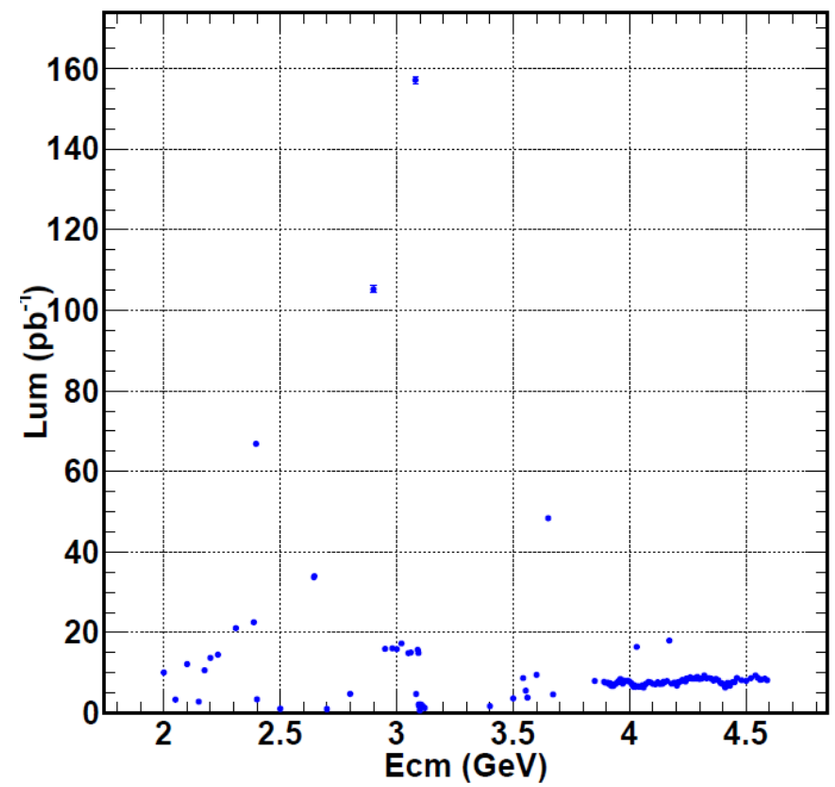
BESIII Overview and Future Prospects

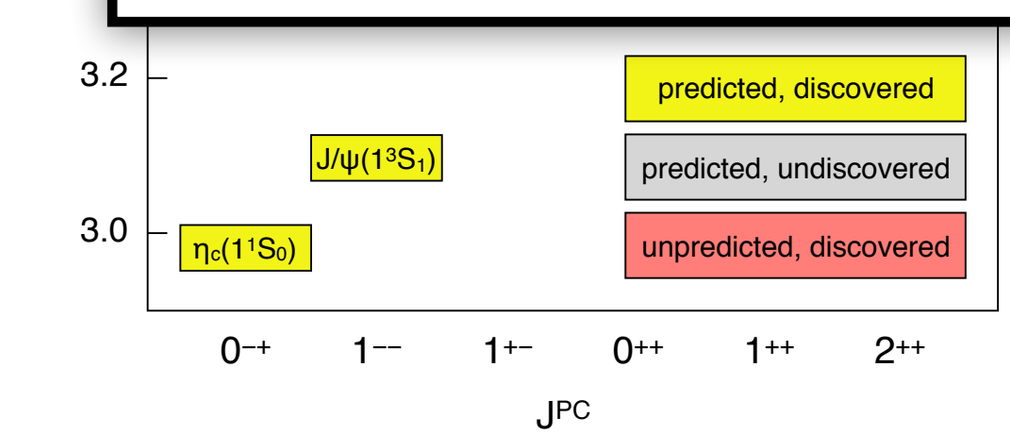
see Haiming HU's talk:
R Measurement at BESIII

BESII Measurement of R…



Data Sets for BESIII…





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BESIII Overview and Future Prospects

Charmonium Spectrum

predictions based on PRD 72, 054026 (2005)
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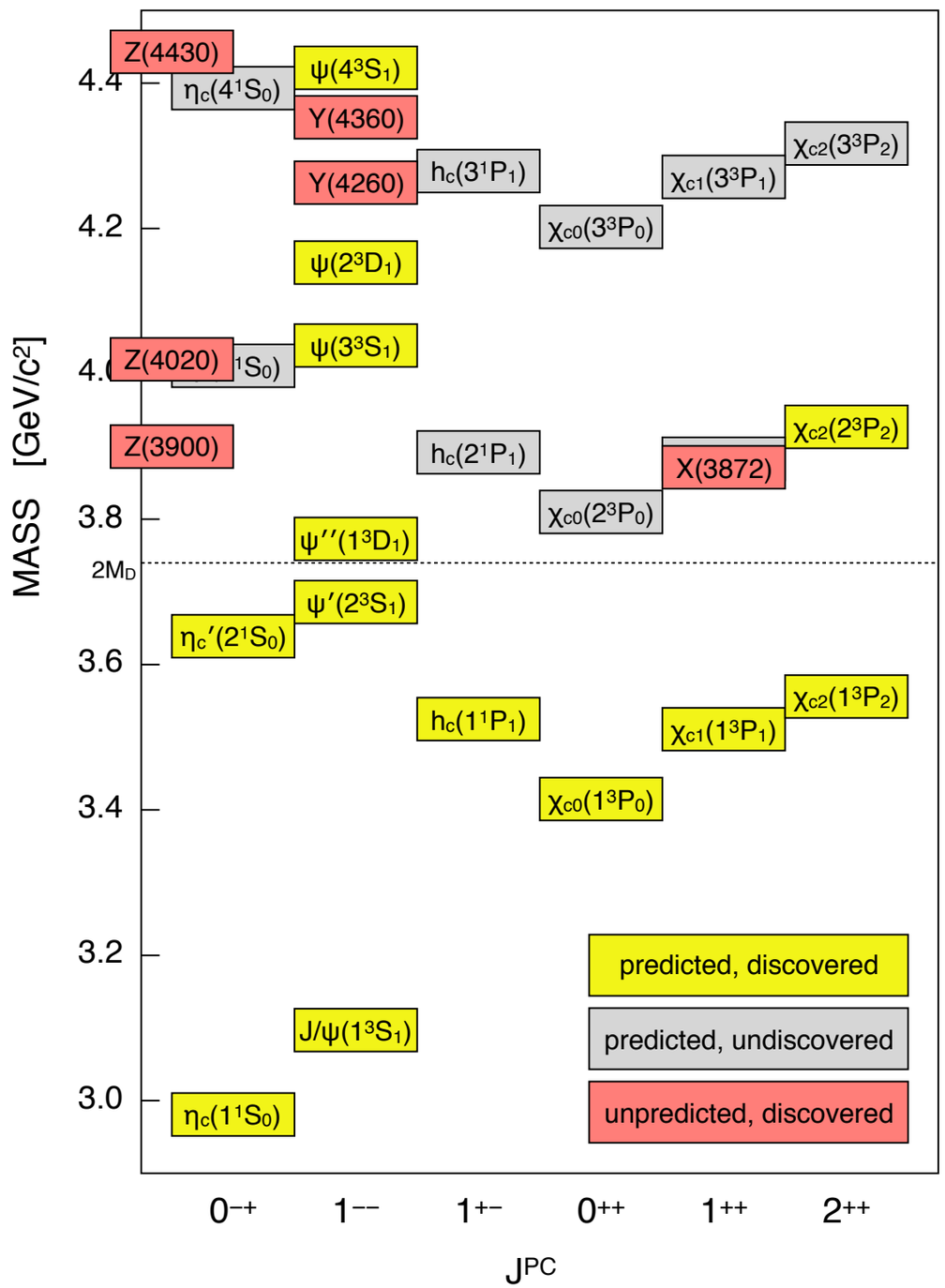

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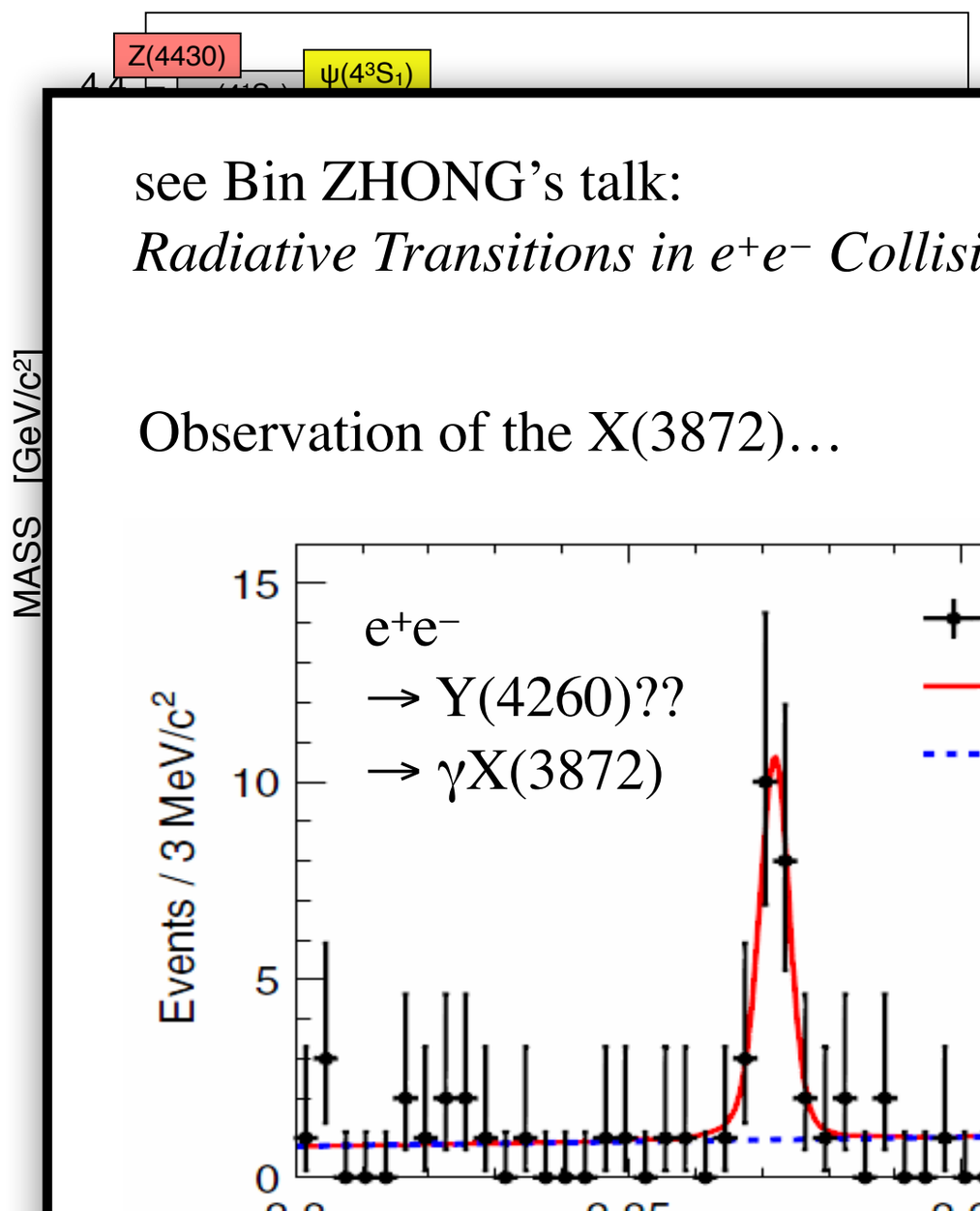
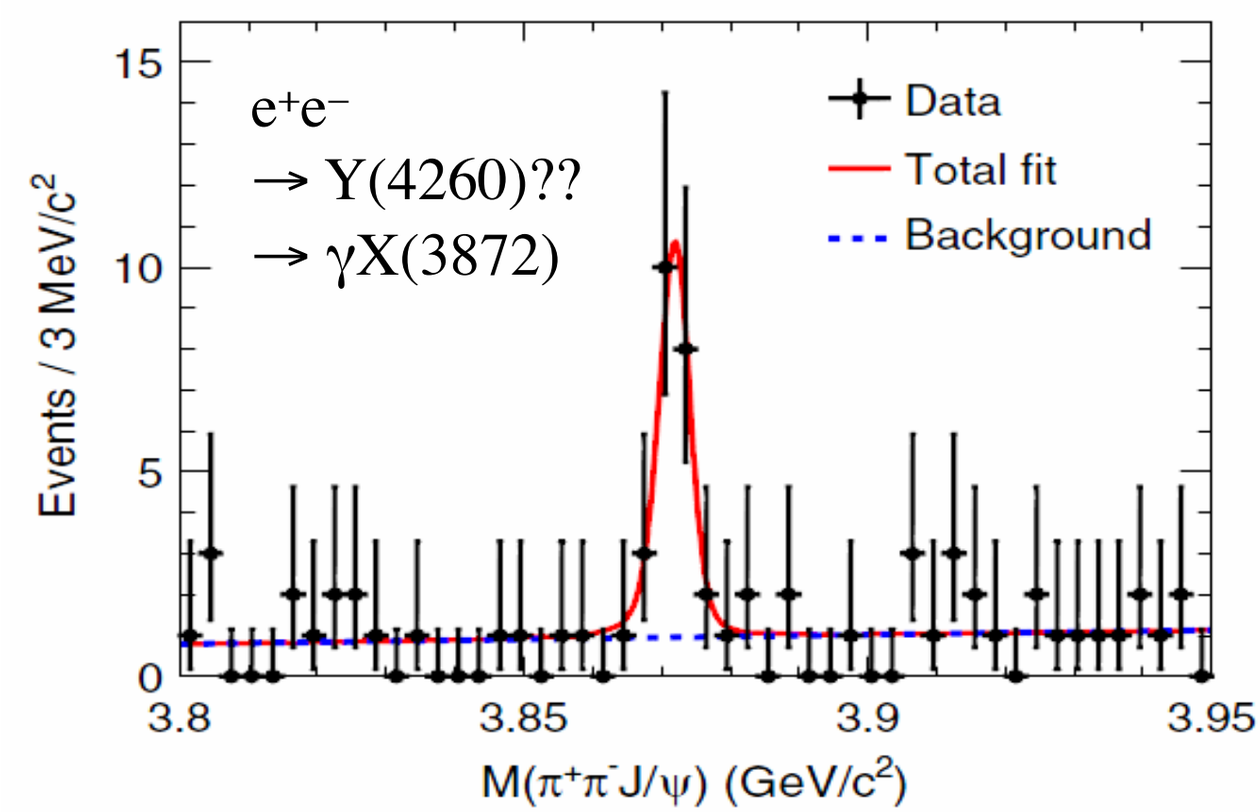


