

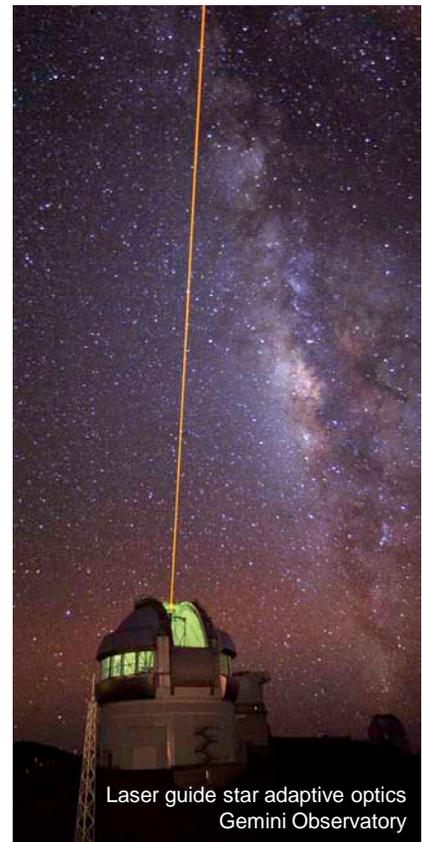
The Fantastical World of Adaptive Optics

A multimedia presentation by
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If the Theory of making Telescopes could at length be fully brought in Practice, yet there would be certain Bounds beyond which Telescopes could not perform. For the Air through which we look upon the Stars, is in a perpetual Tremor; as may be seen by the tremulous Motion of Shadows cast from high Towers, and by the twinkling of the fix'd Stars

Isaac Newton, Opticks, 1730



The Telescope may be humankind's greatest scientific tool. In the 400 years since Galileo first used a telescope to explore the heavens, no other instrument has provided more information about the Universe and our place in it. While space telescopes have provided many of the most stunning discoveries, most of astronomy is done with ground-based telescopes, which are experiencing a golden age. In the past two decades, 17 very large optical / infrared ground-based telescopes have been commissioned, with apertures from 6.5 to 10-meters in diameter. In the next decade, up to three "extremely large telescopes" (ELTs), with 24 to 42 meter apertures, will see first light.

Ground-based telescopes have become extremely precise and complex machines, but they still suffer from the distortions of the Earth's atmosphere first recognized by Isaac Newton nearly three centuries ago. The blurring caused by the atmosphere has traditionally limited the angular resolution of the largest telescopes to the resolution of a small backyard telescopeuntil the invention of adaptive optics, a technique for sensing and removing distortions.

This talk presents the interesting physics and unique technologies of adaptive optics. Adaptive optics is used at most major observatories, and is central to the ELT designs.

This talk was originally prepared for presentation at the 1st EIROforum School on Instrumentation, which was held at CERN, Switzerland during 11-15 May, 2009. The talk will be updated for presentation at the 2nd EIROForum School on Instrumentation, held at the European Photon & Neutron Science Campus, Grenoble, France during 15-22 May, 2011. EIROforum is a partnership of Europe's eight largest intergovernmental research organizations.