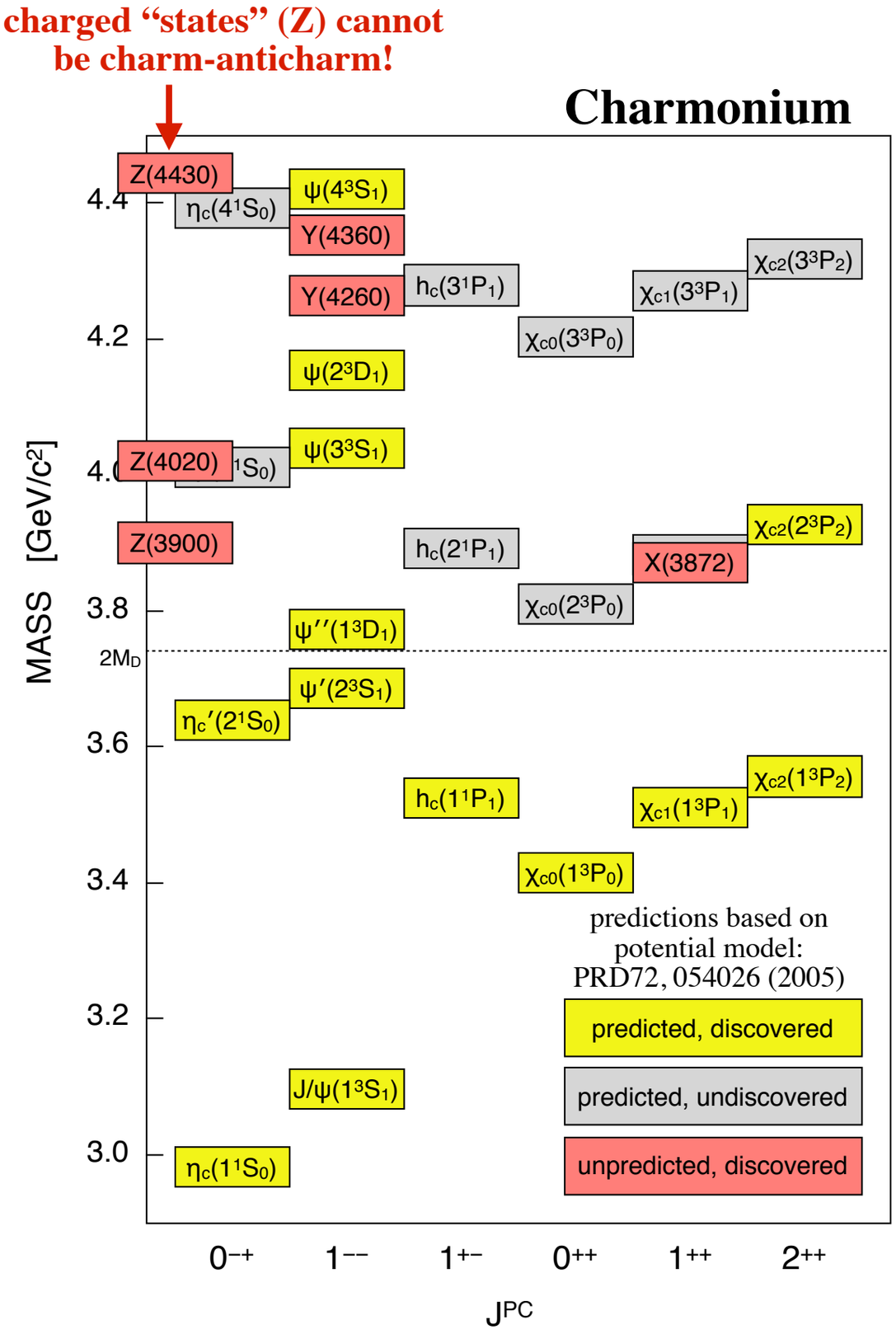
1. XYZ "States" in Charmonium and Bottomonium