see Bin ZHONG's talk:
Radiative Transitions in e^+e^- Collisions at BESIII

Observation of the X(3872)…



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BESIII Overview and Future Prospects

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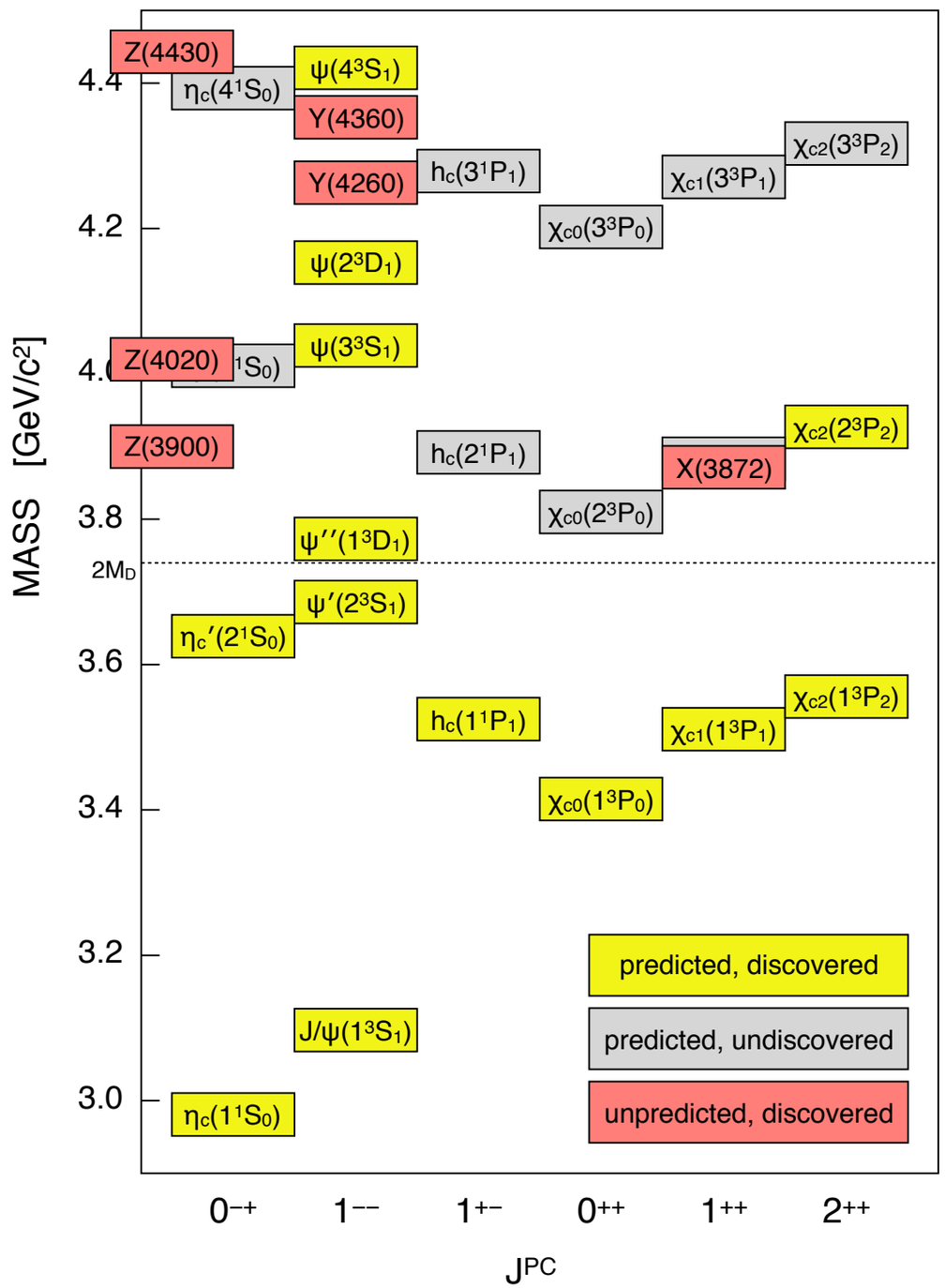

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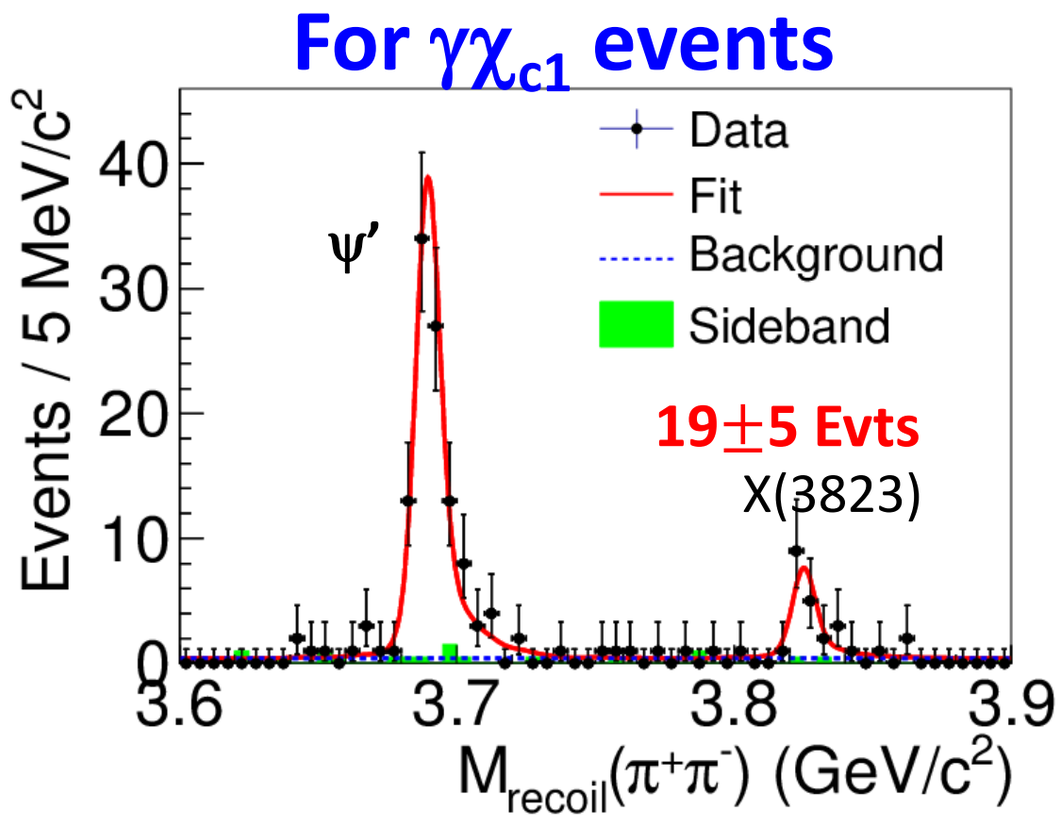
BESIII Overview and Future Prospects

see Jingzhi ZHANG's talk:
Observation of the X(3823) at BESIII

Observation of $e^+e^- \to \pi^+\pi^- X(3823)$ [ψ_2]…



MASS [GeV/c²]

0⁻⁺ 1⁻⁻ 1⁺⁻ 0⁺⁺ 1⁺⁺ 2⁺⁺

J^{PC}

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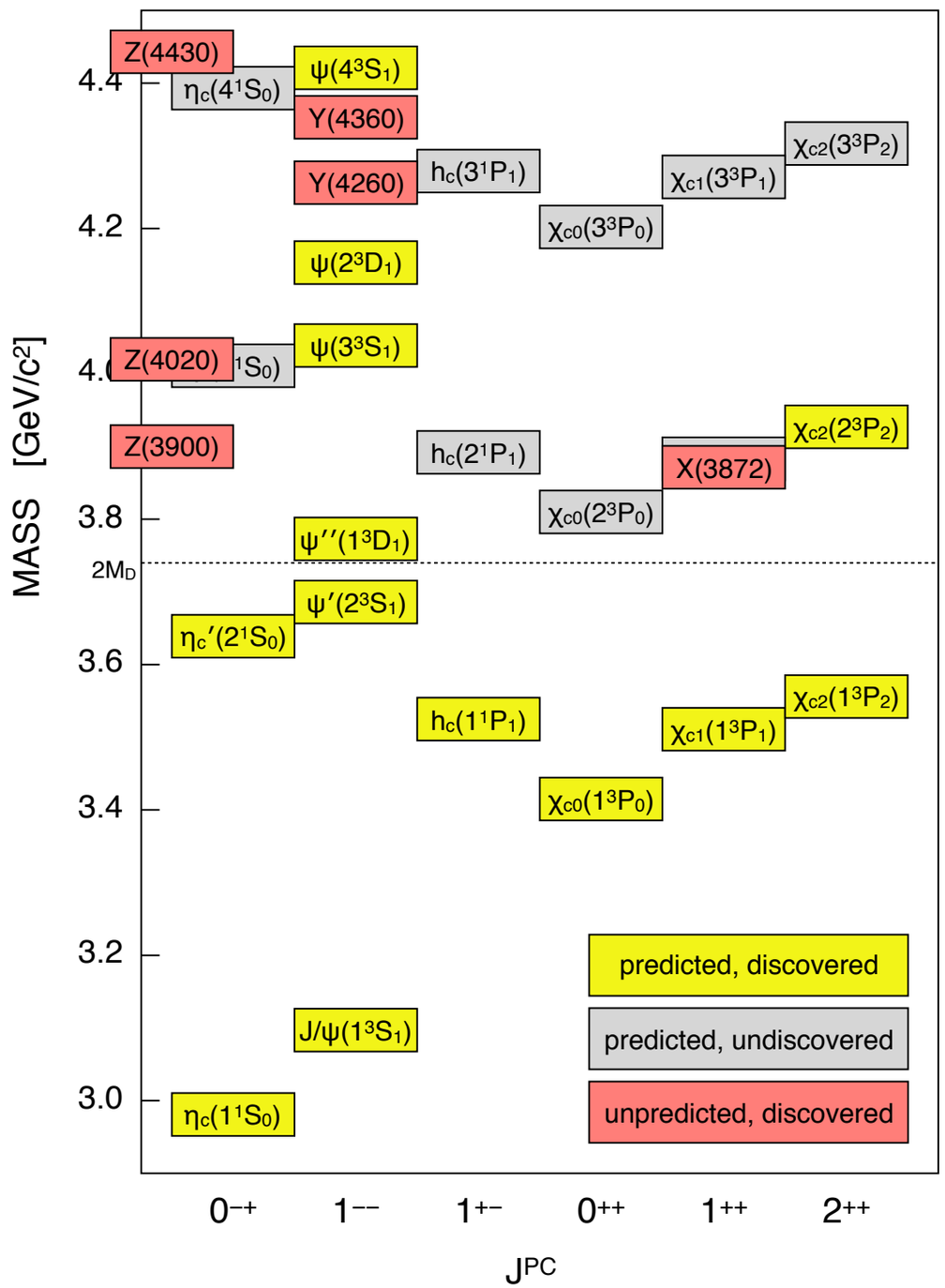

