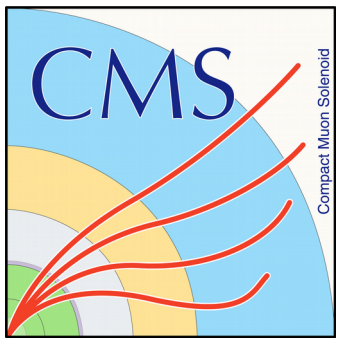
J/ψ measurements in CMS

Mihee Jo

Laboratoire Leprince-Ringuet, École Polytechnique, Palaiseau

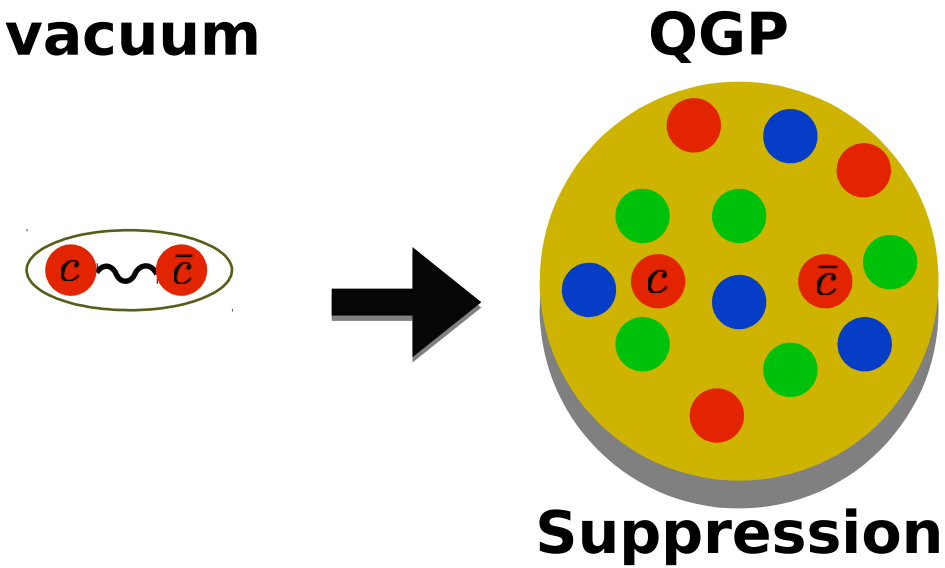
11 May 2017



Introduction

$$\tau^{c\bar{c}}_{\text{formation}} \lesssim \tau^{QGP}_{\text{formation}} < \tau^{QGP}_{\text{life}} < \tau^{\text{quarkonium}}_{\text{decay}}$$

- Quark-gluon plasma (QGP) is (or isn't) created by PbPb collisions
- Quarkonia are expected to experience the whole QGP evolution
  - Debye screening, regeneration



Quarkonia measured in pp, PbPb collisions

- R_{AA}
  - Nuclear modification factor
  - Measurement of an absolute suppression with respect to reference system

- Double ratio
  - Measurement of relative modification of the excited states (nS) to the ground state (1S)
  - Cancels initial state effects (shadowing)

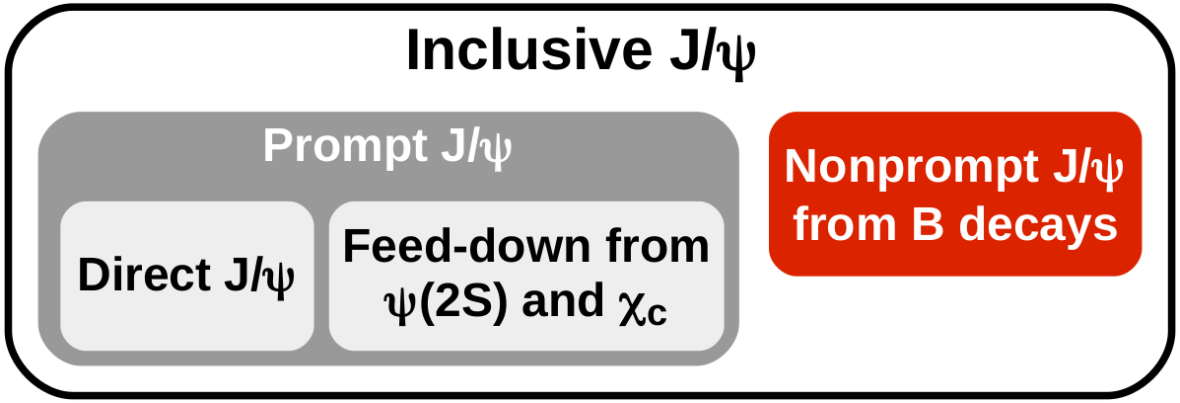
$$\frac{\left[\frac{\psi(2S)}{J/\psi}\right]_{PbPb}}{\left[\frac{\psi(2S)}{J/\psi}\right]_{pp}} = \frac{R_{AA}(\psi(2S))}{R_{AA}(J/\psi)}$$

