Unraveling galaxy formation history using laser guide star adaptive optics system

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【Outline of survey】

The spatial resolution of astronomical observations from the ground is limited by the turbulent effect of the atmosphere. Even the 8.2m Subaru Telescope at Mauna Kea, one of the largest telescope with superb imaging capability, offers 0.6 arcsec resolution at 2μm, 10 times deteriorated than its diffraction limit of 0.06 arcsec. Adaptive optics is an innovative technology to restore the diffraction limited imaging capability by measuring the twinkling of stars and compensating the wavefront error in real time.

Our group constructed (1) a 188 element adaptive optics system and (2) a laserguide star generation system for Subaru Telescope with the JSPS special grant in aid awarded during 2002-2006.

The current project aims at carrying out observations on distant infant galaxies, quasar environments, and stellar populations of nearby galaxies, where the high resolution observations using adaptive optics have not been feasible due to the absence of bright enough guide stars. With the advent of laser guide star facility, we can point telescope to any field lacking guide star to make high resolution observation by operating the adaptive optics system. The team also makes every effort to offer this new facility to the general astronomers community.

【Expected results】

The 188 element system is 5 times more accurate in compensating the wavefront error than the existing 36 element system and hence observations of better quality can be done for objects in the Solar system and proto-planetary stars. Even more important is the fact that new system with laser guide star generating facility opens up a new vision for distant infant galaxies, quasar environments, and stellar populations in nearby galaxies, where the adaptive optics has not been used before.

Lots of new findings will naturally emerge from these observations. Associated system development will also identify engineering and science challenges for the next generation adaptive optics systems for the extremely large telescope era.

【References by the principal investigator】

・M.Iye, K.Ota, N.Kashikawa et al., “A galaxy at a redshift z=6.96”, Nature, 443, 186, (2006)

【Term of project】 FY2007－2011	**【Budget allocation】 21,600,000 yen** (2007 direct cost)

【Homepage address】 http://optik2.mtk.nao.ac.jp/~iye/kiban-s.htm