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see Jianming BIAN's talk:
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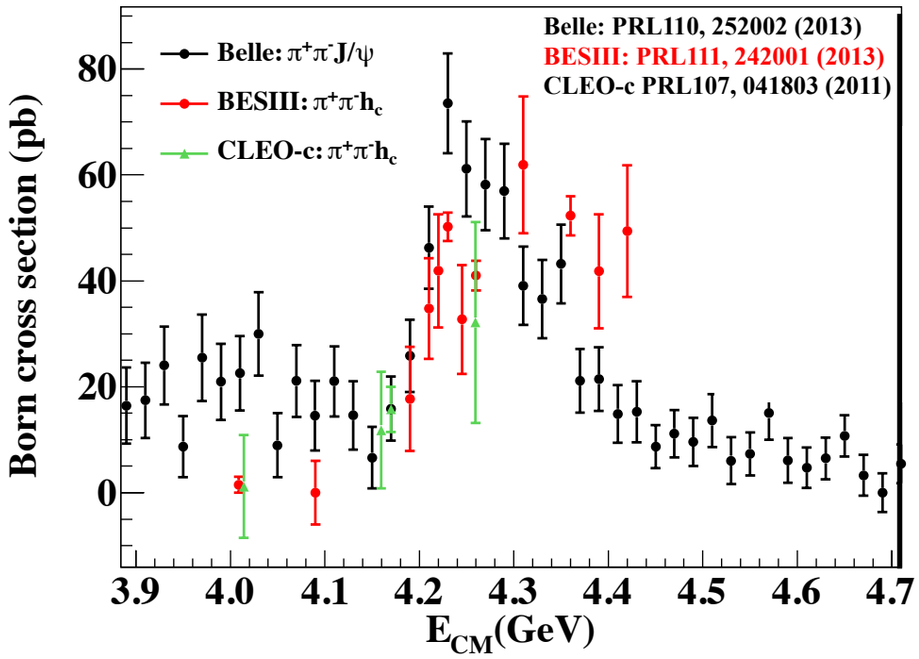

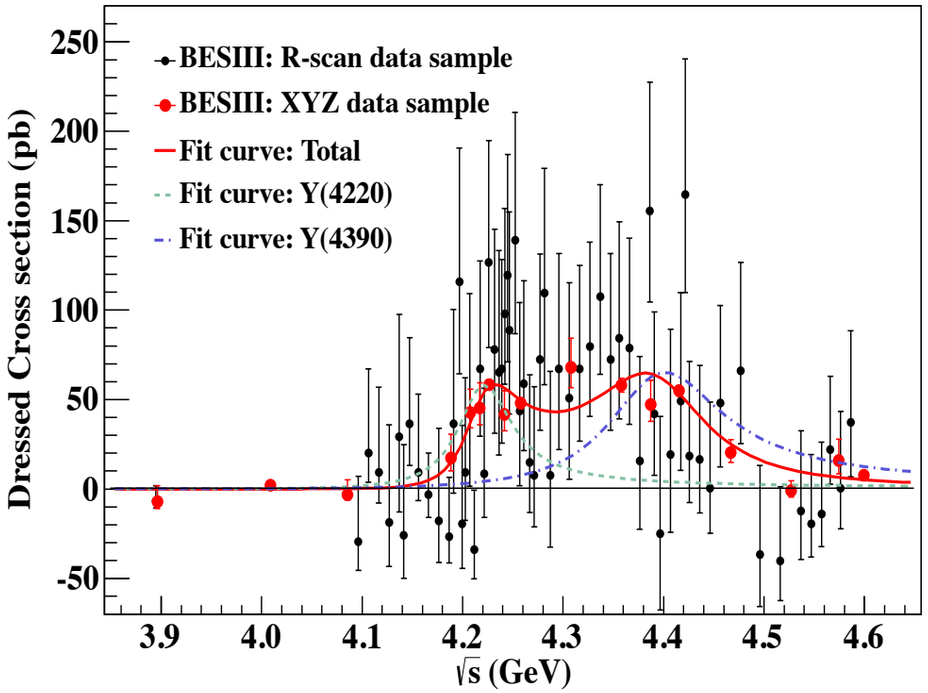

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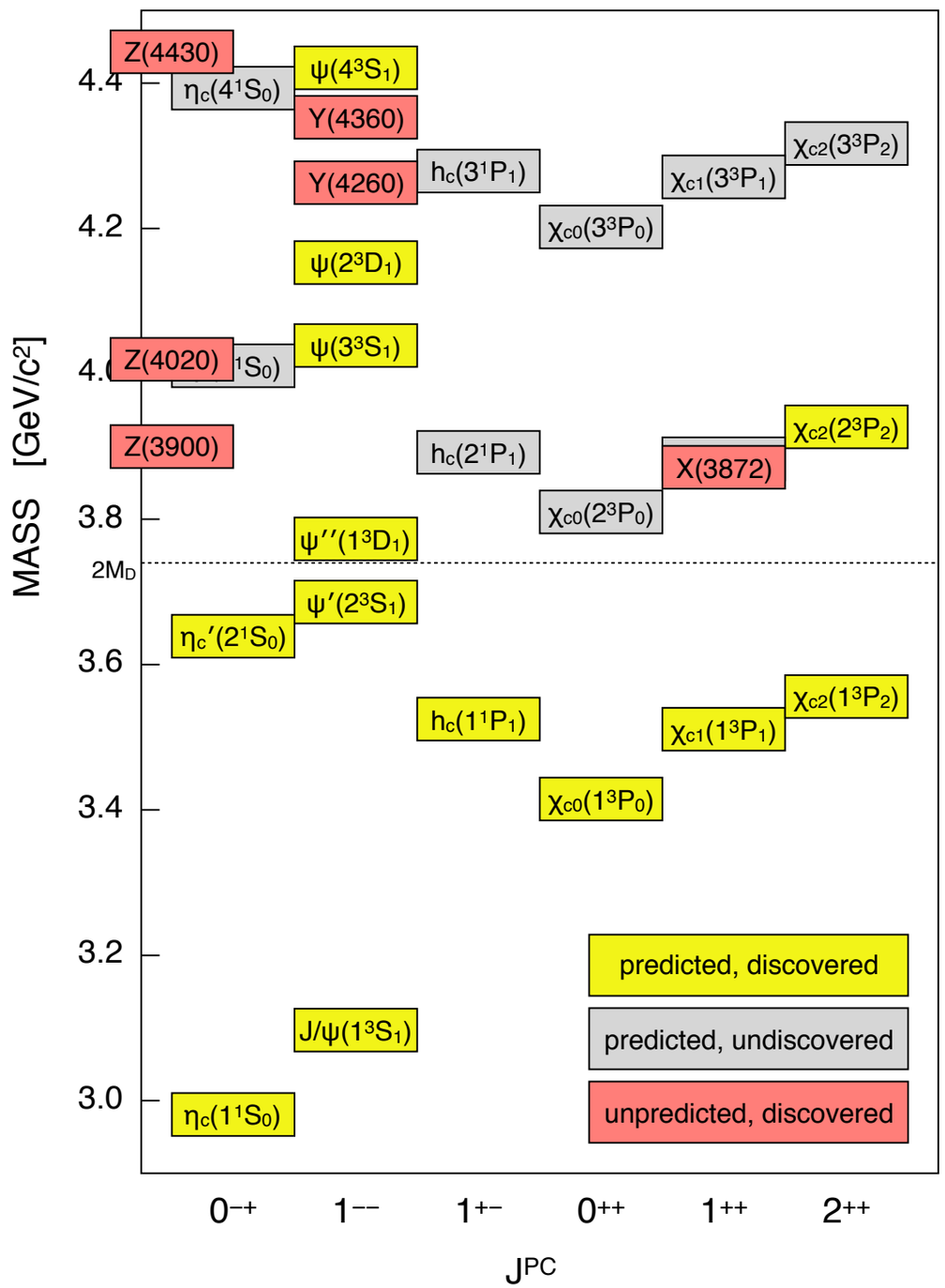

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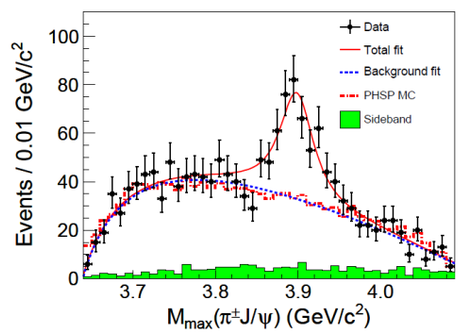
BESIII Overview and Future Prospects

see Landiao LIU's talk:
Z_c States at BESIII

Studies of the Z_c States using data with E_{CM} = 4.23 and 4.26 GeV…



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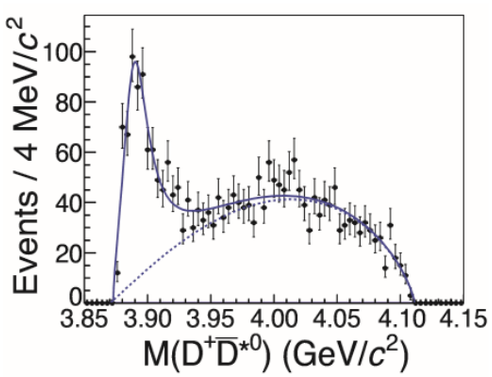
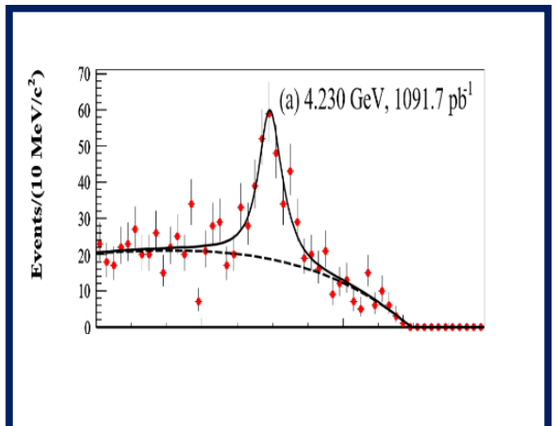


$e^+e^- \to \pi^+ (D\bar{D}^*)^-$

$Z_c(3900)^{\pm}$?



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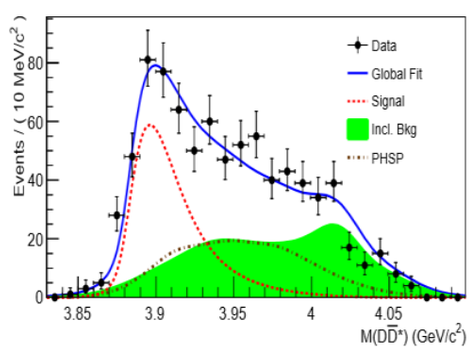

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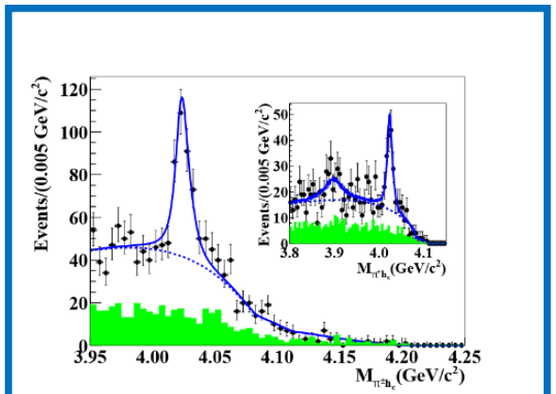
$Z_c(3900)^0$?