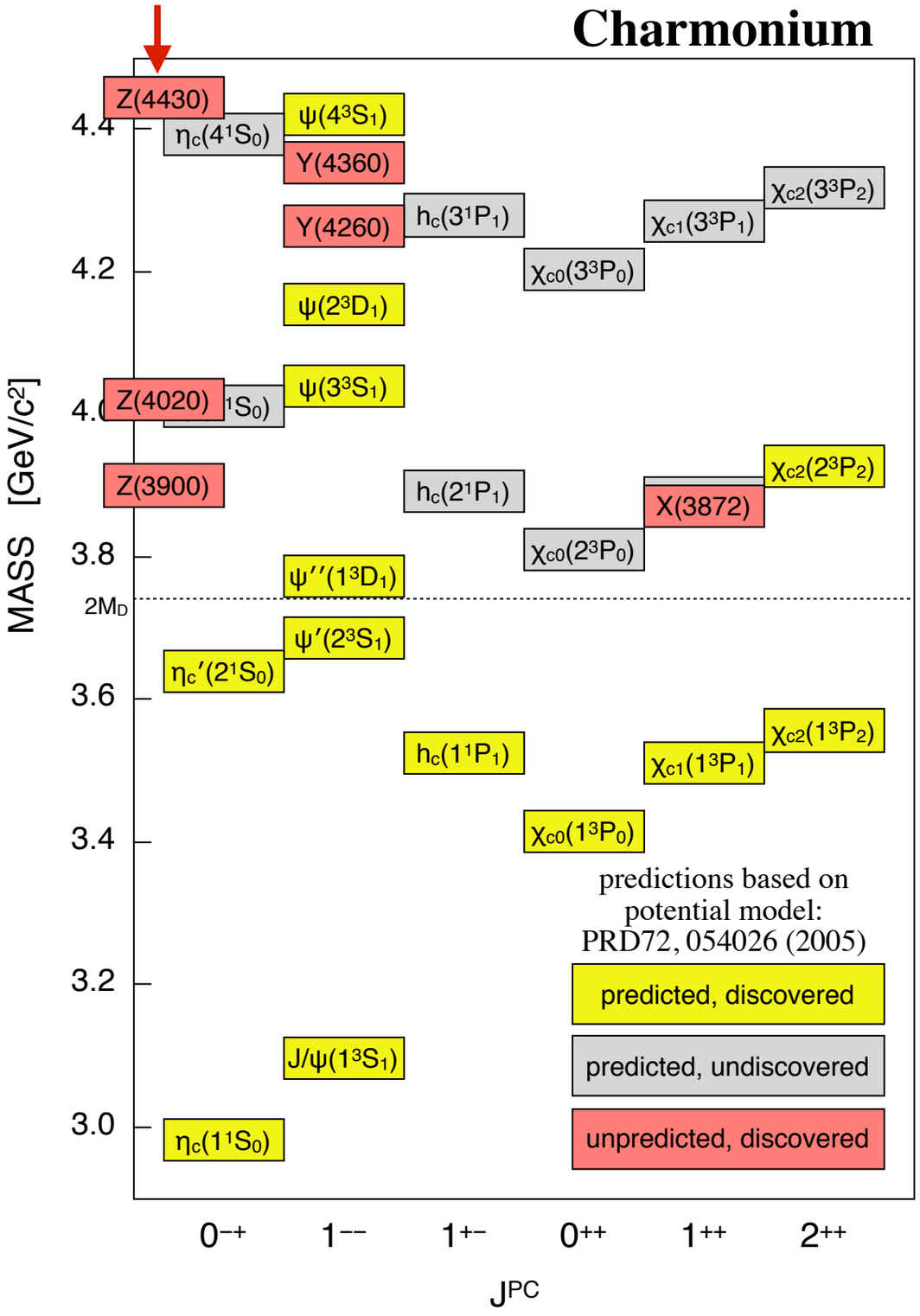
A. Charmonium and bottomonium are simple quark-antiquark bound states in which both potential models and QCD calculations work remarkably well below open-flavor threshold.

B. Experiment indicates a variety of phenomena above open-flavor threshold (the "XYZ") in which this simple quark-antiquark picture breaks down.

C. This is a prime opportunity to study meson spectroscopy, meson-meson interactions, and QCD in general in a region that is still simple, but beyond quark-antiquark dynamics.

