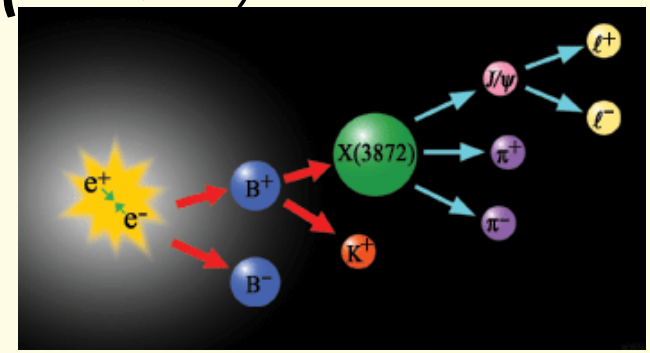
X(3872) Discussion



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- Comparison of observation statistics
- Interpretation in QCD spectroscopy
- Decay ID at D0
- Data selection and background reduction
- Mass Plots
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- More recent observations in the charmonia
- Outlook on measurement and interpretation

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Signal observed:

- Belle: PRL 91, 262001 (Dec 2003)
- CDF: PRL 93, 072001 (Aug 2004)
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- BaBar: PRD 71, 071103 (Apr 2005)

	Mass(MeV)	Width(Mev)	Events
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CDF	3871.3+/-0.7	4.9+/-0.7	730+/-90
D0	3871.8+/-0.6	17+/-3	522+/-100
BaBar	3873.4+/-1.4	3.1+/-0.2	25.4+/-8.7

Hints:

- E705: PRD 50,7 4258 (Oct 1994) at 3836MeV
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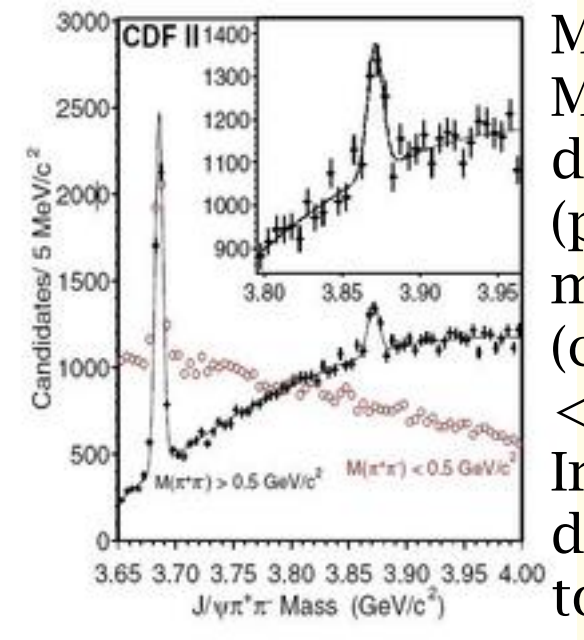
Observations: Plots