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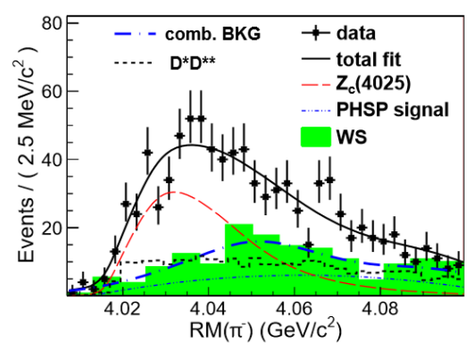

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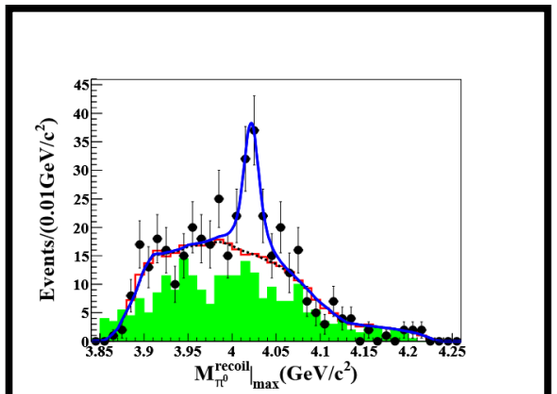

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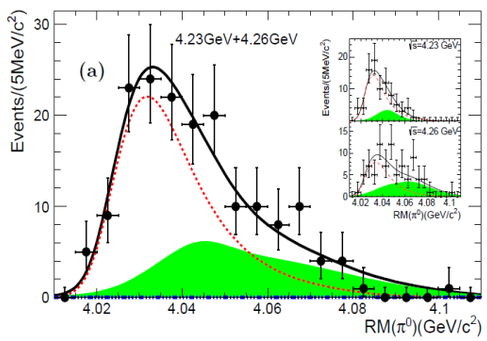

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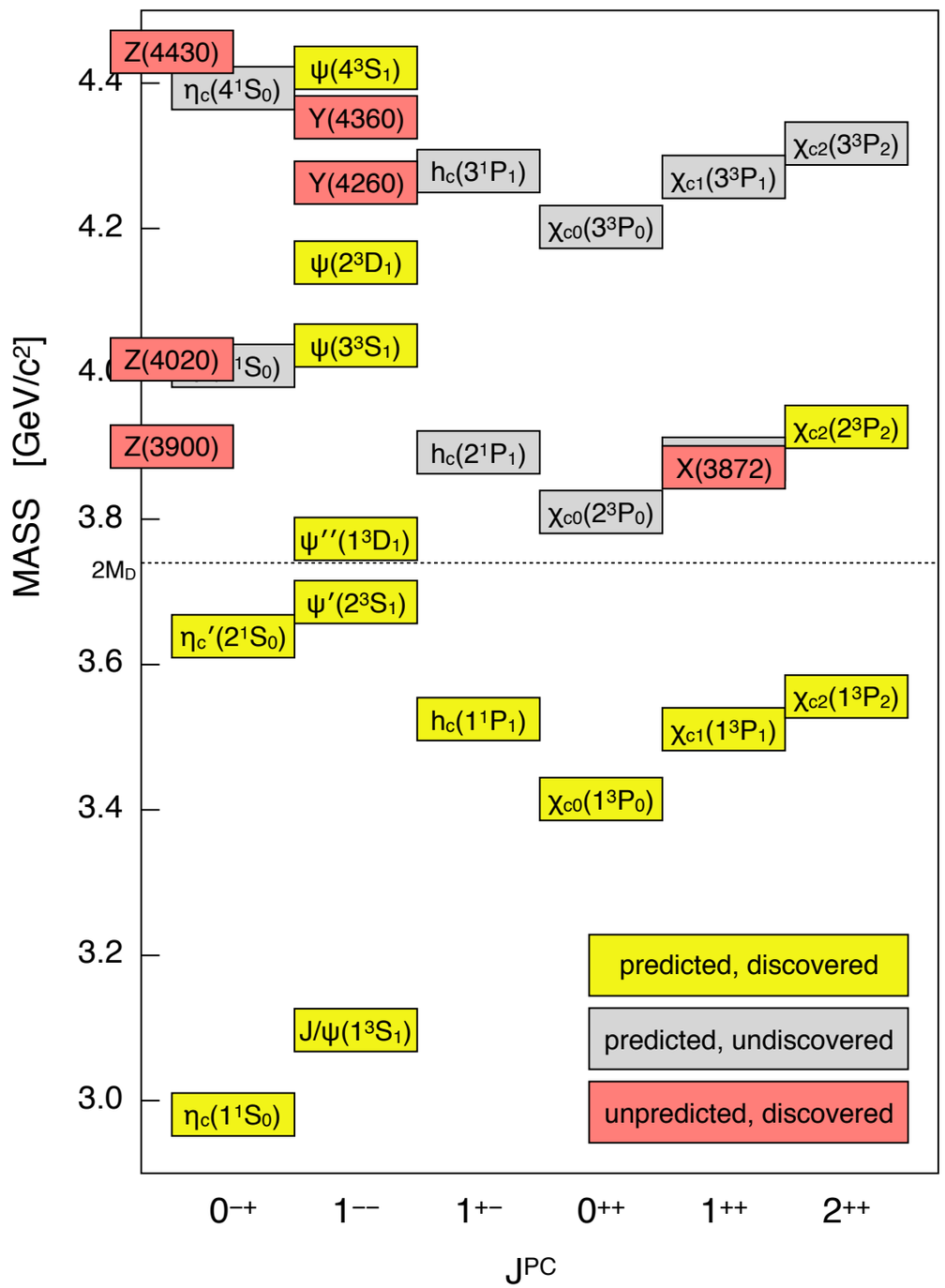

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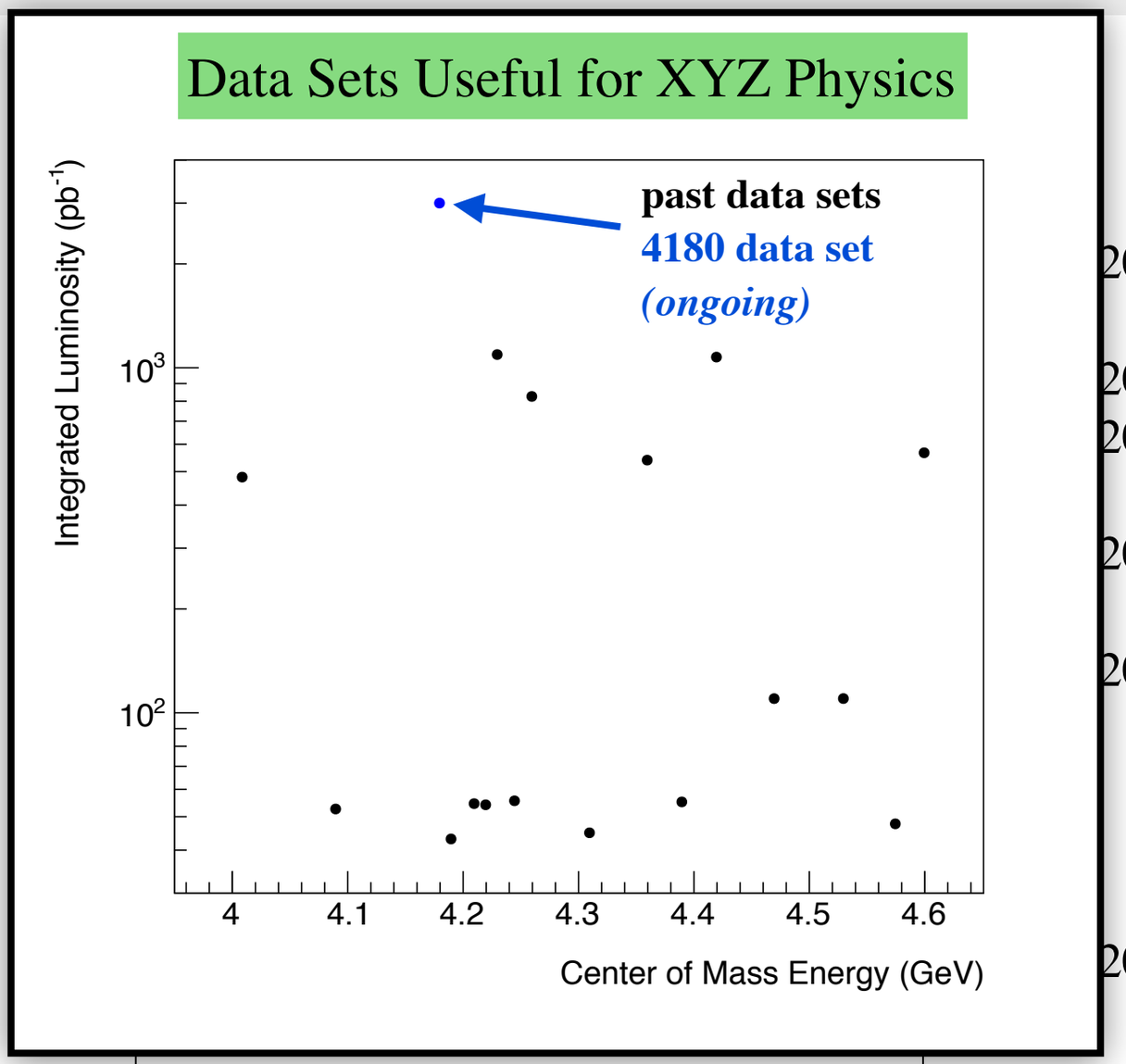

