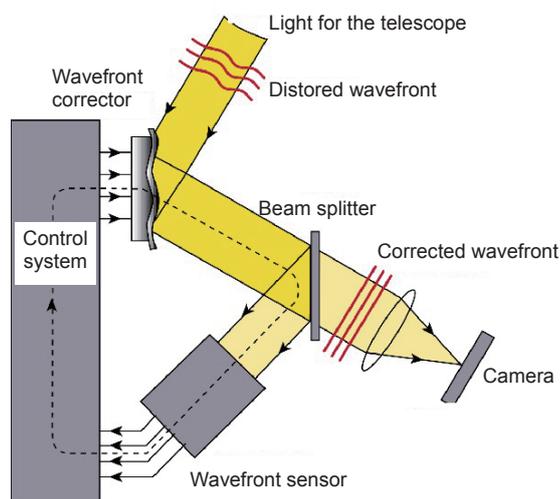


Overview of adaptive optics development

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Principle of adaptive optics

Overview: Adaptive optics (AO) is the technology for correcting the dynamic optical wavefront errors. This article reviews the development process of AO in recent 50 years. Giving a development skeleton of AO is the purpose of this paper. The original ideas of Adaptive Optics were proposed by American astronomer H. W. Babcock in 1953, and Soviet astronomer V. P. Linnik in 1957. At that time, there were no technical basics for realizing the proposes. Until late of the 60th decade of 20th century ARPA of US initiated to support fundamental researches of AO, the first papers of AO were published in 1997. In the period of Strategy Defense Initiatives(SDI), since 1985 AO had its booming period, many innovations appeared, including: the theory of atmosphere turbulence and its correction, high resolution imaging of satellites, laser guide star, laser propagation through atmosphere and thermal blooming. From the 90th decade of 20th century, The applications of AO in different areas were expanded quickly. High resolution imaging of astronomical objects is firstly realized by the Come-On project of European Southern Observatory (ESO). Now AO becomes the standard configuration of large astronomical telescopes. Three giant optical telescopes of 30~50 meters are being constructed. In each of these projects, sophisticated AO systems with large scale wavefront correctors, wavefront sensors and constellation of laser guide stars are being developed. Ground based imaging of satellites is another important application of AO. The Air Force of US constructed two AO telescope with 3.6 meters mirror. In 1986 the first solar AO system was used for high resolution observation of the surface structure of the Sun. Correction of wavefront errors in large laser system such as Inertial Confinement Fusion (ICF) is another important application of AO. The first AO system used in ICF was realized in China in 1985. Since then, many AO systems were developed in ICF facilities in China and LLNL of US. The first AO system for civilian use was the retinal imaging of human eye in 1997 by Rochester University. The developing trends of AO are briefly reviewed in this paper, including expanding the correction field of AO system by Multi-layer Conjugation AO (MCAO) using constellation of laser guide stars, extreme AO for elimination the halo around the core of the corrected point spread function (PSF), miniaturization of AO system by using miniaturizing the wavefront correctors and sensors. In every section of the paper, the developments of AO in China, especially in Institute of Optics and Electronics (IOE), are also included. For each technical innovation, the first published paper of the innovator is cited as far as possible.

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