

#### Introduction and background

Airy beam is known as curved light beam. Airy beam not only inherits the non diffractive and self healing properties of general non diffractive beams, but also has its own propagation law of self bending, that is, the main peak of its beam will shift in the form of quadratic curve when it propagates in free space.[1] These novel properties have attracted wide attention and discussion of researchers, It has been used in many fields such as optical broom and optical micromanipulation.

Numerical simulation of the curved light beam -photonic hook The photonic hook is a curved high-intensity focus by a dielectric trapezoid particle illuminated by a plane wave. [2] The difference between the phase velocity and the interference of the waves inside the particle causes the phenomenon of focus bending which forms a new type of curved light apart from the Airy beam

# Aims and objectives

(1) Learn to use the CST software, first I should know the basic operation of the CST, then understand how to build a model through CST and realize the physical meaning of the model.

②After finishing the first step, I should be successful in building project-related models, this is very significant for my project.

(3) Know the refractive index of some materials

(4) Understand what is photonic hook and know how to build a model of it.

## Approach

I will first build simple models, such as classical sphere model and trapezoidal model, by using CST software according to the materials provided by my supervisor, analyze the results of these models, and summarize the data and knowledge obtained. After finishing these works, I will start to build models related to photonic hook with the help of my supervisor. Through the establishment of these models, I will observe the phenomenon of photonic hook, record and analyze the results, and finally draw relevant conclusions

[1] D. Faccio, J. Dudley, M. Clerici, et al. Optical airy beams and bullets. 2016 [2] L. Yue, B. Yan, and Z. B. Wang, Opt. Lett. 43(4), 771 (2018)

# Numerical simulation of the curved light beam -photonic hook

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### Process

CST Studio Suite<sup>®</sup> is a high-performance 3D EM analysis software package for designing, analyzing and optimizing electromagnetic (EM) components and systems.

# 1.Classical sphere model



For this model, I set the appropriate background and boundary and units. In addition, I set the material of the particles to be the Sio2.

2. Trapezoidal model



For this model, I set the appropriate background and boundary and units. In addition, I set the material (the epsilon is 1.5<sup>2</sup>). In addition, I've done rotation and translation on this model















L=2.2\*LAMBDA

L=2.5\*LAMBDA

1.For the classical sphere model, the electric field intensity is basically in balance, and the change is in shock

2. For the trapezoidal model, As the value of L gets larger and larger, the light becomes curved and the bending becomes more and more obvious

L=3.1\*LAMBDA

# Conclusion