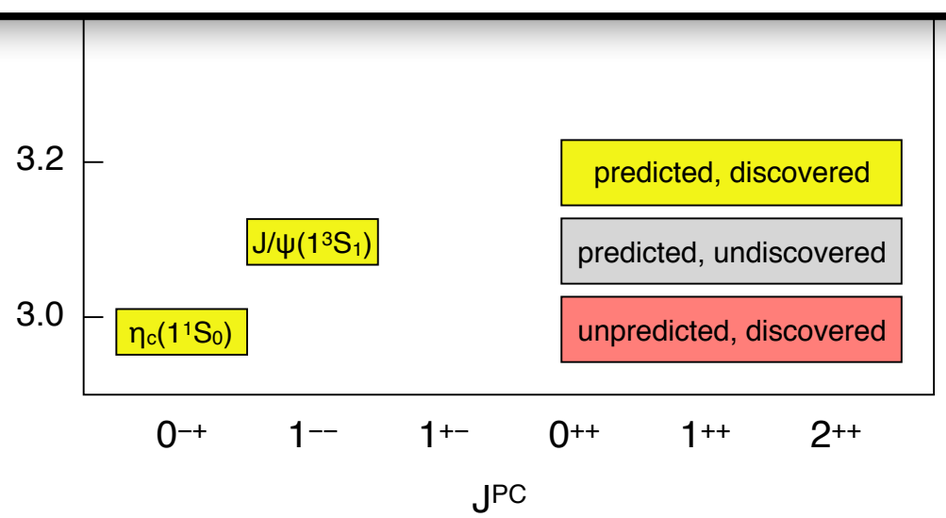

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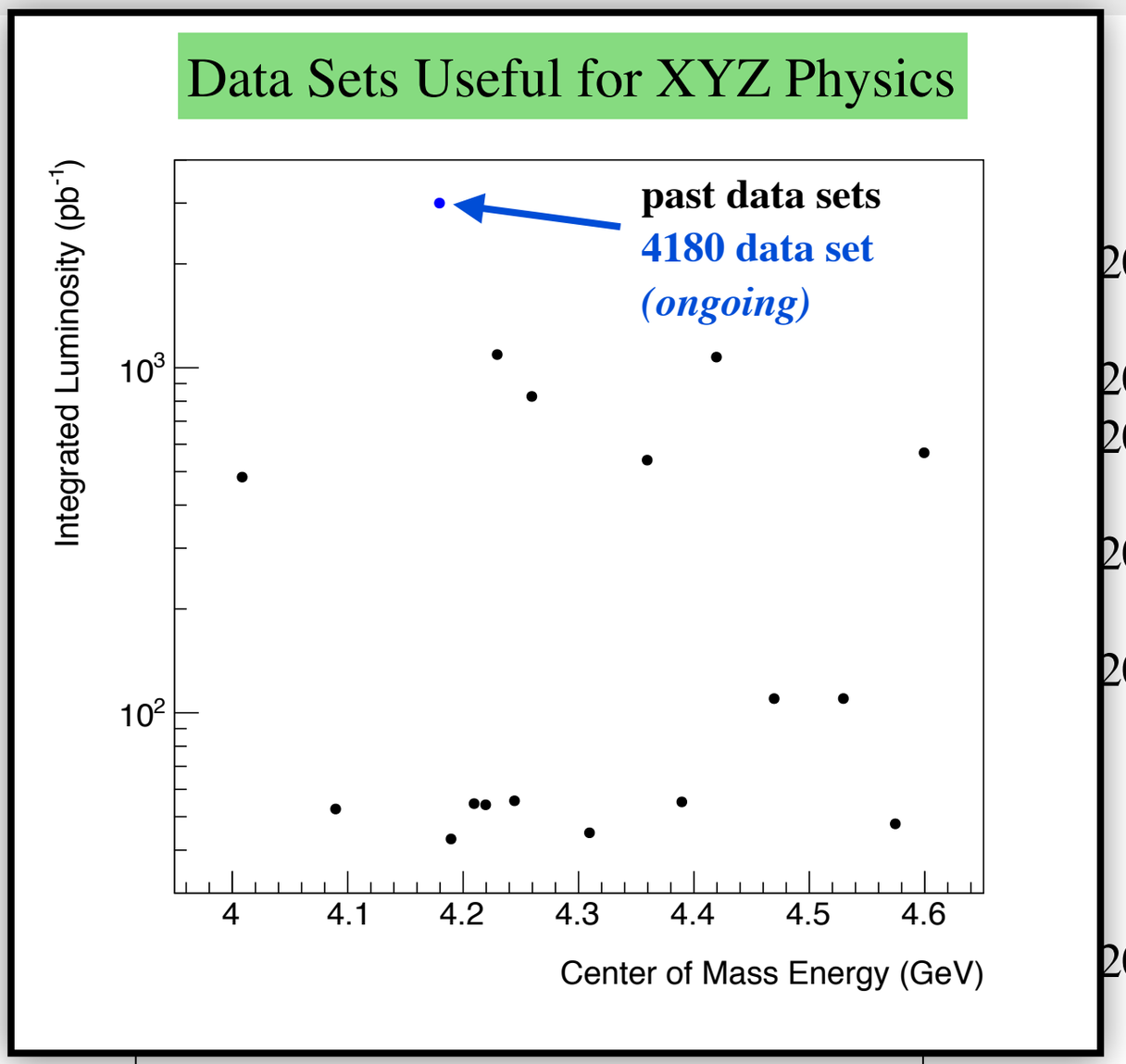
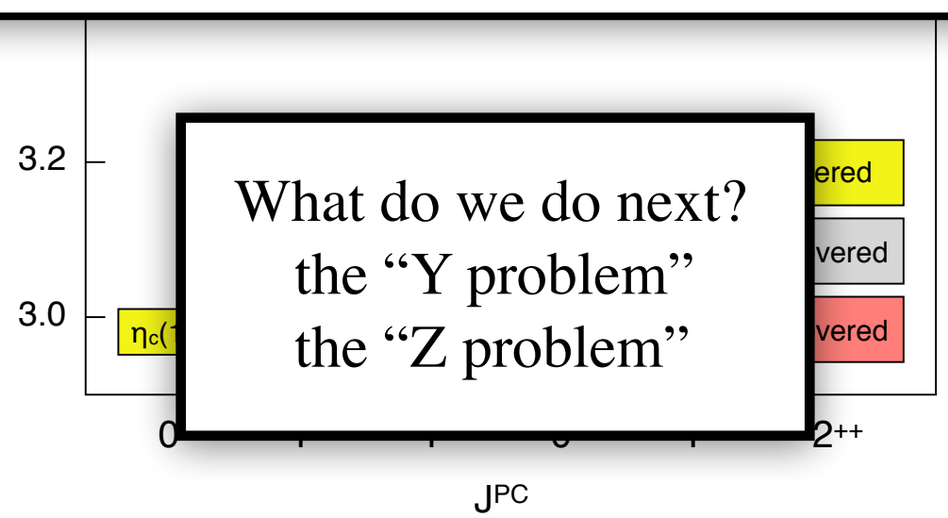
BESIII Overview and Future Prospects





What do we do next?
the "Y problem"
the "Z problem"

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(e^+e^- collisions at E_{CM} between 2.0 and 4.6 GeV)

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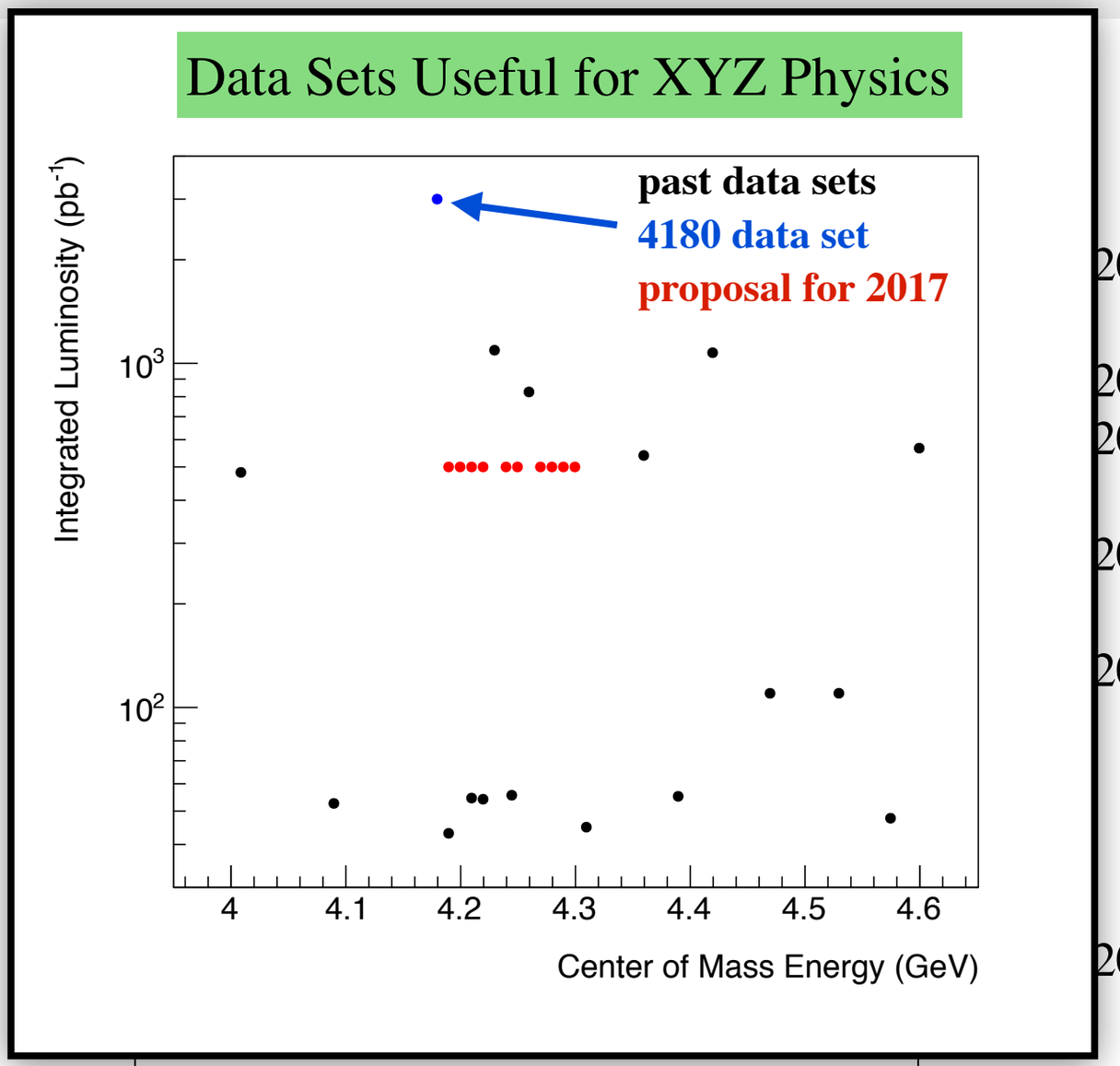

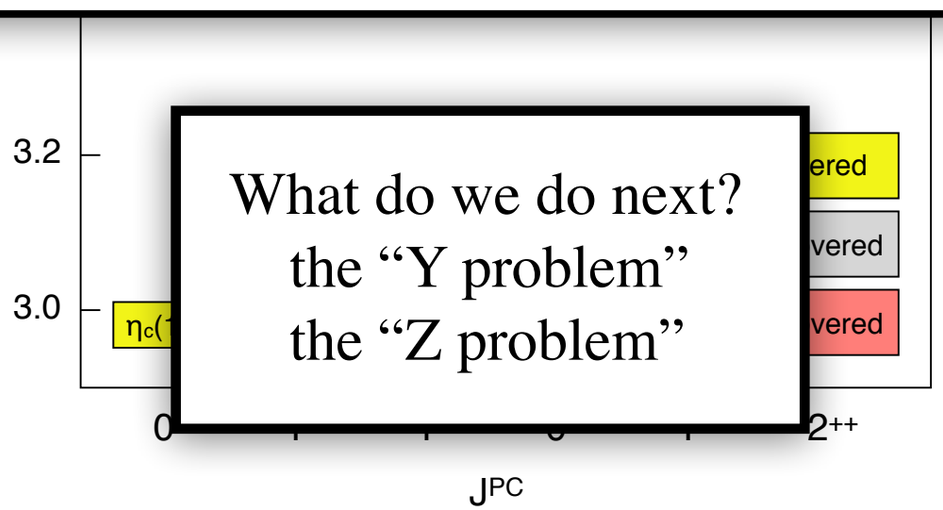

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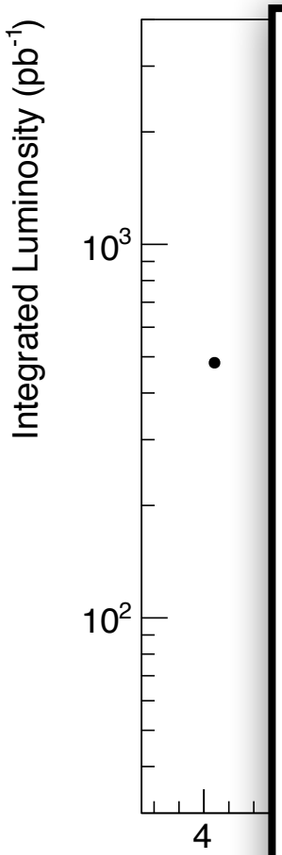
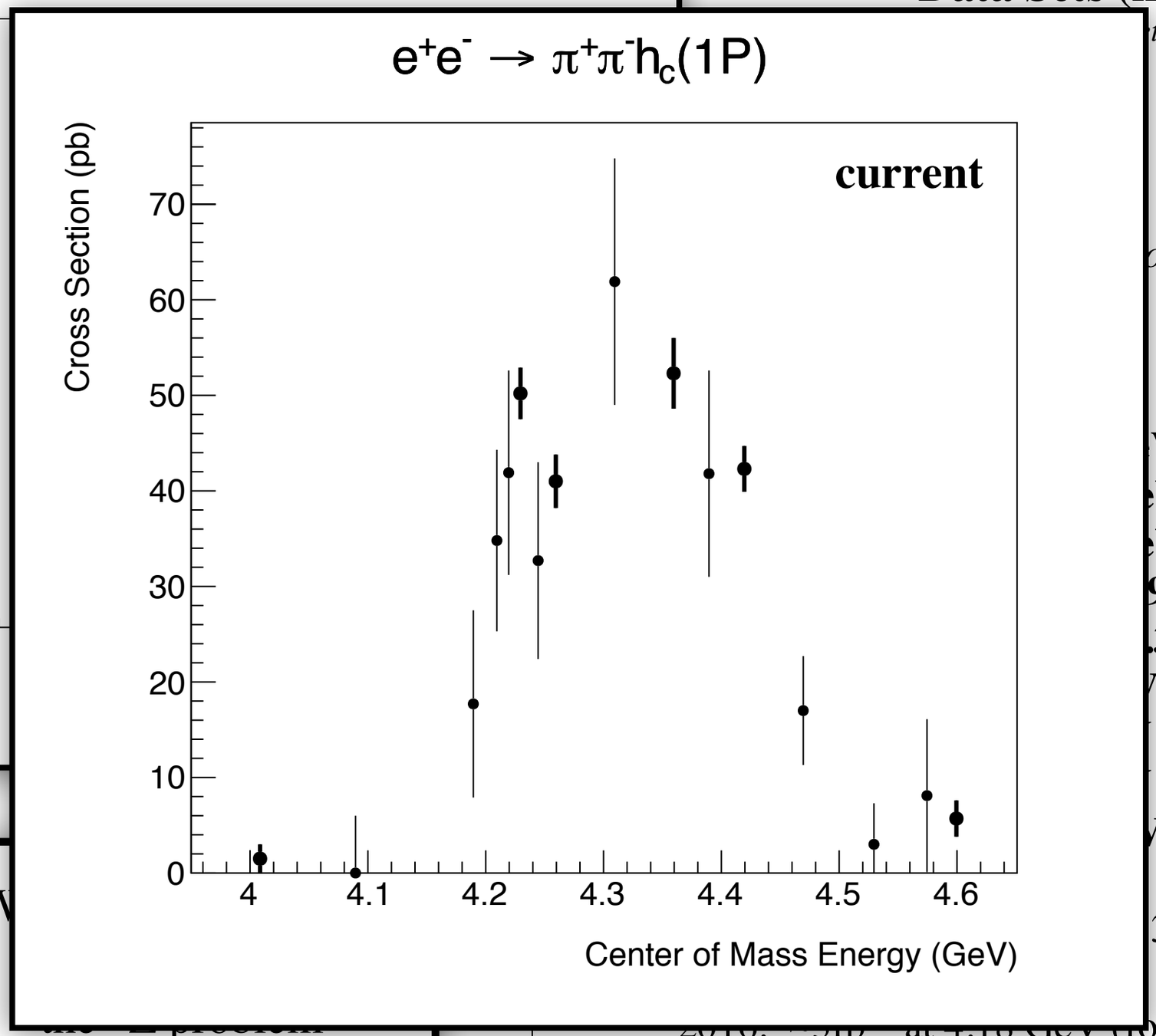
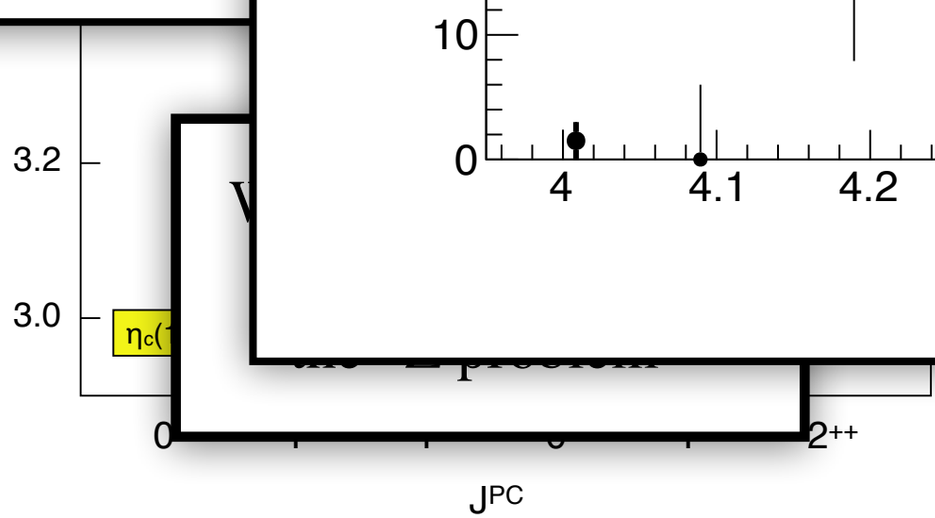
Data Sets Useful for XYZ Physics







