# Charmonium suppression in p-A collisions

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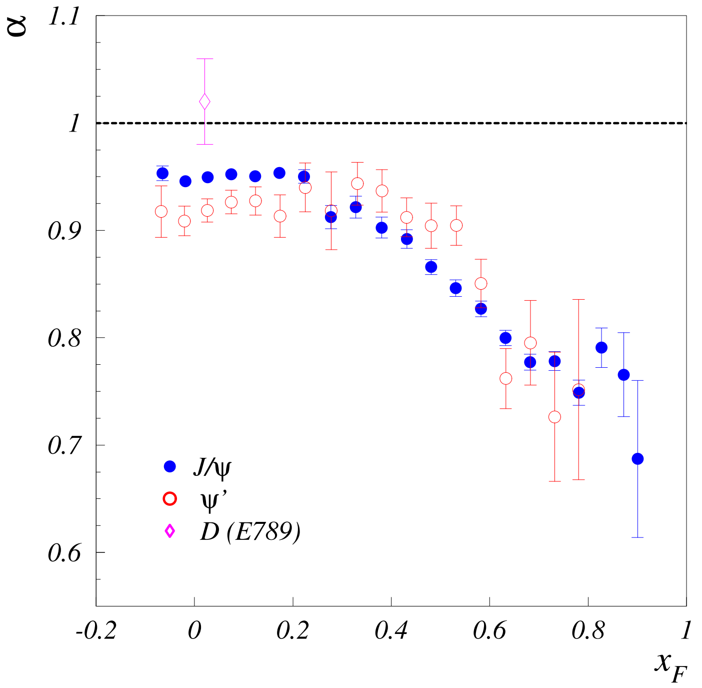
(based on hep-ph/9907286)

# E866/NuSea Data

*nuclear dependence*
*of the suppression*

$$\sigma_A = \sigma_p A^{\alpha}$$




Many interesting features :

- Strong suppression for large $x_F$
  and identical for Psi and Psi'
- Weak absorption around midrapidity
- Psi' more suppressed at low $x_F$

# Model for charmonia absorption

## 2 stage scenario :

- $c\bar{c}$ pairs are created in a color octet state

  - Strong absorption in the medium
  - $c\bar{c}_8 N$ cross section independent of its radius

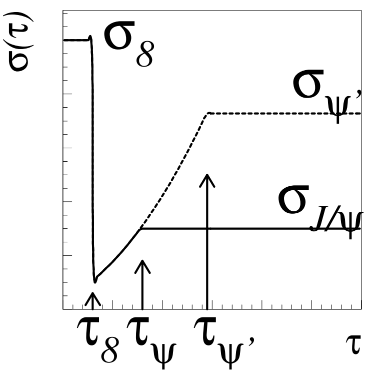
*Emission of a gluon to neutralize its color after a proper time* $\tau_{8\to1}$

- The pairs are in a $c\bar{c}_1$ state

  - spatial evolution given by

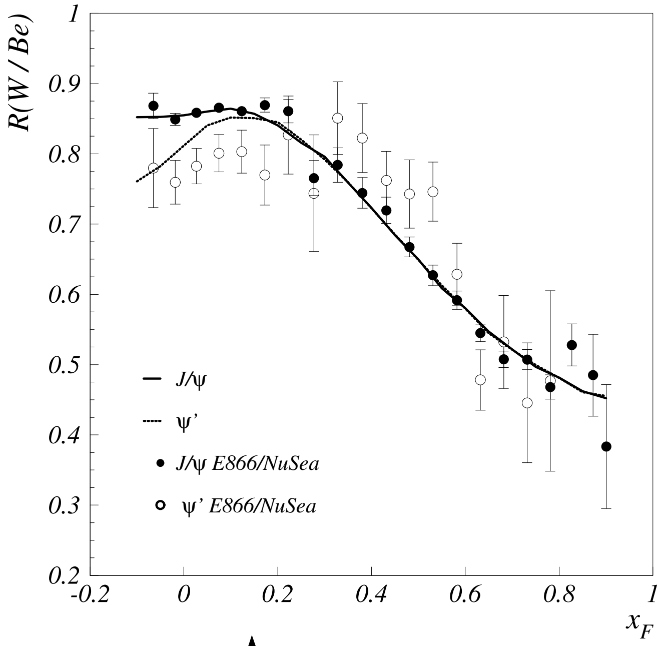
$$r = r_o + v_{c\bar{c}}\,\tau \quad \text{if} \quad r < r_i$$

  - unified treatment for $J/\psi, \chi$ and $\psi'$ , difference comes from the hadronic radius $r_i$
  - $c\bar{c}_1 N$ cross section $\propto r^2$



