WFIRST-AFTA Coronagraphs

Olivier Guyon
Motohide Tamura

WFIRST-AFTA Coronagraphs

Olivier Guyon
The University of Arizona and Subaru Telescope
933 North Cherry Avenue
P.O. Box 210065
Tucson, Arizona 85721, United States
E-mail: oliv.guyon@gmail.com

Motohide Tamura
The University of Tokyo and NAOJ
Osawa 2-21-1, Mitaka
Tokyo 181-8588, Japan
E-mail: motohide.tamura@nao.ac.jp

After successful exoplanet searches using indirect methods from the 1990s, recent technological advances are finally enabling direct imaging of nearby exoplanets. While the list of directly imaged targets is currently small due to the limited contrast achieved with current ground-based instruments, space coronagraph instruments will greatly expand the capability of direct imaging and spectroscopy of exoplanets, eventually enabling imaging and spectroscopic study of super-Earths and potentially habitable Earth-like planets. The Wide-Field Infrared Survey Telescope (WFIRST) coronagraph instrument will be a major technical and scientific step in this direction. The mission will utilize a 2.4 m telescope primarily aimed at conducting a wide-field near-infrared survey. While its centrally obscured pupil considerably complicates the design of a high-contrast coronagraph, it is expected that one can achieve the detection contrast to image an exoplanet as near as the 3rd Airy ring of the point spread function in broadband light, allowing for the first time reflected light imaging and spectroscopic characterization of exoplanets.

This special section presents an overview of the WFIRST coronagraph technologies, as well as related space high-contrast imaging and spectroscopy, wavefront sensing and control, algorithms, modeling, operations, and data analysis. Recent WFIRST coronagraph laboratory and simulation results are described, and the expected mission science yield is shown for imaging giant planets known to orbit nearby stars.