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The LHCspin project: a polarized target experiment at LHC

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A polarized gaseous target, operated in combination with the high-energy, high-intensity LHC beams and a highly performing LHC particle detector, has the potential to open new physics frontiers and to deepen our understanding of the intricacies of the strong interaction in the non-perturbative regime of QCD. Specifically, the LHCspin project aims to perform spin physics studies in high-energy polarized fixed-target collisions using the LHCb detector. Given its forward geometry (2<□<5), the LHCb spectrometer is, in fact, perfectly suitable to cover the forward kinematics of these collisions. Furthermore, being designed and optimized for the detection of heavy hadrons, it will allow to probe the nucleon's structure through, e.g., the inclusive production of c- an b-hadrons, and ideal tool to access the essentially unexplored spin-dependent gluon TMDs. This configuration, with center-of-mass energies ranging from 115 GeV in pp interactions to 72 GeV per nucleon in collisions with ion beams, will allow to explore the nucleon's internal dynamics at unique kinematic conditions by covering a wide backward rapidity region, including the poorly explored high x-Bjorken and high x-Feynman regimes. This ambitious task poses its basis on the recent installation and commissioning of SMOG2, a storage-cell based unpolarized gas target in front of the LHCb spectrometer. With the installation of the proposed polarized target system, LHCb will become the first experiment delivering simultaneously unpolarized beam-beam collisions at 14 TeV and both polarized and unpolarized beam-target collisions at center-of-mass energies of the order of 100 GeV. The status of the LHCspin project is presented along with a selection of physics opportunities.

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