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V
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eV
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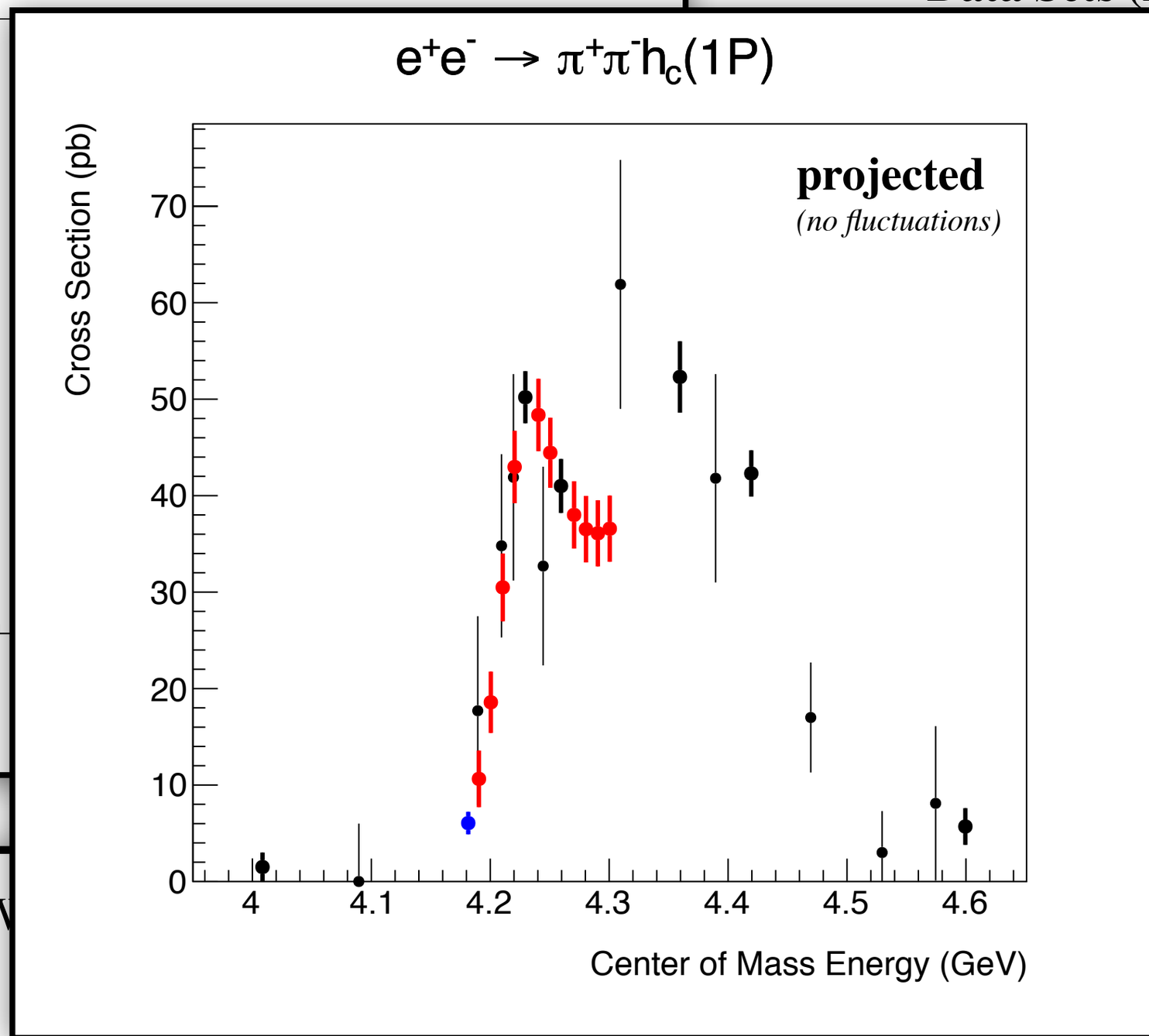

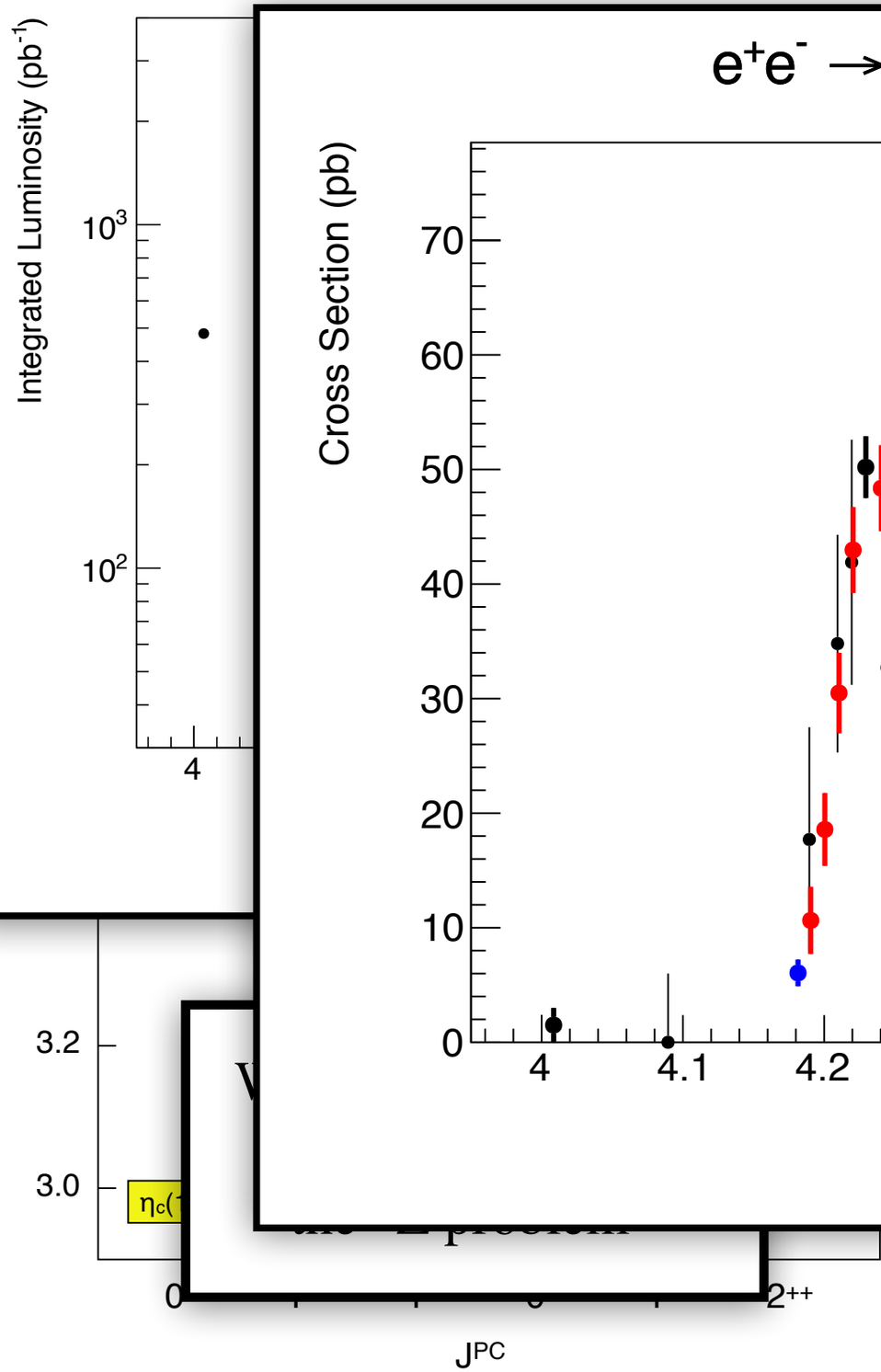

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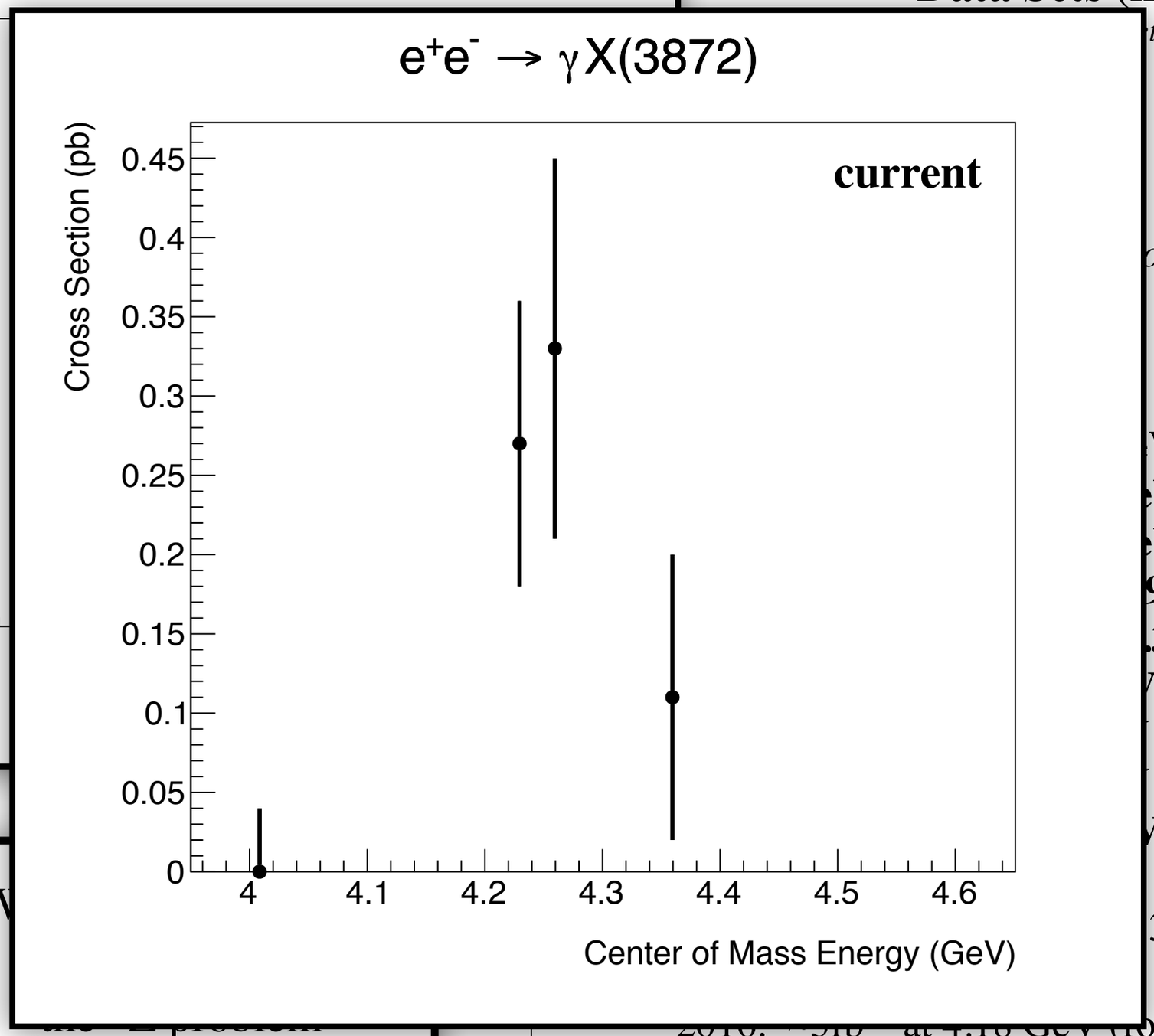