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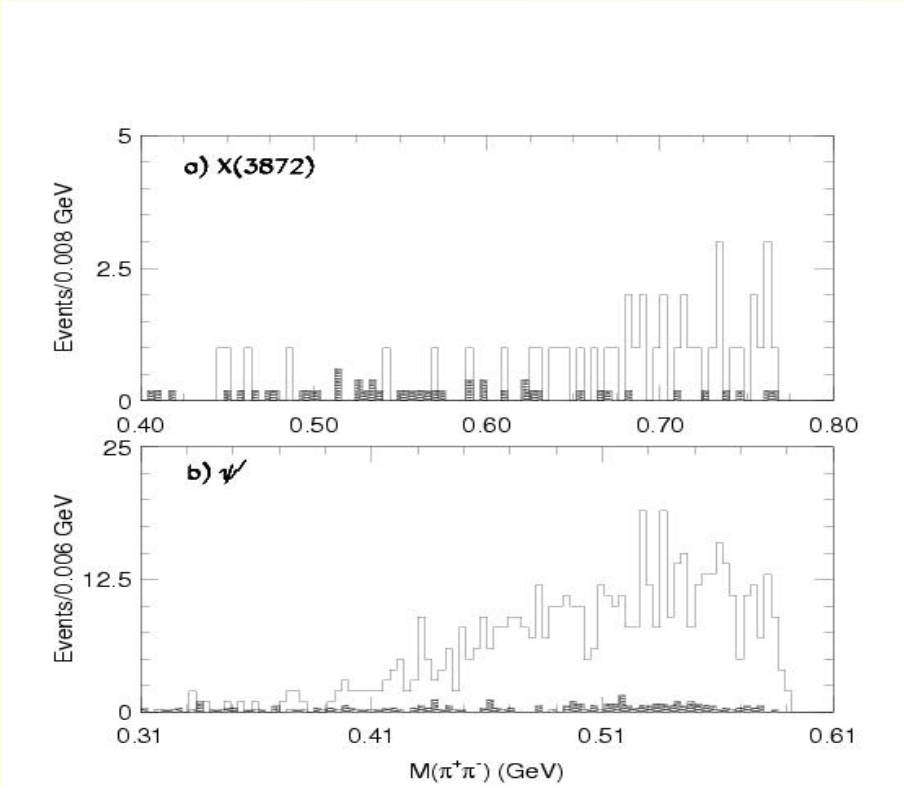

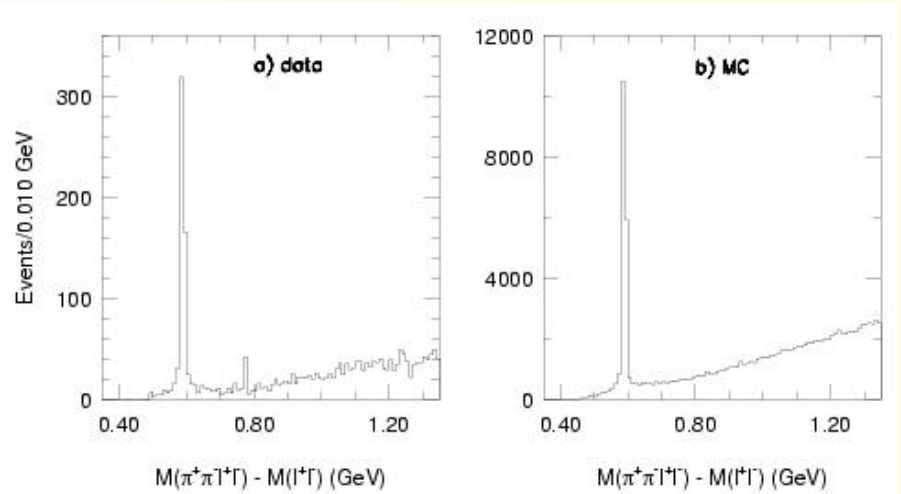

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- 'Hidden' Charmonium... but mass not quite right
- 'Molecular' state (loosely bound DD* –– threshold 3871.5MeV)
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VOLUME 93, NUMBER 16 PHYSICAL REVIEW LETTERS week ending 15 OCTOBER 2004

