1. Comparison of model training results based on reflective optical machine systems

According to the automatic design of the light stop ring, the position between each light stop ring can be obtained. The GWOT system is taken as an example to illustrate. The structure of the stop ring is shown in the figure. Among them, a point close to the primary mirror is selected on the wall of the lens cylinder with a height of H to connect with point 1 and point 2 as the minimum angle path for the lens cylinder to receive stray light. In the path of 1 and 2 connection, it is extended to point 3 and 3 of the lens cylinder, which are connected to the light aperture below the primary mirror and set as the second stop ring. Similarly, set the third, fourth block aura. Due to the limitation of the bottom plate, it is necessary to reprocess the actual size and shape of the retaining ring. Thus, the traditional stray light suppression scheme of the optomechanical system can be obtained.



Fig. 1. Gravitational wave optical telescope

Subsequently, the optical surfaces and mechanical structures are simulated in the stray light analysis software using the measured mirror and black paint properties, respectively. The stray light suppression effects from various angles are illustrated in the following figure.



Fig. 2. reflective optical system PST

The outcomes of the reinforcement learning operation are displayed in the ensuing figure. In controlling stray light suppression measures with RL, a reward surpassing anticipated values indicates satisfactory stray light suppression from the current suppression measures. As the reward progressively stabilizes throughout training, it suggests convergence in the effectiveness of stray light mitigation plans proposed by the reinforcement learning. The relevant network structure parameters are then extracted to replicate the actor-proposed stray light suppression scheme. This scheme, when modeled as machine structural parameters and analyzed using stray light analysis software, forms the reinforcement learning's stray light suppression scheme for this optical system.



Fig. 3 Training the proposed stray light suppression scheme

Assign the corresponding surface properties to the established optical-mechanical model and import it into the stray light analysis software for simulation. The stray light suppression effect of each angle is shown in the table below.



Fig. 4 stray light suppression effect of the stray light suppression scheme proposed by RL

1. Comparison of model training results based on refractive optical machine systems

In this section, based on the design idea of the traditional baffle, the corresponding stray light suppression scheme is formulated for the optical system. The stray light suppression requirement of the star sensor optical camera is to ensure that the aperture and length are as small as possible when the light above the sun suppression angle is suppressed. It can be obtained that the total length of the star sensor optical camera is not more than 140 mm, and the aperture is not more than 120 mm. According to the stray light suppression index, in the case of knowing the maximum length and maximum diameter and the target solar suppression angle, according to the design method of the traditional baffle, The optical machine structure of the optical camera of the star sensor after adding the stray light suppression measures is as follows.



Fig. 5 Optical-mechanical structure of star sensor optical camera

Subsequently, the optical surfaces and mechanical structures are simulated in the stray light analysis software using the measured mirror and black paint properties, respectively. The stray light suppression effects from various angles are illustrated in the following figure.



Fig. 6. refractive optical system PST

The outcomes of the reinforcement learning operation are displayed in the ensuing figure Fig.7. In controlling stray light suppression measures with RL a reward surpassing anticipated values indicates satisfactory stray light suppression from the current suppression measures. As the reward progressively stabilizes throughout training, it suggests convergence in the effectiveness of stray light mitigation plans proposed by the reinforcement learning. The relevant network structure parameters are then extracted to replicate the actor-proposed stray light suppression scheme. This scheme, when modeled as machine structural parameters and analyzed using stray light analysis software, forms the reinforcement learning's stray light suppression scheme for this optical system.

At this time, the stray light suppression scheme proposed after the reflective optical structure training is shown in the figure.



Fig. 7 Training the proposed stray light suppression scheme

Assign the corresponding surface properties to the established optical-mechanical model and import it into the stray light analysis software for simulation. The stray light suppression effect of each angle is shown in the Fig.8.



Fig. 8stray light suppression effect of the stray light suppression scheme proposed by RL