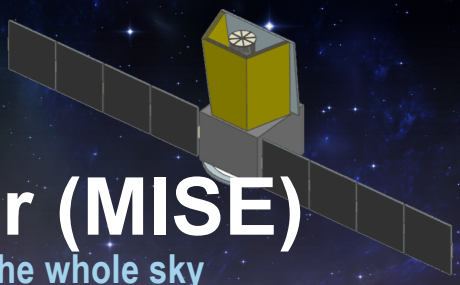


Mid-Infrared Sky Explorer (MISE)

A mid-infrared small satellite for spectro-imaging of the whole sky

MISE will address the NASA science goal: **How did we get here?**
MISE will transform our understanding of the interstellar medium and dust in our Galaxy and in nearby galaxies.

MISE focuses on three key science objectives:

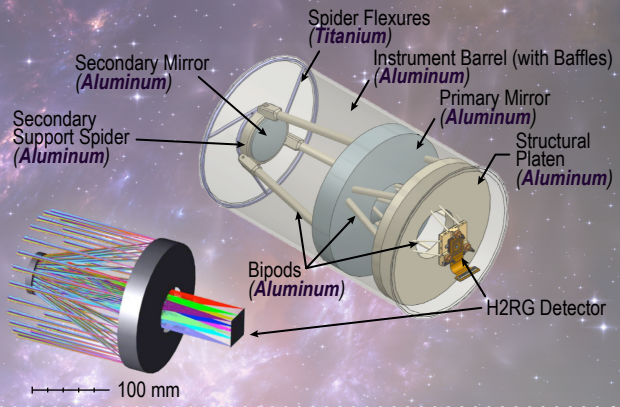
1 Determine the properties of complex organic molecules like polycyclic aromatic hydrocarbons (PAHs) responsible for the mid-infrared emission and their environmental dependence.

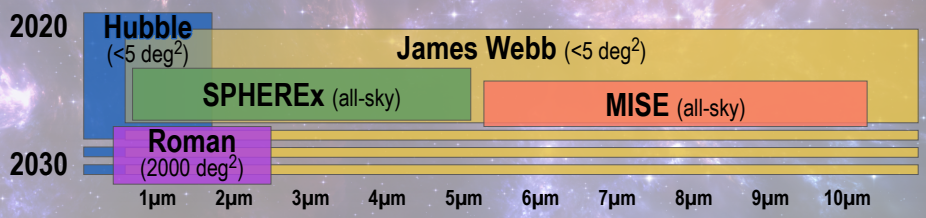
2 Determine the relative contributions of carbon and silicate dust to the Galactic extinction.

3 Study the distribution of PAH strengths as a function of metallicity, age and star-formation history in galaxies in the Local Volume.

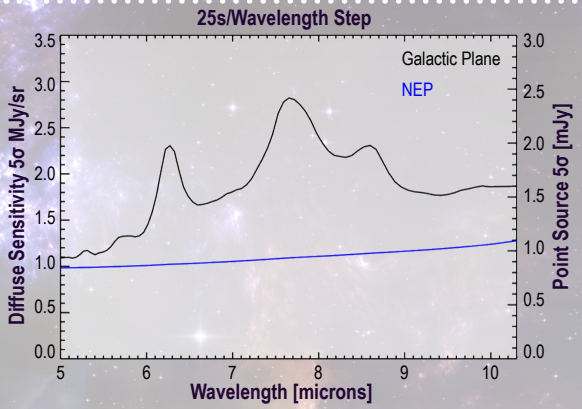
How MISE achieves these objectives:

