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Evolution equation for elastic scattering of hadrons

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We turn high energy elastic scattering of hadrons into an initial value problem using an evolution equation based on the Regge Field Theory, which has a form of the complex nonlinear reaction-diffusion equation, with time being played by the logarithm of energy. The initial conditions are provided by the data-driven models for the real and imaginary parts of the amplitude. Numerical calculations of pp differential cross sections and forward quantities for LHC energies agree very well with experimental data extending up to, and including the diffractive cone. Furthermore, we show that at current accessible energies the non-linear effects play an important role, as the impact parameter space profiles approach the unitarity bound. The equation also predicts some other effects discussed in the literature, like the hollowness of nuclear matter or existence of stationary points in momentum transfer t.

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