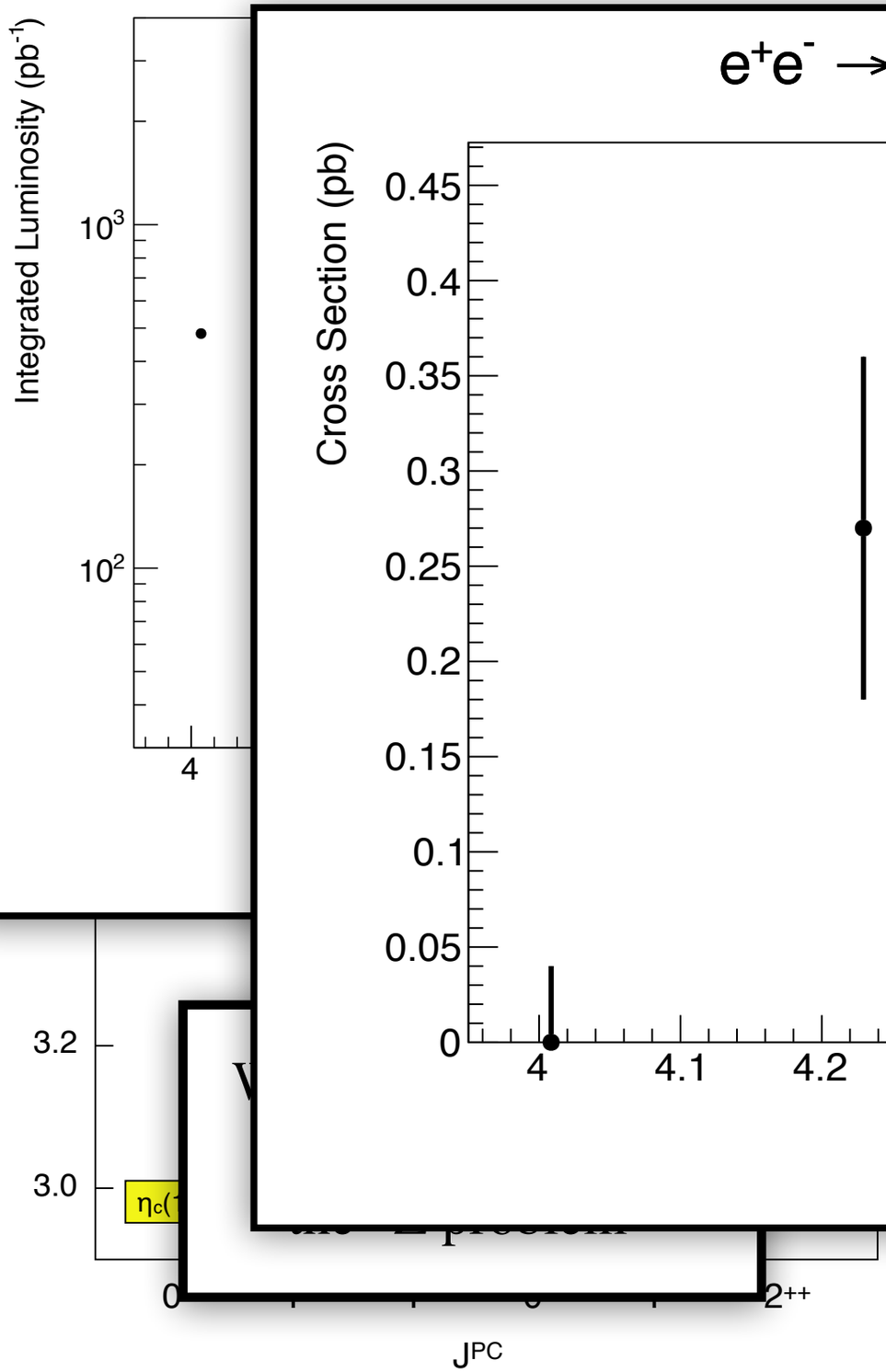

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2016: ~91B at 4.18 GeV (for $\mathbf{D_s}$) *ONGOING*
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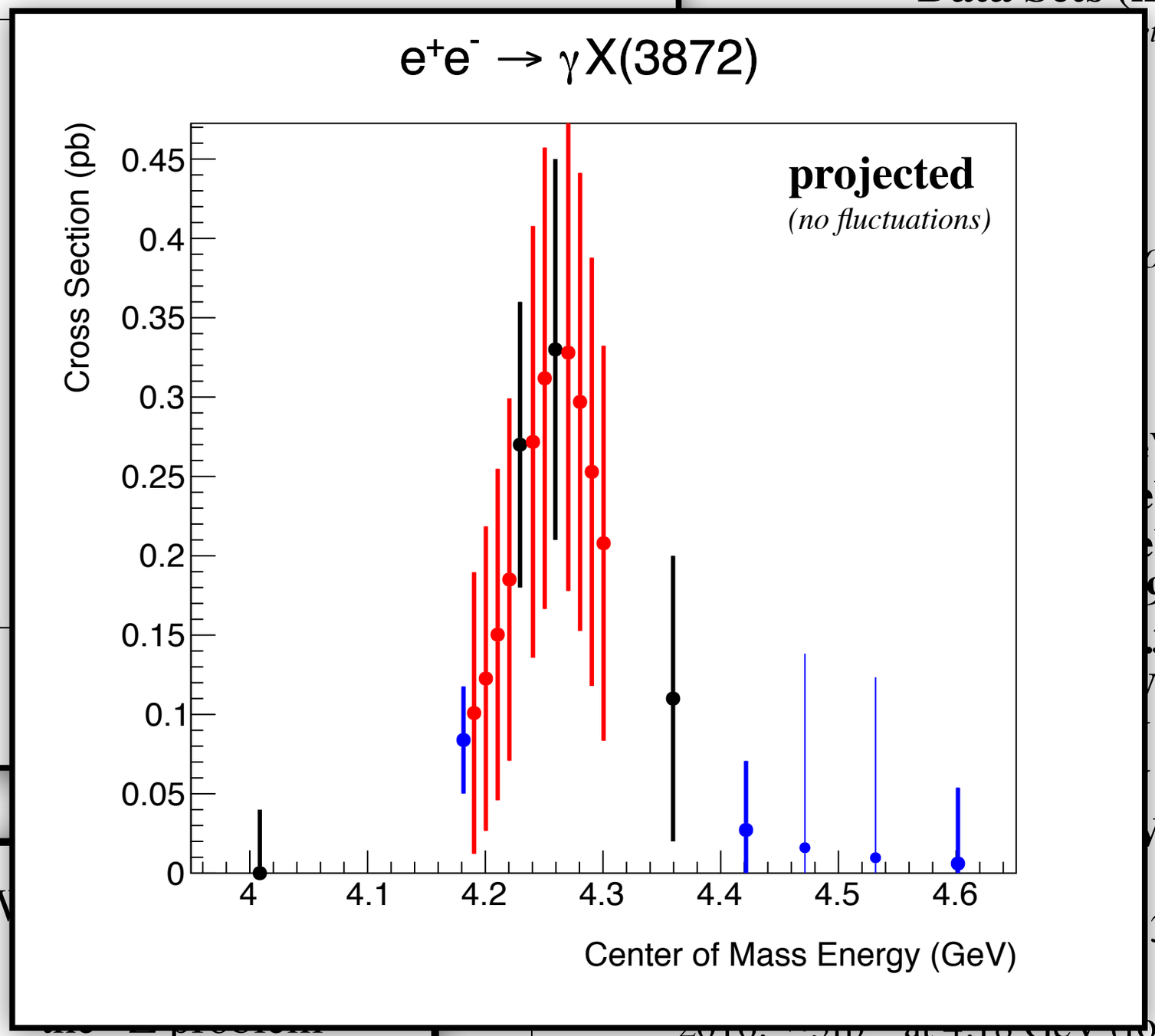

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BESIII Overview and Future Prospects

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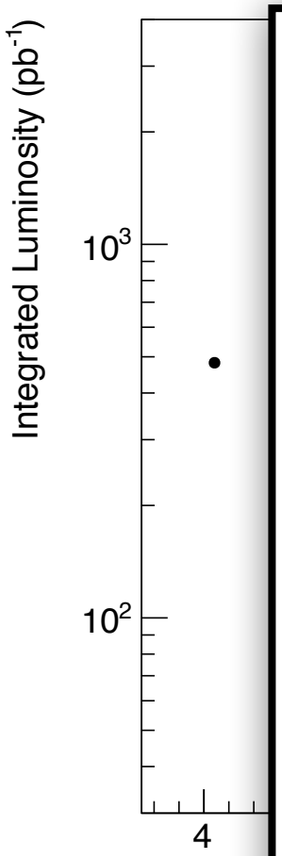

