

Surveying the Solar Neighborhood For Brown Dwarf Companions With the ECLIPSE Discovery Mission

ECLIPSE is a proposed NASA Discovery mission, an optical coronagraphic space telescope for exoplanetary astronomy. It is designed to meet the requirements of high contrast imaging and spectrophotometry, reducing the diffracted and scattered starlight at one arcsecond angular separation from bright stars by three orders of magnitude compared to any Hubble Space Telescope instrument. ECLIPSE brings together a telescope with aperture of 1.8 meters, configured for low optical scattering; a coronagraphic camera for control of diffracted light; and precision active optics for additional control of light scattered by imperfections in the fixed optics. The ECLIPSE mission will return unique science on the nature of planetary systems associated with our Sun's nearest neighbors, and on the processes governing their formation and evolution. During a three-year survey of stars in the solar neighborhood, ECLIPSE will directly detect and characterize jovian-mass planets orbiting AFGK stars to 10 pc; image the structures within protoplanetary and debris disks; and provide a powerful capability to detect and study brown dwarf companions in the solar neighborhood. A survey of 500 single stars within 15 pc can detect companions with absolute z magnitude of 22 at separations > 10 AU in most of the targets. Spectrophotometry of CH₄ and H₂O bands between 0.8-1.0 microns can be used to derive the effective temperatures of the objects. The ECLIPSE brown dwarf survey would directly measure the luminosity function of brown dwarf companions down to ~ 20 Jupiter masses, providing a crucial comparison with field objects.