In this article the authors study four-point *three-loop* scattering amplitudes in gauge theories at a certain high-energy limit. The high-energy limit is known as the Regge limit where one can drastically simplify the four-dimensional scattering amplitudes; the loop amplitudes can essentially be described in terms of integrals over a two-dimensional momentum space. For the basics of the Regge limit, see, *e.g.*, [1, 2]. Applying calculatory methods developed in [2], the authors compute three-loop corrections of the four-point amplitudes which are generated by a mixing effect among the involved gluons at the high-energy limit.

To follow details of the computation the reader needs to be familiar with computational techniques in perturbative QCD such as the Balitsky-Fadin-Kuraev-Lipatov (BFKL) equation and its non-linear generalization known as the Balitsky-JIMWLK equation; for the references on these techniques see [2]. The results are in agreement with a recent report on the infrared structure of the three-loop corrections [3] and also with a recent computation of non-planar four-point amplitudes at three-loops in $\mathcal{N} = 4$ super Yang-Mills theory [4]. For updates along the lines of these developments, see also [5].

References

[1] V. Schatz, "High-energy scattering in the Regge limit," hep-ph/0307326.

[2] S. Caron-Huot, "When does the gluon reggeize?," JHEP **1505**, 093 (2015) doi:10.1007/JHEP05(2015)093 [arXiv:1309.6521 [hep-th]].

[3] . Almelid, C. Duhr and E. Gardi, "Three-loop corrections to the soft anomalous dimension in multileg scattering," Phys. Rev. Lett. **117**, no. 17, 172002 (2016) doi:10.1103/PhysRevLett.117.172002 [arXiv:1507.00047 [hep-ph]].

[4] J. M. Henn and B. Mistlberger, "Four-Gluon Scattering at Three Loops, Infrared Structure, and the Regge Limit," Phys. Rev. Lett. **117**, no. 17, 171601 (2016) doi:10.1103/PhysRevLett.117.171601 [arXiv:1608.00850 [hep-th]].

[5] S. Caron-Huot, E. Gardi, J. Reichel and L. Vernazza, "Infrared singularities of QCD scattering amplitudes in the Regge limit to all orders," arXiv:1711.04850 [hep-ph].