Outline

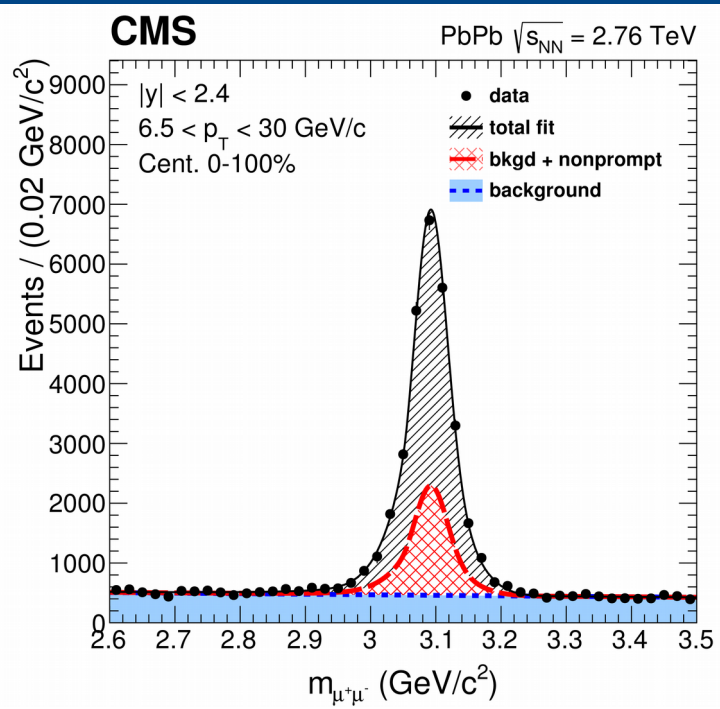
- Nuclear modification factor of prompt and nonprompt J/ψ at PbPb at 2.76 TeV
  - Eur.Phys.J. C77 (2017) no.4, 252

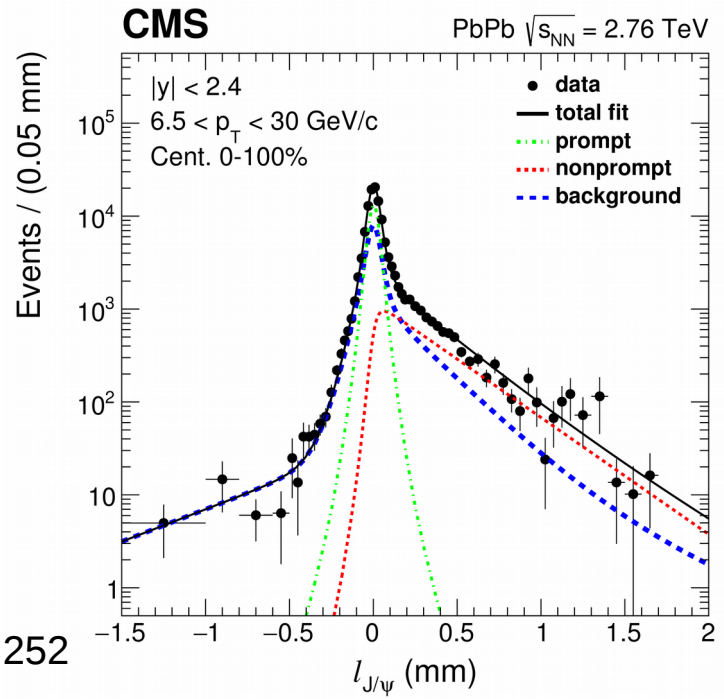
- Relative modification of prompt J/ψ and ψ(2S) from pp to PbPb at 5 TeV
  - Phys.Rev.Lett. 118 (2017) 162301