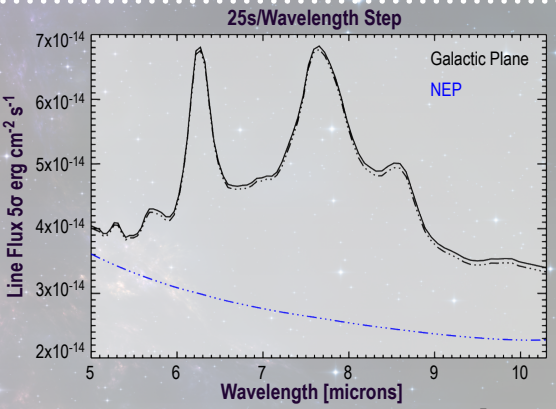
- MISE observes 6.2, 7.7, 8.6 μm PAH lines at R=50
- UV intensity hardness is measured by 6.99, 8.99 μm Ar lines at R=100
- MISE measures star-formation rate through the 7.45 μm Pfund-α emission line at R=100
- MISE measures the depth of the 9.7 μm silicate feature at R=50
- MISE measures the dust extinction at 5.2-10.3 μm
- MISE observes the H_2 molecular line emission at 6.91, 8.03, 9.66 μm at R=100 to meet secondary objectives



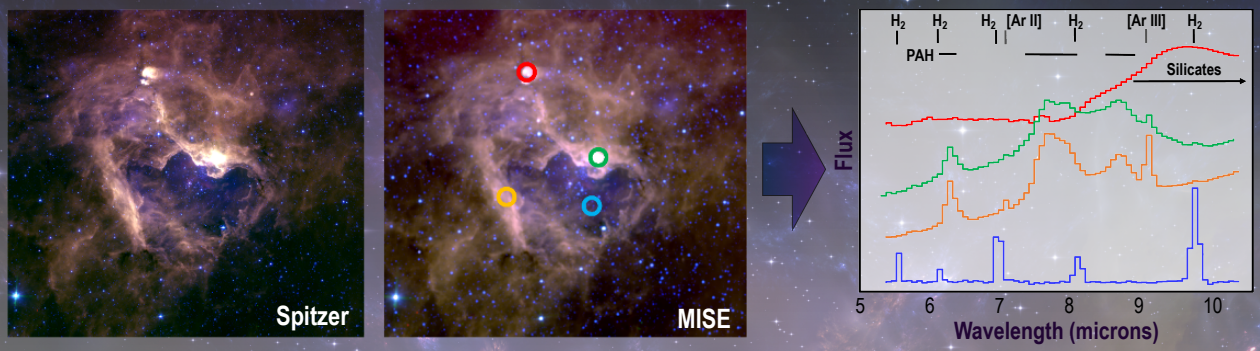


MISE design and capabilities focus on the needs of understanding the physical properties of the interstellar medium and dust in our Galaxy via key spectral emission lines, with scientific objectives based on PAH, Ar, Pfund-α, and H_2 radiation. The design is low-risk, carries significant science and engineering margins, and makes use of technologies with high readiness level for space observations using a ride-share launch platform. MISE complements the wavelength coverage of SPHEREx all-sky R=35-130 maps from 0.75-5 μm to 5.2-10.3 μm at R=50 with key spectral lines sampled at R=100.

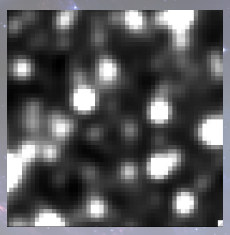




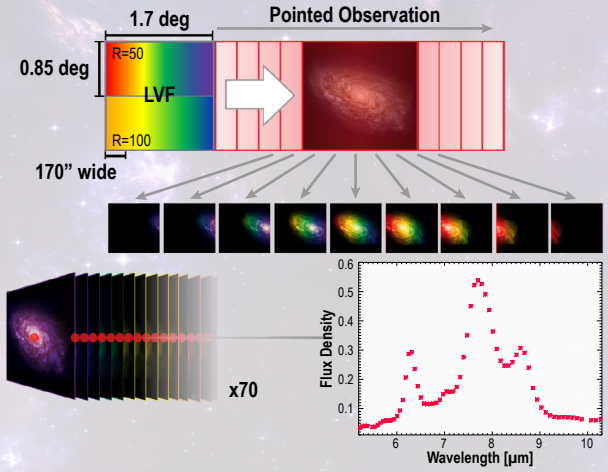
The MISE all sky survey will map the entire sky over two years with the spatial and spectral resolution to characterize more than 10^7 sources in the Galactic Plane and 10^5 nearby galaxies out to distances of 100 Mpc. The left panel shows the expected diffuse source and point source sensitivities in the Galactic Plane (black solid) and the North Ecliptic Pole (NEP; blue); right panel shows the line flux sensitivity in the Galactic Plane with faint source confusion (black solid) and without (black dot-dashed), and at the NEP (blue).