# Results of the fit

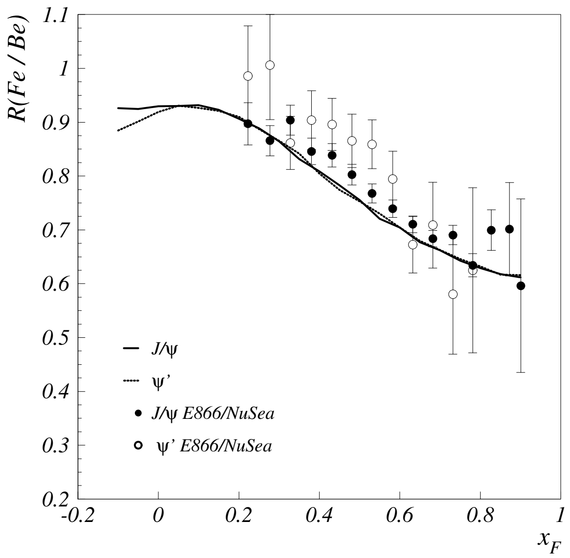
Fit to the E866 data :
J/Psi and Psi' production
in W relative to Be




$\tau_{8\to 1} < 0.1$ fm

The fit gives the following values :

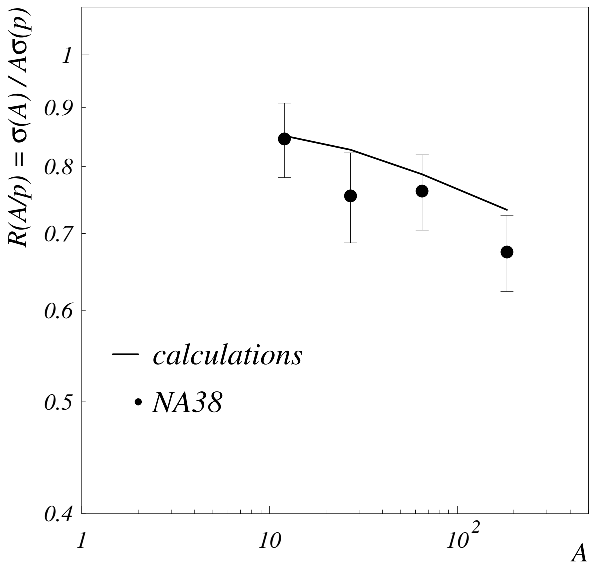
- $r_0 \approx 0.15$ fm, $\nu_{c\bar{c}} \approx 1.85$, $\sigma_{c\bar{c}_1 N} \approx 2.1$ mb
- $\tau_{8\to 1} \approx 0.02$ fm, $\sigma_{c\bar{c}_8 N} \approx 22$ mb




Calculation of J/Psi and Psi' production in Fe relative to Be

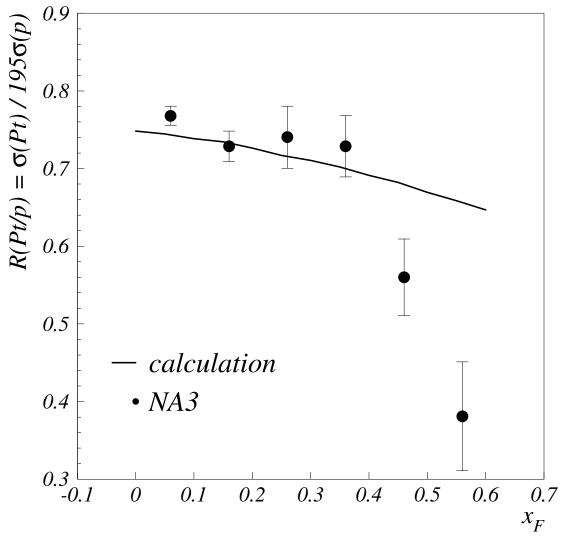
# Comparison with SPS data

**NA38 :** different targets at 450 GeV at midrapidity




$\Rightarrow$ nice agreement with data

**NA3 :** p (200 GeV) + Pt, for $0 < x_F < 0.6$




$\Rightarrow$ correct description at low $x_F$

$\Rightarrow$ overestimate for the highest $x_F$

# Conclusions

- Development of a simple model to parametrize J/Psi suppression in p-A reactions assuming nuclear absorption **only**

- Fitting the 5 parameters allows the description of Fermilab data (E866) and partially SPS data (NA3, NA38) as well as photoproduction.

**BUT :** Octet lifetime much too short to be physically understandable

**Other mechanisms like :**

- comoving partons
- shadowing & energy loss

are neglected but do not yield strong suppression at large $x_F$ (see R. Vogt)

# Present situation and outlook

**E866/NuSea :**

- *Drell-Yan :* data compatible with zero energy loss, shadowing only should be responsible

- *Charmonium :* octet production puzzles

Open charm can verify if :

- *Intrinsic charm* is the reason for suppression at large $x_F$, leading to an equal suppression of open- and closed- charm mesons

- *J/Psi - h interactions* plays an important role Difference between closed and open charm mesons