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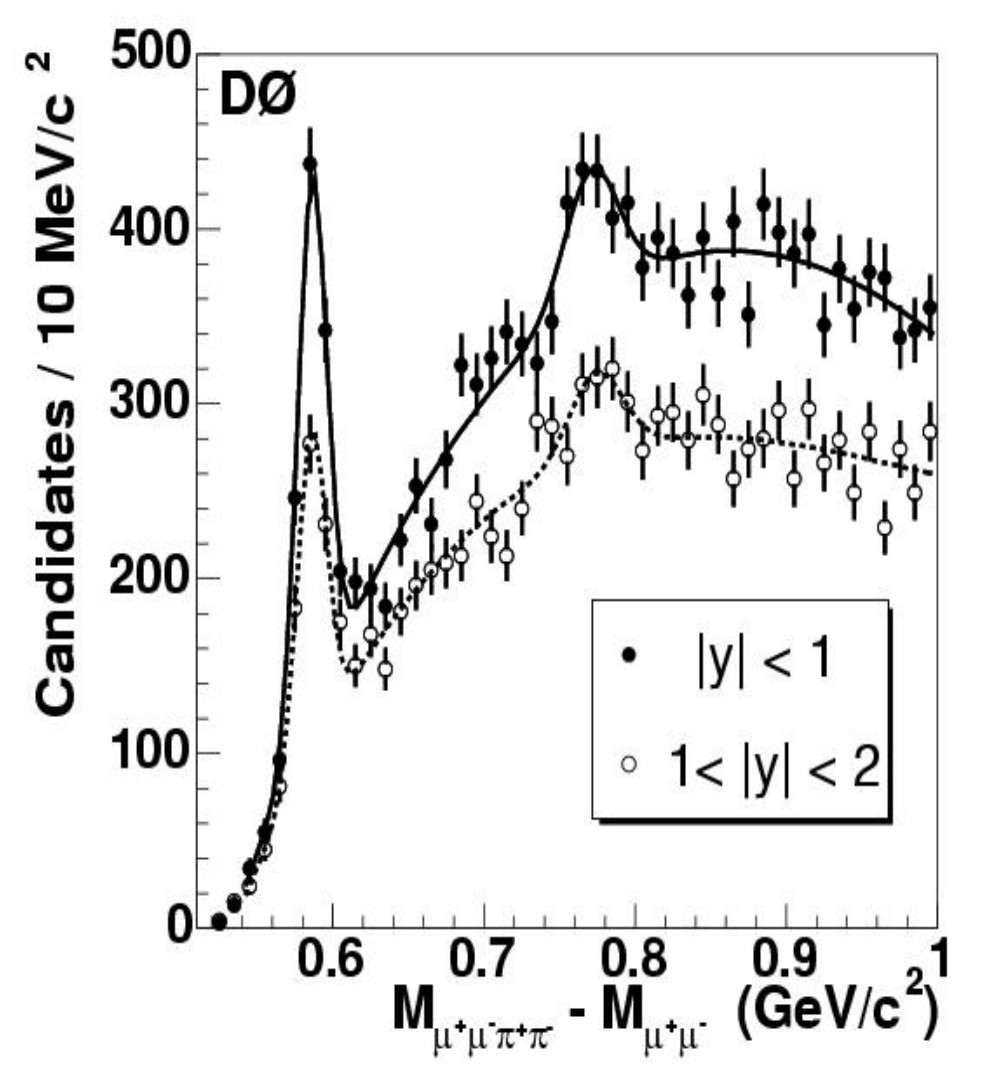