Prompt & nonprompt charmonia



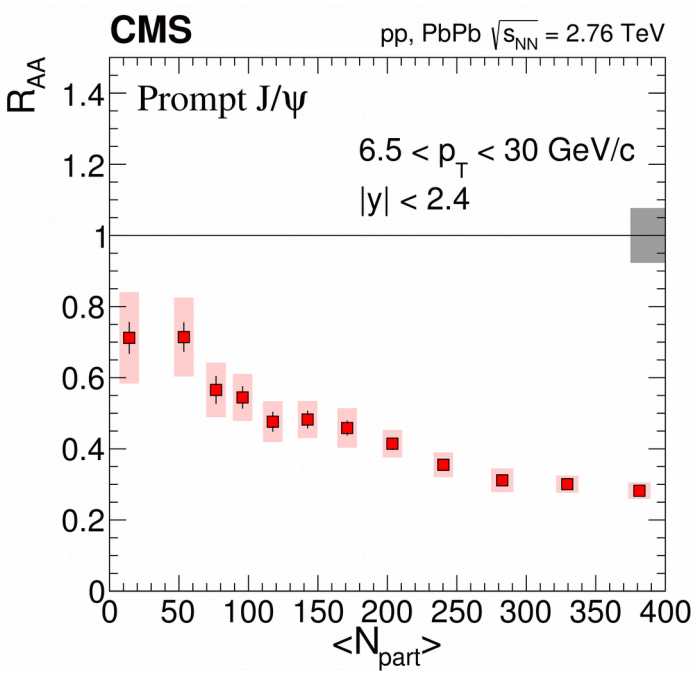
- **Prompt charmonia**
  - Debye screening, regeneration
- **Nonprompt charmonia**
  - b quark energy loss due to elastic collisions, gluon radiation