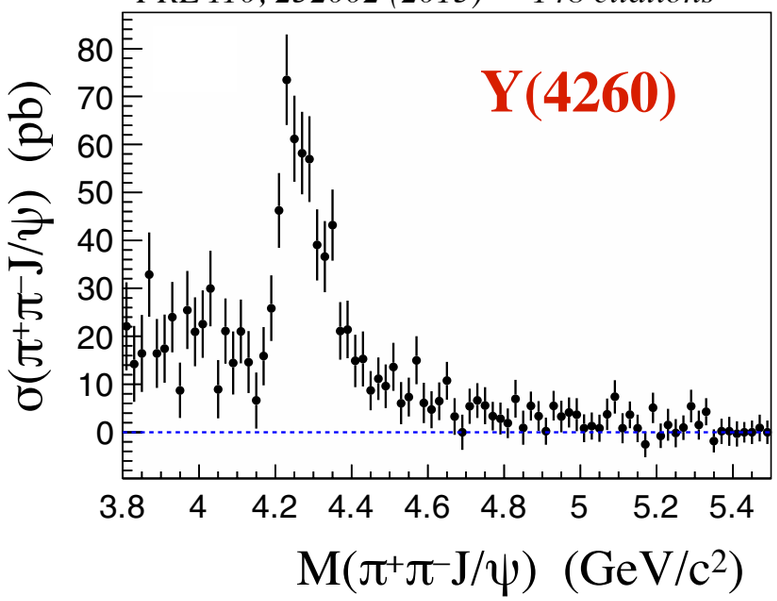
2. The Status of Experiment *(by example)*

charged "states" (Z) cannot be charm-anticharm!



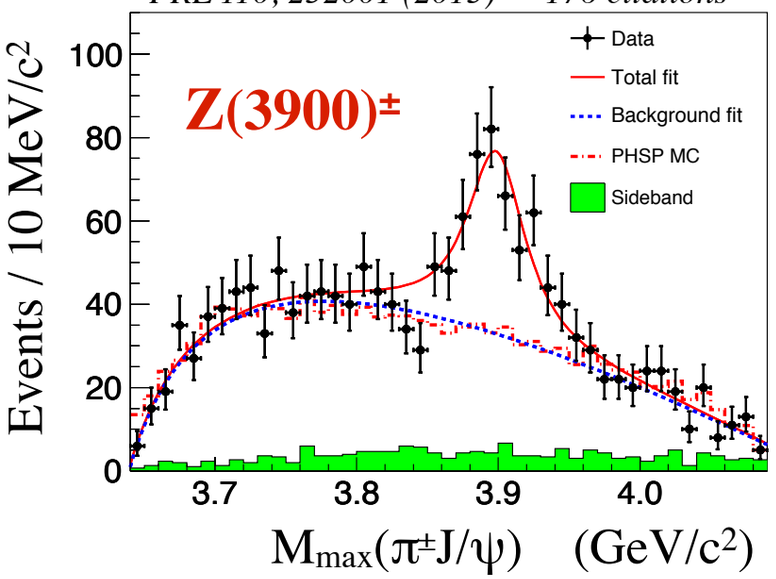
A. $e^+e^-(\gamma_{ISR}) \rightarrow \pi^+\pi^- J/\psi$ at Belle

