

Central exclusive diffractive production of axial-vector $f_1(1285)$ and $f_1(1420)$ mesons in proton-proton collisions at the LHC

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We present a new study of the central exclusive diffractive production of $f_1(1285)$ and $f_1(1420)$ resonances in proton-proton collisions within the tensor-pomeron approach [1], [2]. Two pomeron-pomeron- f_1 (l, S) tensorial couplings are possible a priori: $(l, S) = (2, 2)$ and $(4, 4)$. We adjust the parameters of our model to the WA102 experimental data [3] and compare with predictions of the Sakai-Sugimoto model, where the pomeron-pomeron- f_1 couplings are determined by the mixed axial-gravitational anomaly of QCD [4]. Then we present our predictions for the energies available at the LHC. The total cross section and several differential distributions are presented. We find for the $f_1(1285)$ a total cross section of about $35 \mu\text{b}$ for $\sqrt{s} = 13 \text{ TeV}$ and a rapidity cut on the f_1 meson of $|y| < 2.5$. Absorption corrections are included for our final distributions. Our results may be used to investigate the $pp \rightarrow pp\pi^+\pi^-\pi^+\pi^-$ reaction at LHC energies; see [5] for other diffractive mechanisms. The four-pion final state is also interesting in searches for glueballs. We predict a much larger cross section for production of $f_1(1285)$ than for production of $f_2(1270)$ (calculated within the same approach [6]) in the $\pi^+\pi^-\pi^+\pi^-$ decay channel for the LHC energies. This opens a possibility to study the $f_1(1285)$ meson in experiments planned at the LHC. We present several predictions for the ATLAS, CMS, ALICE, and LHCb experiments. Some effort to measure central exclusive four pion production at the energy $\sqrt{s} = 13 \text{ TeV}$ was initiated already by the ATLAS Collaboration [7].

- [1] C. Ewerz, M. Maniatis, O. Nachtmann, *Annals Phys.* 342 (2014) 31.
- [2] P. Lebiedowicz, O. Nachtmann, A. Szczurek, *Annals Phys.* 344 (2014) 301.
- [3] D. Barberis *et al.* (WA102 Collaboration), *Phys. Lett. B*440 (1998) 225; A. Kirk, *Phys. Lett. B*489 (2000) 29.
- [4] T. Sakai and S. Sugimoto, *Prog. Theor. Phys.* 113 (2005) 843; N. Anderson, S. K. Domokos, J. A. Harvey, N. Mann, *Phys. Rev. D* 90 (2014) 086010.
- [5] P. Lebiedowicz, O. Nachtmann, A. Szczurek, *Phys. Rev. D*94 (2016) 034017.
- [6] P. Lebiedowicz, O. Nachtmann, A. Szczurek, to appear in *Phys. Rev. D*
- [7] E. Bols, <http://cds.cern.ch/record/2288372/files/CERN-THESIS-2017-175.pdf>

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Secondary track (number)

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