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Beam-Beam effects

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Particle colliders are one of the main drivers for discoveries in particle physics. Their performance is usually limited by the strong electromagnetic interactions of the two beams, so-called beam-beam interactions. Due to its non-linear and dynamical nature, this force introduces severe limitations by generating collective instabilities or distorting the single particle trajectories leading to a reduction of the beam lifetime and/or a growth of the emittances. In this lecture, we illustrate the mechanisms through which these degradations of the beam quality occur as well as basic models to describe them. We thus obtain an understanding of the fundamental properties of modern colliders.

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