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Inclusive quarkonium photoproduction at the LHC

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We demonstrate that hadron-hadron collisions at the LHC can be used to extract inclusive photoproduction cross sections. We focus on quarkonium cross sections in proton-lead collisions. We illustrate this by constructing a Monte Carlo for both the signal and background and show that, despite the background having a significantly larger cross section, the signal can be experimentally disentangled by characterising the hadronic activity in the (i) central, (ii) forward, and (iii) far-forward detectors. We find that the resulting cross sections are large enough to be measured at all four of the main LHC experiments. We estimate the background-to-signal ratio after isolation to be of the order of 0.001 and 0.1 in the low and large transverse-momentum regions, respectively. The range of accessible photon-nucleon centre-of-mass energies, $W_{\gamma p}$, at the LHC largely exceeds what has and will be studied at lepton-hadron colliders, HERA and the EIC. As a result, the available kinematics in inclusive photoproduction measurements are broader: the J/ψ P_T spectrum can be extended from 10 GeV (HERA data) to 20 GeV. In addition, we propose and assess the Jacquet-Blondel method to reconstruct the photon-nucleon centre-of-mass energy and the fractional energy of the quarkonium with respect to the photon.

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