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Beam-beam collision in the high-disruption regime¹ WENLONG ZHANG, THOMAS GRISMAYER, FABRIZIO GAUDIO, RICARDO FONSECA, LUIS SILVA, GoLP/Instituto de Plasmas e Fusão Nuclear, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal — The collision of high energy particle beams presents a platform where quantum electrodynamics (QED) theory can be accurately tested. Bright γ rays and nonlinear Breit-Wheeler pair production can also be copiously produced in these collisions. However, disruption effects may arise, including the focus/deflection of beam particles by the strong self-consistent collective field. These disruption effects significantly change the key parameters at the interaction point, in particular for long and dense beams. Here, we present a numerical study on the beam-beam collisions in high-disruption regime using the particle-in-cell (PIC) simulation (OSIRIS), exploring how photon emission and pair production differ from the low disruption limit. The beam energy loss and the increased luminosity due to the disruption effects are also considered. The trade-off between the luminosity enhancement and the beam depletion is analysed in the context of upcoming particle colliders.

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Wenlong Zhang
Universidade de Lisboa

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