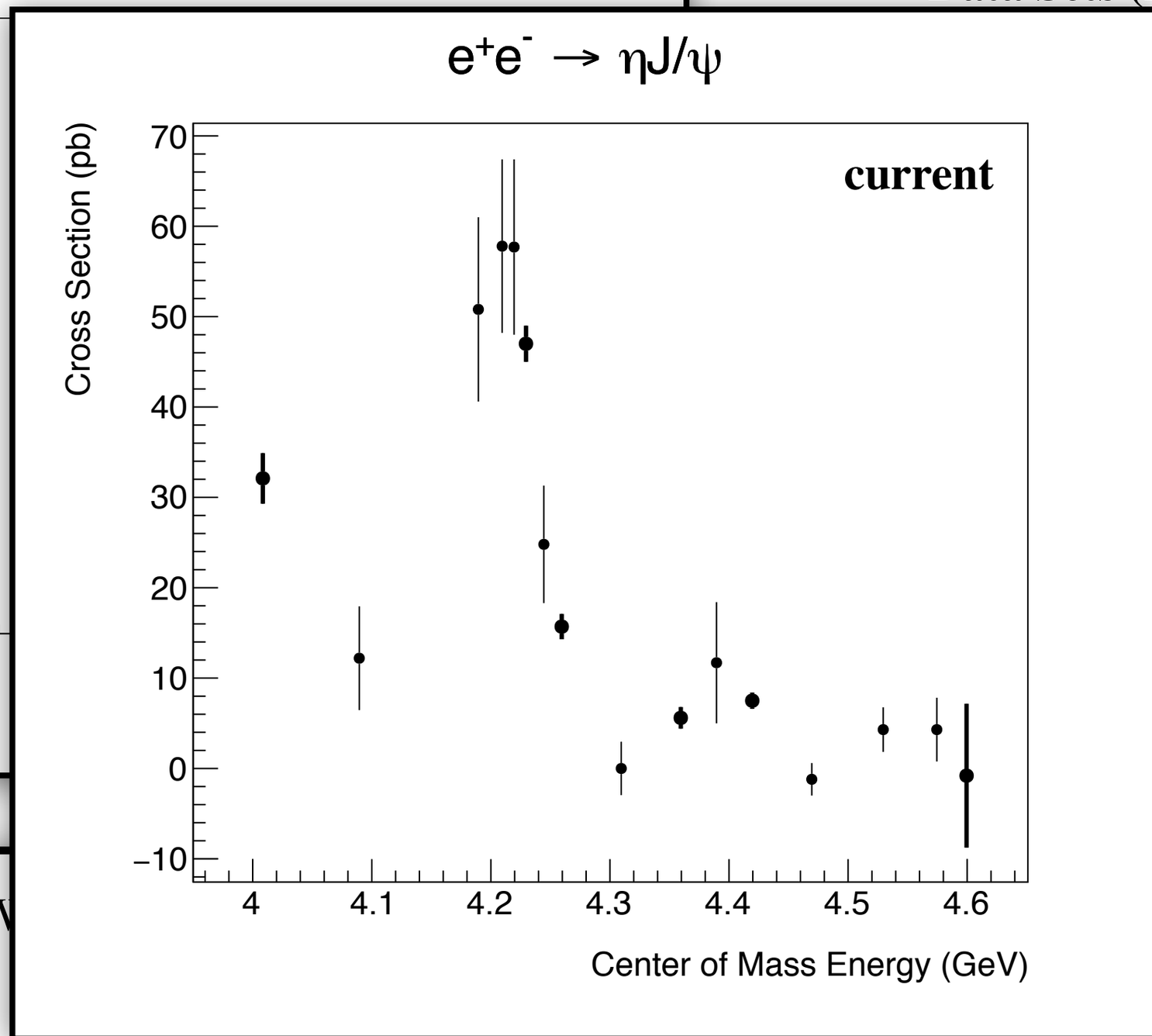

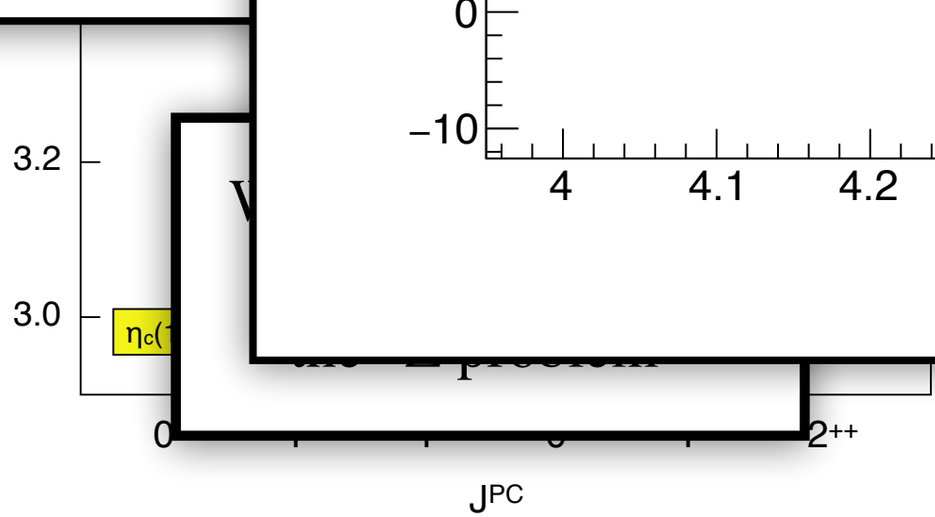

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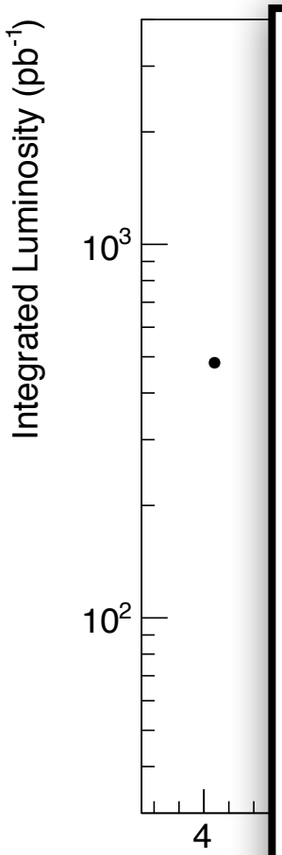

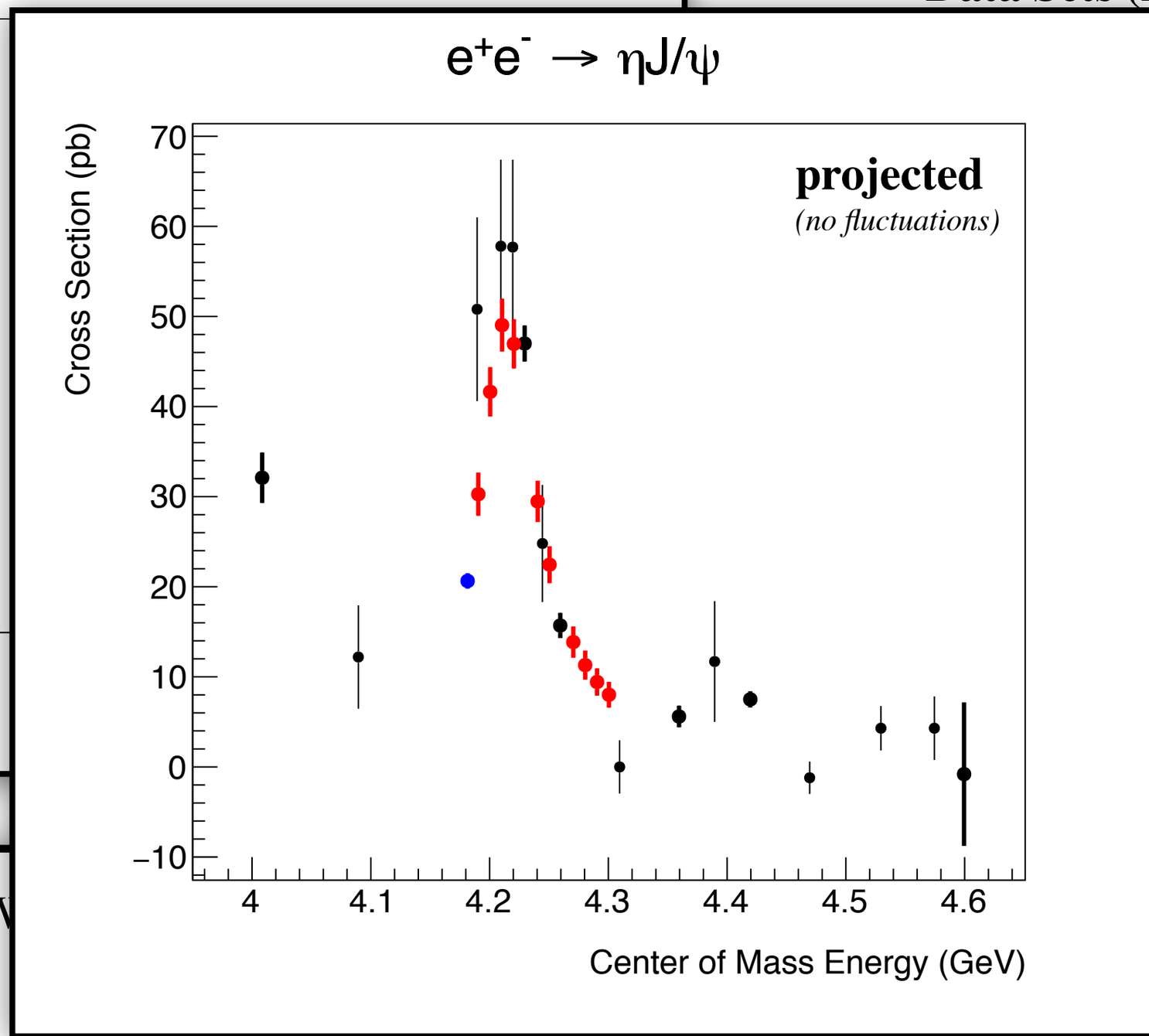

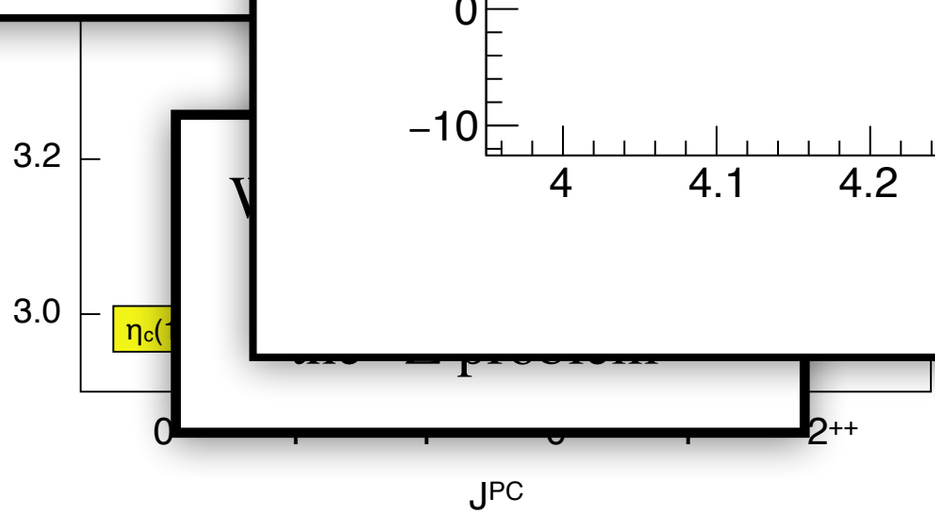

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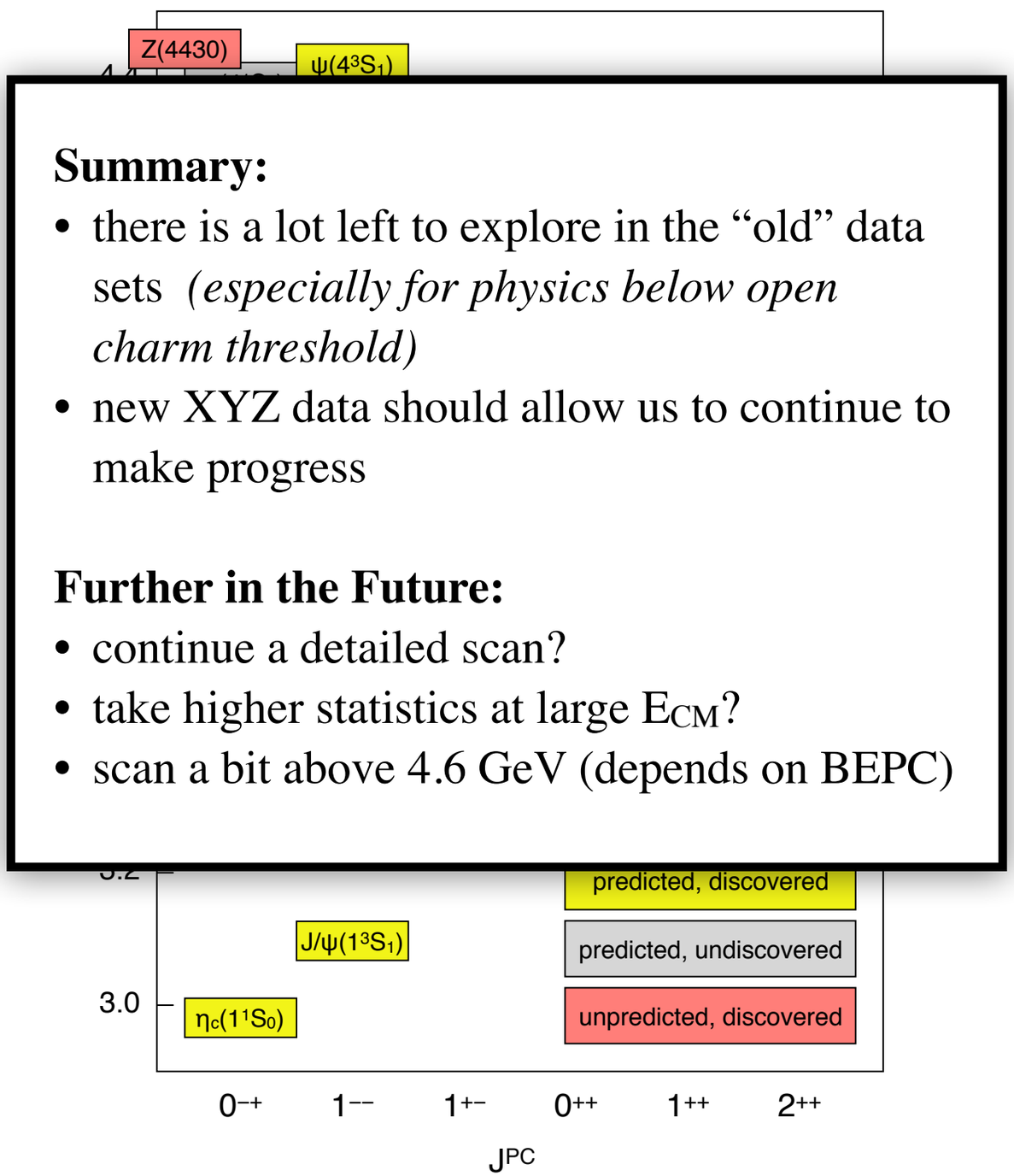
BESIII Overview and Future Prospects

Charmonium Spectrum

predictions based on PRD 72, 054026 (2005)
measurements from PDG 2014



Summary:

- there is a lot left to explore in the "old" data sets *(especially for physics below open charm threshold)*
- new XYZ data should allow us to continue to make progress

Further in the Future:

- continue a detailed scan?
- take higher statistics at large E_{CM}?
- scan a bit above 4.6 GeV (depends on BEPC)

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