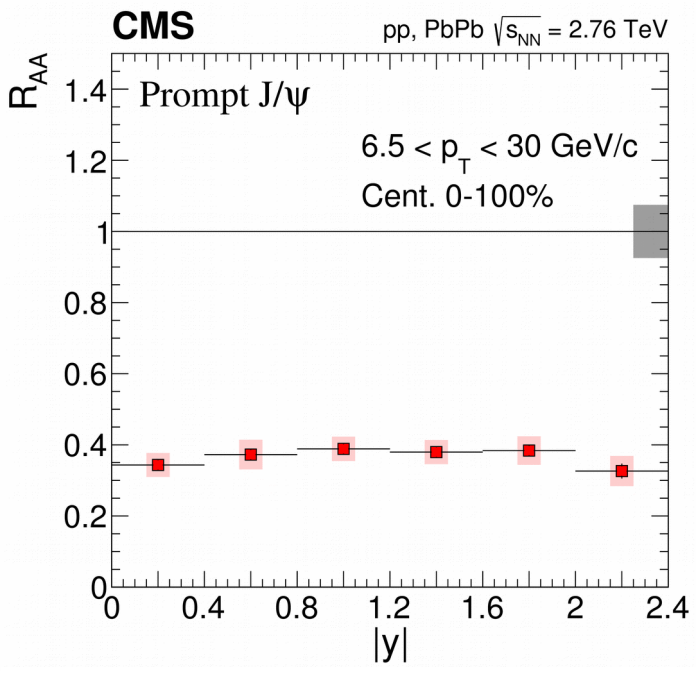


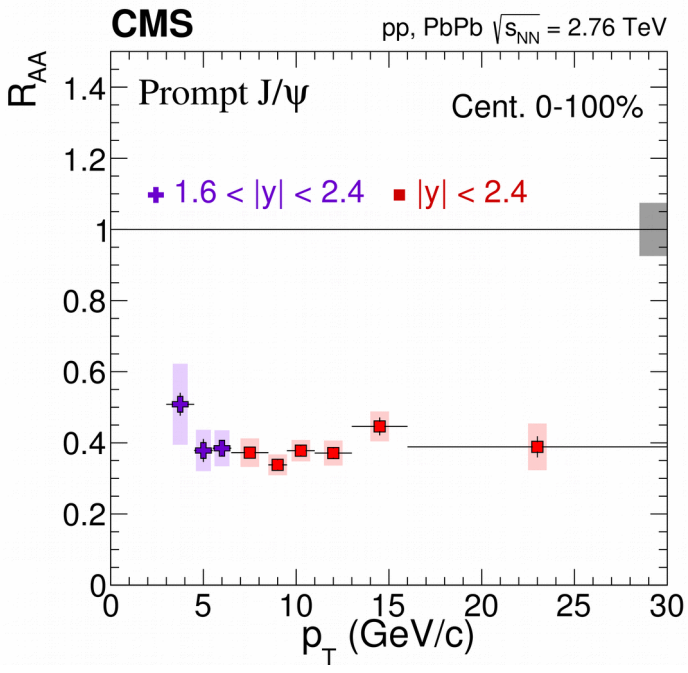


Eur.Phys.J. C77 (2017) no.4, 252

Prompt J/ψ R_{AA} @ 2.76 TeV



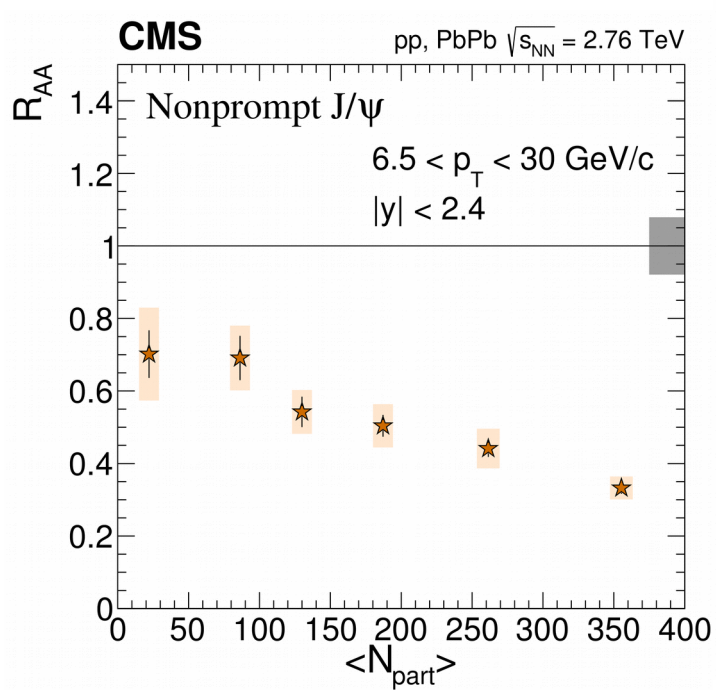


