

Origins Space Telescope: The Heterodyne Receiver (HERO)

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The Heterodyne Receiver for OST (HERO) is a very high spectral resolution ($\Delta\lambda/\lambda = 10^{-7}$, or $\Delta v = 0.03$ km/s) instrument for the Origins Space Telescope (OST) and complements OST's incoherent mid- to far-IR spectrometers. HERO is designed as a large focal plane array for OST. One of the three main science drivers for the OST is to trace the trail of water from the

ISM via the different stages of star and planet formation to habitable worlds. Other science topics currently identified for the heterodyne receivers are the study of turbulence and shocks in the ISM and their role in star formation, the determination of the cosmic ray ionization rate in the Milky Way and nearby galaxies, and the discovery of the earliest stages of dust formation around evolved stars. Little HERO has an unprecedented frequency range of 486 GHz to 2.7 THz, covering a large number of water transitions, including the dominant water cooling lines, as well as other important cooling lines. HERO extends the heterodyne receiver heritage of such successful observatories as the Herschel Space Observatory and ALMA by incorporating the latest technologies. In particular, for the first time, close to quantum limited mixers combined with new, extremely low power components make it possible to fly heterodyne focal plane arrays on a space observatory. HERO has four receiver bands, each possessing two polarizations and nine pixels, while placing very modest requirements on the spacecraft. HERO can carry out pointed observations as well as make on-the-fly maps and can operate in dual frequency, dual polarization modes. HERO is the product of a detailed design study of a new generation of heterodyne receivers for the OST and will enable a host of unique science objectives requiring the highest spectral resolving powers.