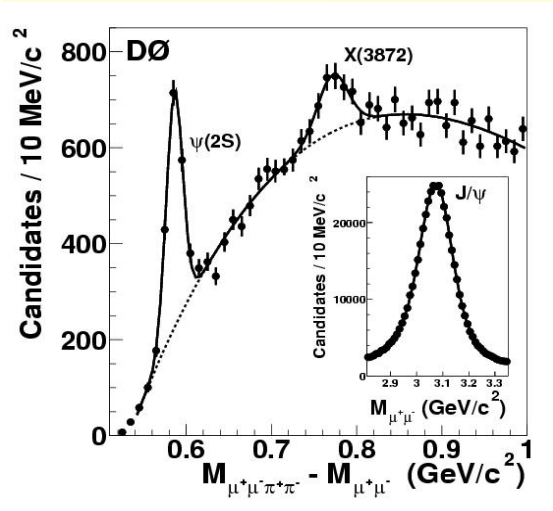

Sample: 230pb^{-1}
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- Width: 17±3MeV
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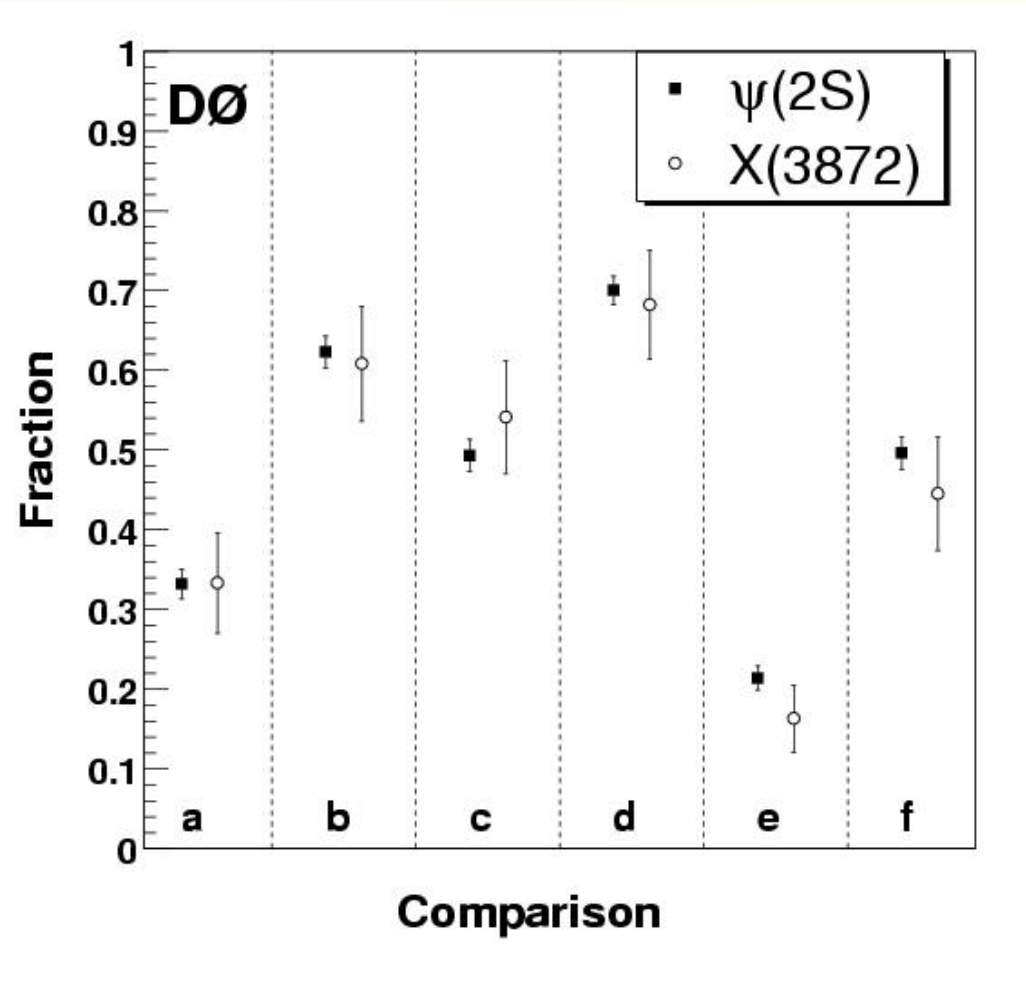

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(f) $\cos(\theta_\mu) < 0.4$	593 ± 33	232 ± 46
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c,f) Helicity: (cosine of) angle between pion(muon) and X in the dipion(muon) rest frame.

