In this paper the author studies geometric features of the so-called amplituhedron [1] which is defined in terms of the positive Grassmannian $G_+(k,n)$. The amplituhedron $\mathcal{A}_{n,k}^{(m)}$ is defined as an image of the map $G_+(k,n) \to G_+(k,k+m)$, and can be represented by a $(k+m)\times n$ matrix.

It is known that the $m=1$ amplituhedron $\mathcal{A}_{n,k}^{(1)}$ is homeomorphic to a k-dimensional ball [2]. In this paper the author consider the particular case of $m=2$ by classifying all boundaries of $\mathcal{A}_{n,k}^{(2)}$ and studying topological and combinatoric properties of $\mathcal{A}_{n,k}^{(2)}$ for any n and k. The author concludes that the results indicate that $\mathcal{A}_{n,k}^{(2)}$ is homeomorphic to a $2k$-dimensional closed ball as well.

The amplituhedron is developed and advocated in the computation of scattering amplitudes in gauge theories [3]. In connection to physics, the $m=4$ amplituhedron $\mathcal{A}_{n,k}^{(4)}$ is of direct relevance to tree-level scattering amplitudes in planar $\mathcal{N}=4$ super Yang-Mills theory. The results in this paper would be useful for further understanding of the amplituhedron $\mathcal{A}_{n,k}^{(4)}$ and $\mathcal{N}=4$ super Yang-Mills theory.

References

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