PRL 110, 252002 (2013) — 148 citations



B. e^+e^- (at 4.26 GeV) $\rightarrow \pi^+\pi^- J/\psi$ at BESIII

PRL 110, 252001 (2013) — 176 citations

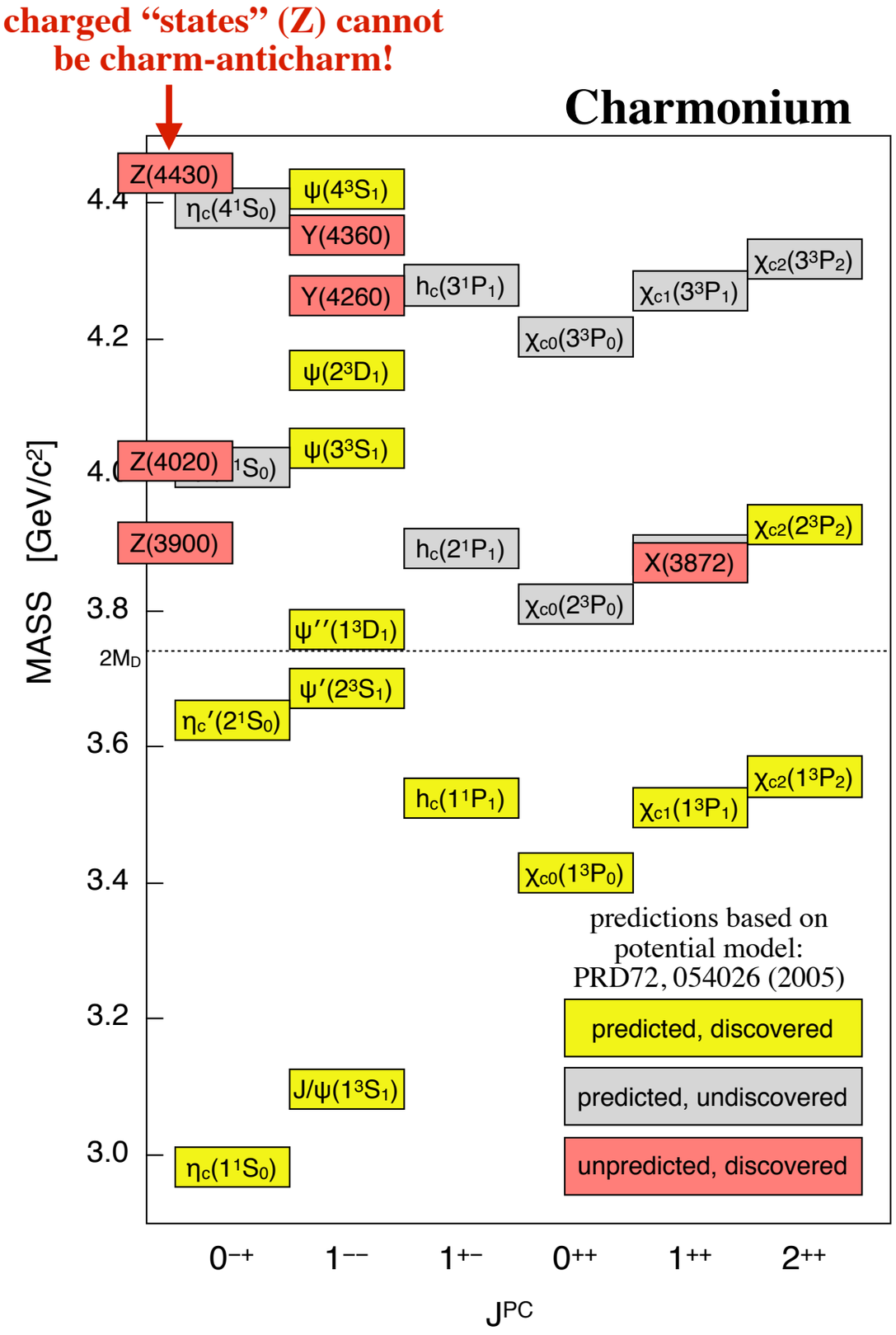


D. Patterns are emerging!

C. Striking parallels in bottomonium:

$Y(4260) \rightarrow Y_b(10890)$, $Z(3900) \rightarrow Z_b(10600)$, $Z(4020) \rightarrow Z_b(10650)$

3. The Outlook for Experiment



A. To progress, Belle, BaBar, BESIII, LHCb, etc. will keep adding pieces to the puzzle.

B. Two experiments are especially unique and timely:

B1. **Belle-II**

facts	broad QCD topics
KEK, Tsukuba, Japan	bottomonium
e^+e^- in bottomonium	ISR to charmonium
50× data of Belle	charmonium in bottomonium
start date in 2018	and B decays

B2. **BESIII**

facts	broad QCD topics
IHEP, Beijing, China	charmonium
e^+e^- in charmonium	ISR to light quarks
running since 2009	light quarks in charmonium
10 more years?	and D decays

C. The puzzle of the XYZ's seems imminently solvable, which would push QCD studies of mesons beyond quark-antiquark dynamics.

D. These efforts will provide critical input to similar programs in the light quark sector (e.g. GlueX at JLab).