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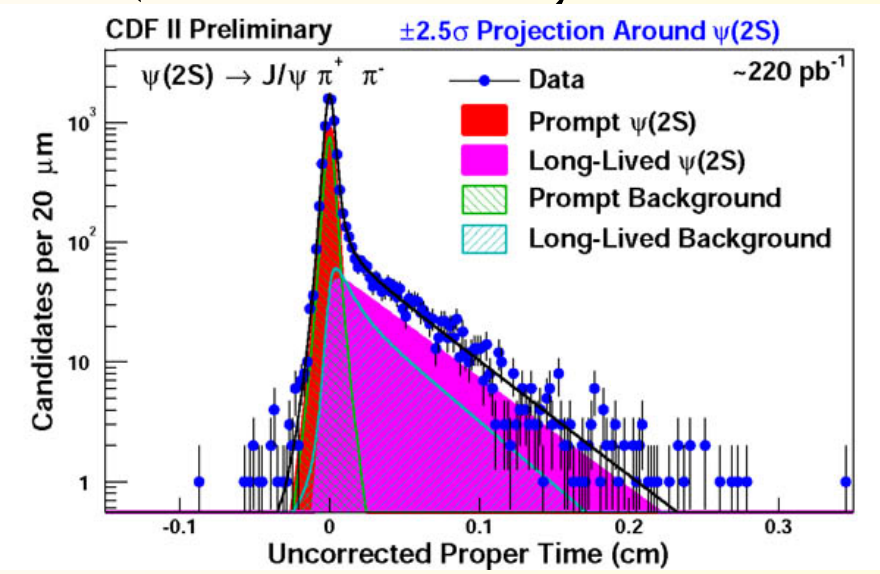
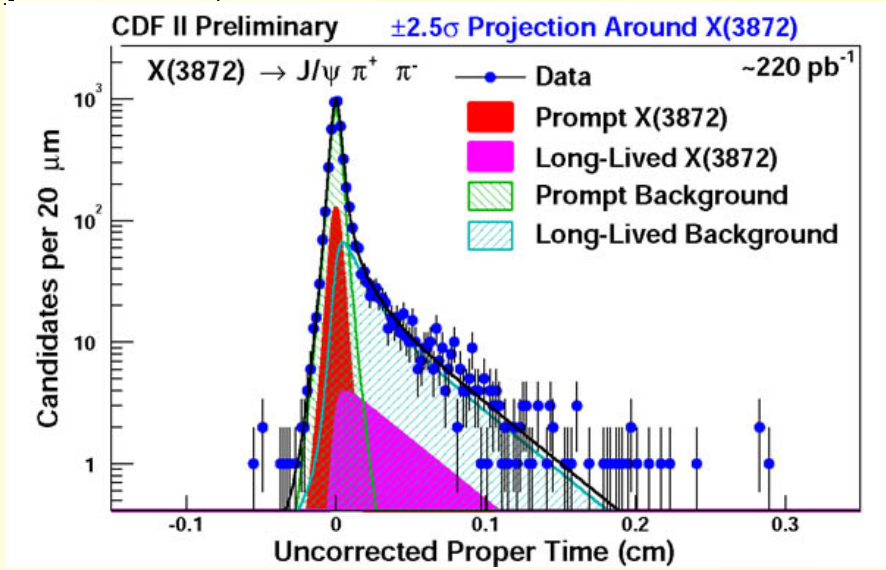




Further comments and conclusions

- No significant differences in the variables we considered between the X and the psi prime
- In the last sentence we imply our data leans towards an interpretation in terms of a ccbar or charmonium hybrid.
- Our range in muon eta is larger than CDF –– but our signal is smaller.

