

This article is based on a PhD thesis by the author about recent developments (up to May 2008) on the relations between scattering amplitudes and Wilson loops in $\mathcal{N} = 4$ super Yang-Mills theory. More precisely, a duality between maximally-helicity-violating (MHV) planar amplitudes of n gluons and light-like Wilson loops along polygons with n cusps in $\mathcal{N} = 4$ super Yang-Mills theory, is studied in a reviewing fashion. Of particular interest is the *two-loop* calculations of the Wilson loops for $n = 4$ and 5, reported in [1] and [2], respectively. These results provide strong evidence for the duality between the planar MHV amplitudes and the Wilson loops which is first conjectured in [3]. Furthermore, it is shown that the both sides of the duality has a novel symmetry, now known as the dual superconformal symmetry. The author is one of the discoverers of this symmetry in the context of the duality so that the description of the symmetry part (in section 8) will be useful for interested readers. The article also contains a numerical two-loop evaluation of the duality for $n = 6$. The reader will also benefit from the overall description on a historical background of the recent developments together with a list of references.

References

- [1] J. M. Drummond, J. Henn, G. P. Korchemsky and E. Sokatchev, Nucl. Phys. B **795**, 52 (2008) [arXiv:0709.2368 [hep-th]].
- [2] J. M. Drummond, J. Henn, G. P. Korchemsky and E. Sokatchev, Nucl. Phys. B **826**, 337 (2010) [arXiv:0712.1223 [hep-th]].
- [3] J. M. Drummond, G. P. Korchemsky and E. Sokatchev, Nucl. Phys. B **795**, 385 (2008) [arXiv:0707.0243 [hep-th]].