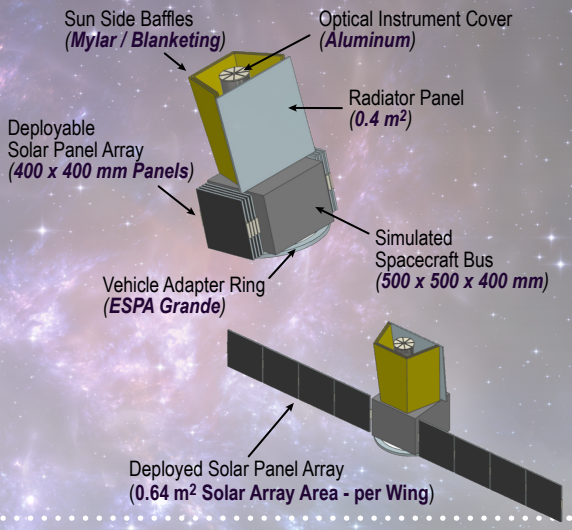
The left panel is a 4.5/5.8/8.0 μm Spitzer/IRAC observation of a star-forming region ~25 arcmin across. The middle panel shows the same region with the resolution and sensitivity of MISE with composite colors. MISE will obtain 5.2 – 10.3 μm R=50 spectra in every MISE pixel; four representative regions are chosen and their simulated MISE spectra are plotted in the right panel. In addition, MISE will provide R=100 spectro-imaging over narrow wavelength ranges centered on key spectral lines of [ArII], H_2, Pfund-α, and [ArIII].



- In its all-sky survey taking 2 years with two passes at 25-seconds in each spectral channel, MISE will easily detect more than 10^5 extragalactic sources.
- MISE spectra for these point sources will allow studies similar to those in our Galaxy using PAH, Ar, Pfund-α and H_2 emission lines.



MISE obtains spectral coverage from 5.2-10.3 μm by moving the telescope in 35 small discrete steps corresponding to the spectral resolving power across the dispersion direction of the Linear Variable Filter (LVF). The second sky survey has a half width offset relative to the first sky survey for Nyquist sampling the spectra, leading to 70 wavelength samples. In the opposite direction, LVF is split into two equal halves to provide R=50 over the full wavelength range and R=100 centered on the key spectral lines.



MISE provides a stable mid-IR telescope from space with a rideshare configured platform:

- 16.5-cm all-Aluminum optics actively cooled to 60K
- Wavelength range: 5.2 – 10.3 μm
- Pixel scale: 3"/pixel, f/3.5-4 optics system
- Field of view: 1.7x1.7 degrees on the sky
- Single 10.6 μm cut-off H2RG detector array, actively cooled to 40 K
- Spectral line sensitivity in a 100 second integration: 10^{-14} erg/s/cm^2 (5σ) at R=50
- Point source sensitivity: ~1 mJy (5σ) at 10 μm at R=50 in 25 seconds
- Surface brightness sensitivity: 2 MJy/sr (5σ) at 10 microns at R=50 in 25 seconds
- A single operational model with two years of science operations

MISE Science Team: Asantha Cooray (PI), Rhonda Morgan (Study Lead), Tzu-Ching Chang (Study Scientist), Ranga Chary, Giovanni Fazio, Joseph Hora, Aigen Li, Amy Mainzer, Craig McMurtry, Judith Pipher, William Reach, Jason Rhodes, Volker Tolls, Stephen Unwin, Andre Wong, Mike Zemcov

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