Newsflashes: more charmonium like states

- A few days ago (from BaBar):

Observation of a Broad Structure in the $\pi^+\pi^- J/\psi$ Mass Spectrum around $4.26\,\mathrm{GeV}/c^2$

- ...and this morning (from Belle):

Observation of a new charmonium state in double charmonium production in e^+e^- annihilation at $\sqrt{s} \approx 10.6$ GeV

Abstract

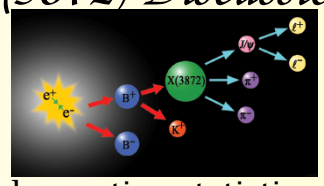
We report the first observation of a new charmonium state at a mass of $(3.943 \pm 0.006 \pm 0.006)\,\mathrm{GeV}/c^2$. This state, called $X(3940)$, is observed in the process $e^+e^- \to J/\psi X(3940)$ in the spectrum of masses recoiling against a reconstructed J/ψ. We also observe the decay of the $X(3940)$ into $D^*\overline{D}$ and measure the intrinsic width of this state to be less than $52\,\mathrm{MeV}/c^2$ at the 90% C.L. These results are obtained from a $350\,\mathrm{fb}^{-1}$ data sample collected with the Belle detector near the $\Upsilon(4S)$ resonance, at the KEKB asymmetric energy e^+e^- collider.

More on interpretation

- Phenomenological prperties of the X (mainly from hep-ex/0407033):
  a) Decays observed to jpsi pi pi and jpsi + three pions (hep-ex/0408116)
  b) Very close to DD* mass threshold
  c) Narrow
  d) DDbar decays not seen - although kinematically favored for a charmonium state (hep-ex/0307061)
  e) Dipion mass spectrum favors higher masses near the rho(770). To test whether the dipions come from the rho need to look at the two neutral pions + Jpsi mode.
- Most charmonia states (from phenomenology) dont fit.
- Needs a full angular analysis of the two pions + Jpsi state to detrmine quantum numbers and test the "molecular" hypothesis.

COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

X(3872) Discussion



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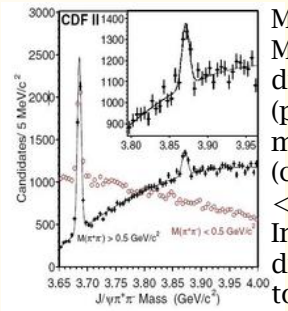

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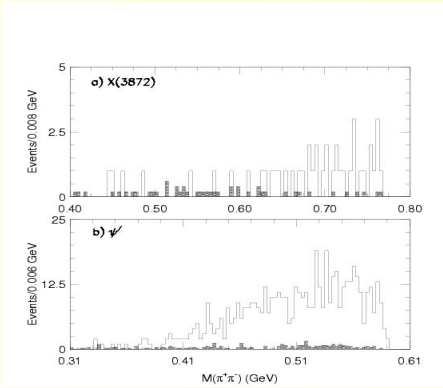

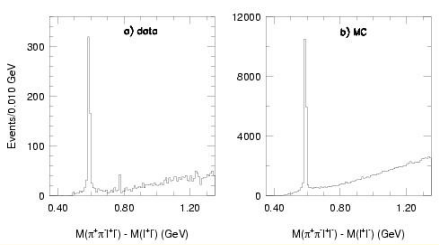

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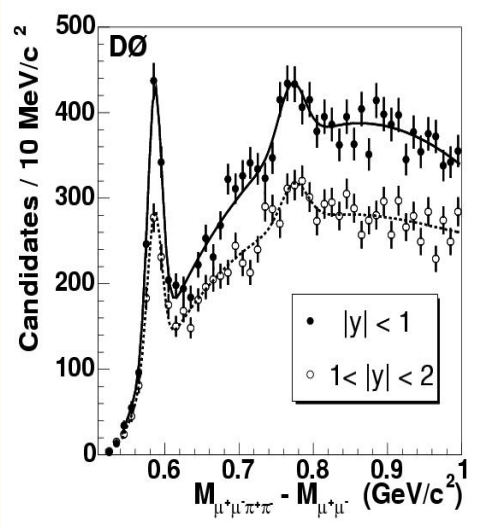