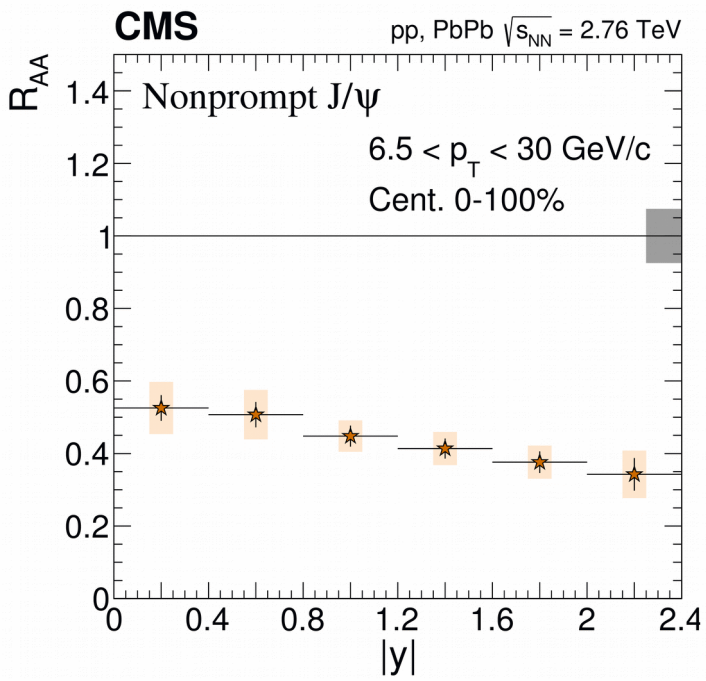


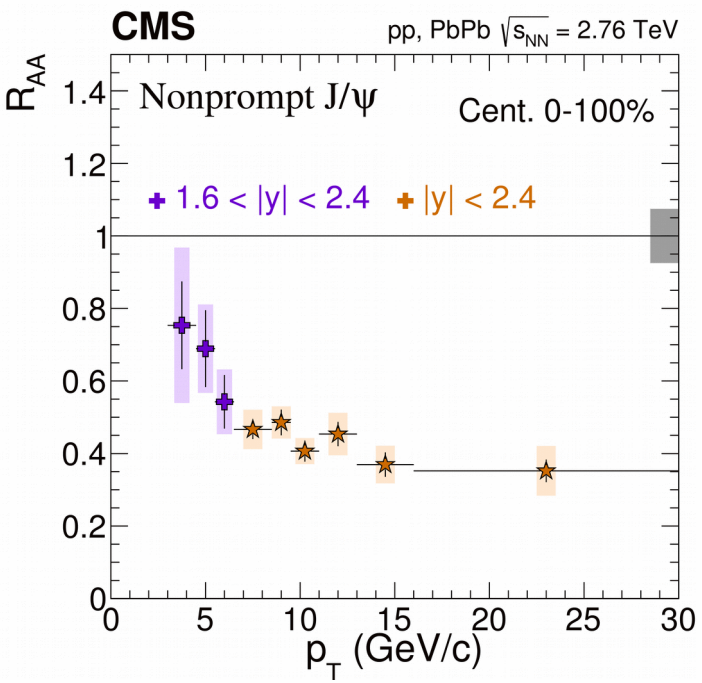
- More suppressed in head-on collisions
- Suppression patterns over |y|, p_T are flat

