

1 Physics opportunities with exclusive J/ψ at ECCE

2 Xinbai Li for ECCE Collaboration (University of Science and Technology of China)

3 **Abstract**

4 Among the heavy quarkonia production processes at the future Electron-Ion Collider
5 (EIC), the exclusive photoproduction with large cross section and simple final state is
6 expected to play a key role. In the reaction, an incident virtual photon fluctuates into
7 quark-antiquark pair, which then scatters off the target elastically, emerging as a real
8 quarkonium. The scattering process occurs via the exchange of a color neutral object,
9 pomeron, which can be viewed as two gluons with self interaction (gluon ladder) in the
10 language of QCD. Due to the gluonic nature of pomeron, the exclusive heavy quarkonia
11 photoproduction at EIC can be related to the gluon distribution of proton and nucleus
12 using perturbative QCD. Furthermore, the distribution of momentum transfer from the
13 target in the process is sensitive to the interaction sites, which provides a powerful tool to
14 probe the spatial distribution of gluon in nucleus. Recently, there has been great interests
15 among the nucleon structure community in determining the anomaly contribution M_a
16 as a key to understand the origin of the proton mass. The trace anomaly is sensitive to
17 the gluon condensate and exclusive production of quarkonia such as J/ψ and Υ is an
18 excellent laboratory to extract the anomaly contribution M_a , in which the sensitivity can
19 be maximized for the production near threshold.

20 In this poster, we will cover the J/ψ detection at the proposed EIC detector, ECCE,
21 using full detector simulation. And we will present the capability of exclusive process of
22 J/ψ photoproduction detection to probe the gluon nPDF and spatial distribution, the near
23 threshold production mechanism and trace anomaly of proton mass decomposition with
24 the ECCE detector setup.