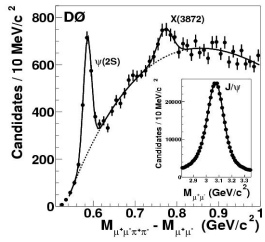

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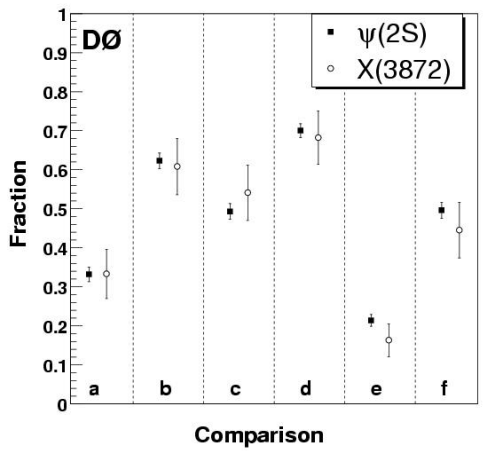

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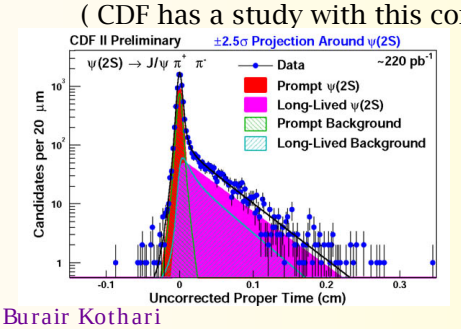

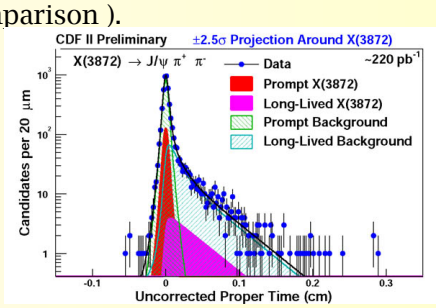

Further comments and conclusions

- No significant differences in the variables we considered between the X and the psi prime
- In the last sentence we imply our data leans towards an interpretation in terms of a ccbar or charmonium hybrid.
- Our range in muon eta is larger than CDF -- but our signal is smaller.

Newsflashes: more charmonium like states

- A few days ago (from BaBar):

Observation of a Broad Structure in the $\pi^+\pi^- J/\psi$ Mass Spectrum around 4.26 GeV/c^2

- ...and this morning (from Belle):

Observation of a new charmonium state in double charmonium production in e^+e^- annihilation at $\sqrt{s} \approx 10.6$ GeV

Abstract

We report the first observation of a new charmonium state at a mass of $(3.943 \pm 0.006 \pm 0.006)\,\mathrm{GeV}/c^2$. This state, called $X(3940)$, is observed in the process $e^+e^- \to J/\psi X(3940)$ in the spectrum of masses recoiling against a reconstructed J/ψ. We also observe the decay of the $X(3940)$ into $D^*\overline{D}$ and measure the intrinsic width of this state to be less than $52\,\mathrm{MeV}/c^2$ at the 90% C.L. These results are obtained from a $350\,\mathrm{fb}^{-1}$ data sample collected with the Belle detector near the $\Upsilon(4S)$ resonance, at the KEKB asymmetric energy e^+e^- collider.

More on interpretation

- Phenomenological prperties of the X (mainly from hep-ex/0407033):
  a) Decays observed to jpsi pi pi and jpsi + three pions (hep-ex/0408116)
  b) Very close to DD* mass threshold
  c) Narrow
  d) DDbar decays not seen - although kinematically favored for a charmonium state (hep-ex/0307061)
  e) Dipion mass spectrum favors higher masses near the rho(770). To test whether the dipions come from the rho need to look at the two neutral pions + Jpsi mode.
- Most charmonia states (from phenomenology) dont fit.
- Needs a full angular analysis of the two pions + Jpsi state to detrmine quantum numbers and test the "molecular" hypothesis.