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Inclusive diffraction at LHeC/FCC-eh/EIC

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We analyze the possibilities for the study of inclusive diffraction offered by future electron-proton/nucleus colliders in the tera-electron-volt regime, the Large Hadron-electron Collider (LHeC) as an upgrade of the HL-LHC, and the Future Circular Collider in electron-hadron mode. Compared to ep collisions at HERA, we find an extension of the available kinematic range in x by a factor of order 20 and of the maximum Q2 by a factor of order 100 for LHeC, while the Future Circular Collider (FCC) version would extend the coverage by a further order of magnitude both in x and Q2. This translates into a range of the available momentum fraction of the diffractive exchange with respect to the hadron (ξ), down to 10-4–10-5 for a wide range of the momentum fraction of the parton with respect to the diffractive exchange (β). Using the same framework and methodology employed in previous studies at HERA, considering only the experimental uncertainties and not those stemming from the functional form of the initial conditions or other ones of theoretical origin, and under very conservative assumptions for the luminosities and systematic errors, we find an improvement in the extraction of diffractive parton densities from fits to reduced cross sections for inclusive coherent diffraction in ep by about an order of magnitude. For eA, we also perform the simulations for the Electron Ion Collider. We find that an extraction of the currently unmeasured nuclear diffractive parton densities is possible with accuracy similar to that in ep.

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