Eur.Phys.J. C77 (2017) no.4, 252

Nonprompt J/ψ R_{AA} @ 2.76 TeV



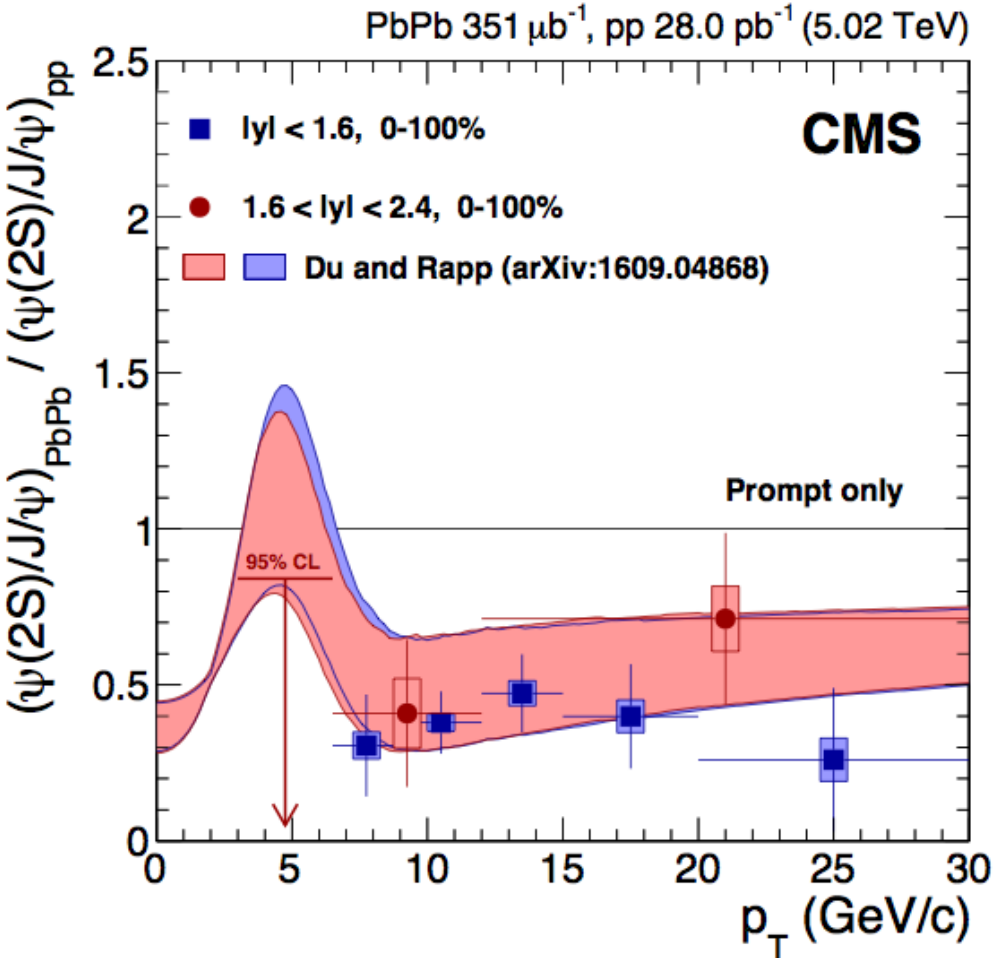




- More suppressed in head-on collisions
- More suppressed at forward rapidity region
- More suppressed at higher p_T region

