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## Study of multiplicity-dependent charmonia production in $p+p$ collisions at PHENIX

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The production of quarkonia in high-energy heavy-ion collisions has been studied extensively to understand their production mechanisms and properties of Quark-Gluon Plasma (QGP). PHENIX has the capability to measure  $J/\psi$  with muon arms at forward and backward rapidity ( $1.2 < |y| < 2.2$ ) and charged particle multiplicity with silicon trackers at various acceptance ranges. The recent PHENIX study shows an increasing trend of  $J/\psi$  yields versus multiplicity in  $p+p$  collisions, which implies that the multi-parton interactions contribute to the  $J/\psi$  production at the RHIC energy.  $\psi(2S)$  have the same quark contents as  $J/\psi$  but different binding energies, so  $J/\psi$  and  $\psi(2S)$  are expected to be modified differently due to the final-state effect like interaction with nuclear mediums or co-moving particles. Such different modifications can be applied to  $A+A$  collisions, even in small systems like  $p+A$  collisions; thus, understanding the modification mechanism is crucial for the precise understanding of the whole production mechanism. It will be very interesting to extend the study of the relative production of two states in various multiplicity ranges of  $p+p$  collisions. In this talk, we will present the study of multiplicity-dependent production of charmonia in  $p+p$  collisions with PHENIX, along with comparisons to the results from other experiments and MC based on PYTHIA8.

### Experiment/Theory

PHENIX

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