

Inclusive quarkonium photoproduction

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We explore the possibility to use ultra-peripheral proton-lead collisions at the LHC to study inclusive J/ψ photoproduction, namely when a quasi-real photon emitted by the fully stripped lead ion breaks a proton to produce the J/ψ . Owing to the extremely large energies of the colliding hadrons circulating in the LHC, the range of accessible $W_{\gamma p}$ largely exceed what has been and will be studied at lepton-hadron colliders like HERA and the EIC. We obtain a leading-order inclusive-photoproduction cross section of order $50 \mu\text{b}$, which we find large enough to be measured by CMS and LHCb. In addition, we find that inclusive-photoproduction can be isolated from possible hadroproduction processes by imposing the absence of significant activity in the lead-going direction, and may be further isolated by imposing rapidity-gap based cuts on detector activity. We estimate the background-to-signal ratio to be of order 0.001 and 0.01 at CMS and LHCb, respectively. In addition, we propose a method similar to the Jacquet-Blondel Method to reconstruct $W_{\gamma p}$ and the elasticity (z). Reconstructing these variables will allow kinematic regions to be defined that minimise theoretical uncertainty. We find that z can be reconstructed with a resolution of 0.1, 0.15, and 0.2 in LHCb $\text{Pb}p$, CMS, and LHCb $p\text{Pb}$, respectively, where $\text{Pb}p$ and $p\text{Pb}$ imply opposite beam directions.

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