Eur.Phys.J. C77 (2017) no.4, 252

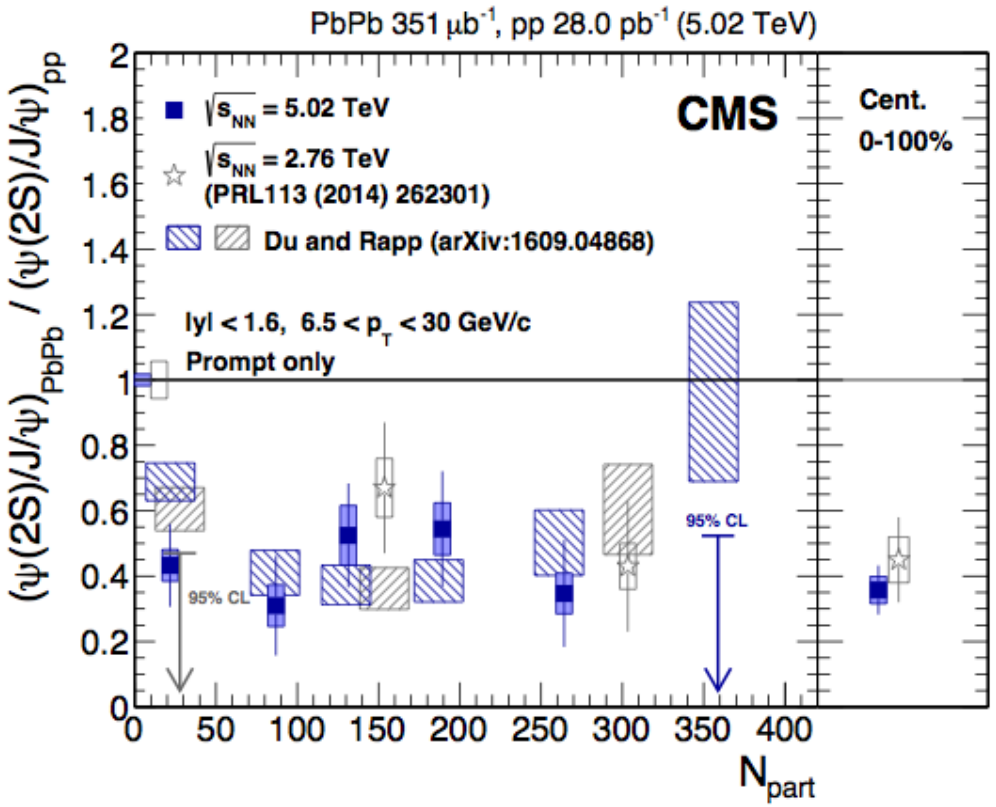
ψ(2S) / J/ψ vs. p_T @ 5 TeV

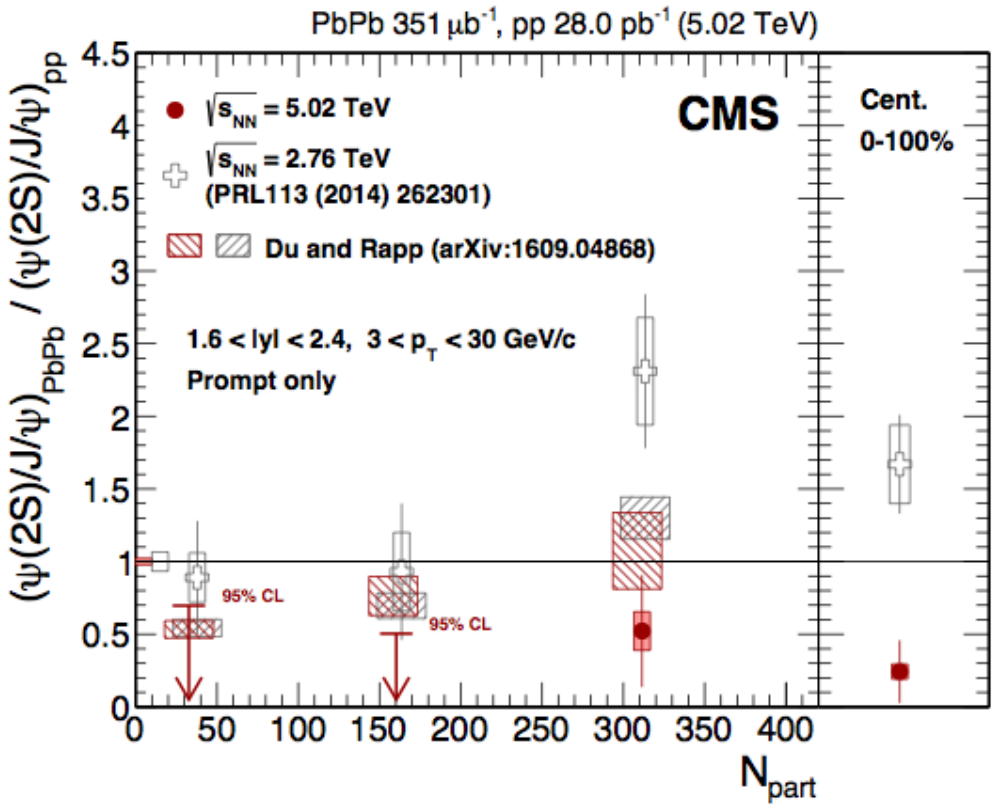


- $R_{AA}(\psi(2S))/R_{AA}(J/\psi) < 1$ in all bins → ψ(2S) is more suppressed than J/ψ
- No p_T dependence within uncertainties

