

# XXX-th International Workshop on High Energy Physics “Particle and Astroparticle Physics, Gravitation and Cosmology: Predictions, Observations and New Projects”



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## The interaction region of high energy protons

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New experimental data about proton-proton collisions obtained at the LHC allow to widen drastically the energy interval where one gets some knowledge about the structure of their interaction region.

It is shown how the shape and the darkness of the interaction region of colliding protons change with increase of their energies. In particular, the collisions become fully absorptive at small impact parameters at LHC energies that results in some special features of inelastic processes. Possible evolution of the shape from the dark core to the fully transparent one is discussed that implies the terminology of the black disk would be replaced by the black torus.

The parameter which determines the opacity of central collisions plays a crucial role in the behavior of the differential cross section of elastic scattering outside the diffraction cone where the predictions of all phenomenological models failed at LHC energies. The role of the ratio of real to imaginary part of the elastic scattering amplitude at non-forward scattering becomes decisive there. It allows to estimate this ratio for the first time by comparison with experiment at LHC energies which happens to be drastically different from its values measured at low transferred momenta. Moreover, the behaviours of the real and imaginary parts separately differ in the models and in the approach based on the unitarity condition. This problem is still waiting for its resolution.

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