Exclusive scalar meson production: from high to intermediate energies

Antoni Szczurek

Institute of Nuclear Physics, Polish Academy of Sciences Krakow, Poland

We calculate several differential distributions for exclusive double diffractive heavy scalar charmonium $\chi_c(0^{++})$ production in proton-antiproton collisions at the Tevatron and in proton-proton collisions at the LHC in terms of unintegrated gluon distributions (UGDFs) within the k_t-factorisation approach. We estimate also the contribution of $\gamma^*\gamma^* \to \chi_c(0^{++})$ fusion. The $g^*g^* \to \chi_c(0^{++})$ transition vertex is calculated as a function of gluon virtualities for normal and reggeised gluons applying the standard pNRQCD technique. Different models of UGDFs are used and the results are shown and discussed. The cross section for diffractive component depends strongly on UGDFs. The integrated cross section for photon-photon fusion is calculated. The two components have very different dependence on momentum transfers t_1, t_2.

We evaluate differential distributions for exclusive scalar $f_0(1500)$ production for $p\bar{p} \to N_1 N_2 f_0$ (FAIR@GSI) and $pp \to pp f_0$ (J-PARC@Tokai). Both QCD diffractive and pion-pion meson exchange current (MEC) components are included. Rather large cross sections are predicted. The pion-pion component, never discussed in the literature, dominates close to the threshold while the diffractive component takes over for larger energies. The diffractive component is calculated based on two-gluon impact factors as well as in the framework of Khoze-Martin-Ryskin approach proposed for diffractive Higgs boson production. Different unintegrated gluon distribution functions (UGDFs) from the literature are used. The production of $f_0(1500)$ close to threshold could limit the so-called πNN form factor in the region of larger pion virtualities.

E-mail: antoni.szczurek@ifj.edu.pl