Phys.Rev.Lett. 118 (2017) 162301

ψ(2S) / J/ψ vs. centrality @ 5 TeV

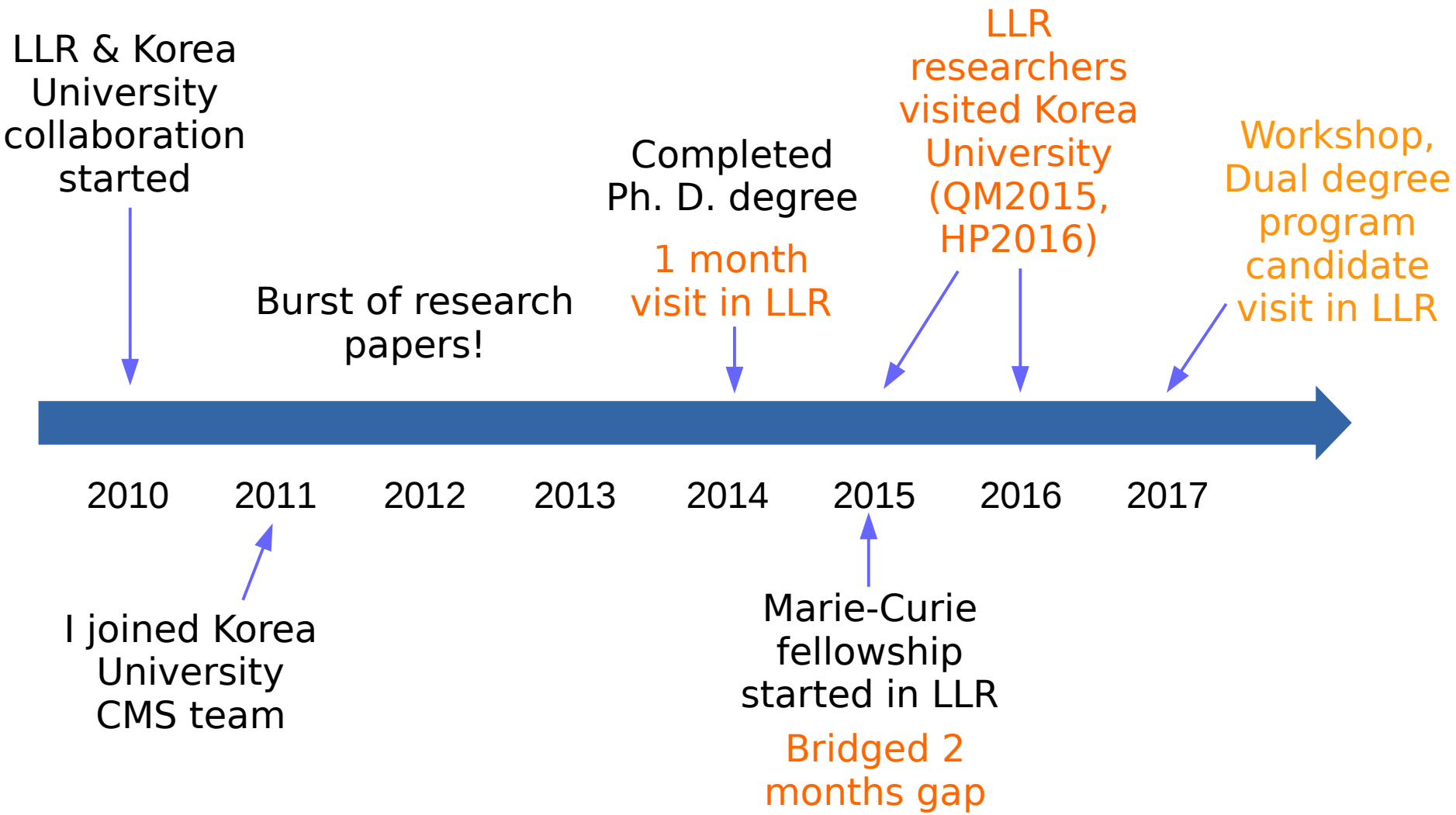




- CMS results vs centrality, p_T and rapidity can help to constrain the model:
  - Relative contribution of primordial and regenerated charmonia
  - Dissociation and regeneration rates
  - Temperatures at which J/ψ and ψ(2S) regenerate

Phys.Rev.Lett. 118 (2017) 162301

Little bit of memories



- Lots of interesting research papers, accomplishments and fun
- FKPPL fund has been very useful to continue and strengthen the collaboration

Summary

- Prompt and nonprompt J/ψ at 2.76 TeV are suppressed
- Prompt ψ(2S) at 5 TeV is suppressed over all measured region
  - A hint of different final state effects for the excited state to the ground state
- More comprehensive study with R_{AA} measurements at 5 TeV
- Thank you for all the supports from FKPPL!