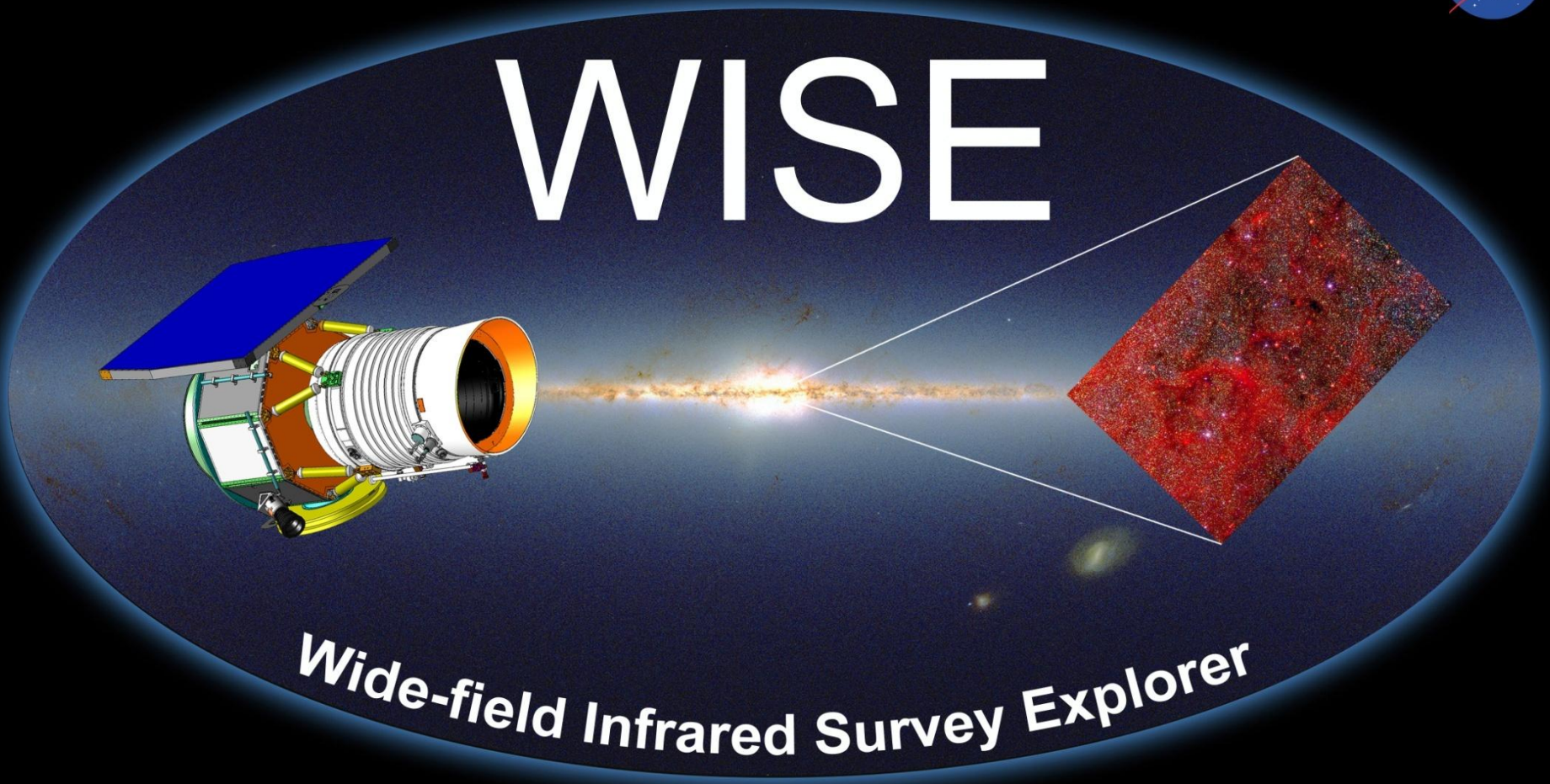
National Aeronautics and Space Administration

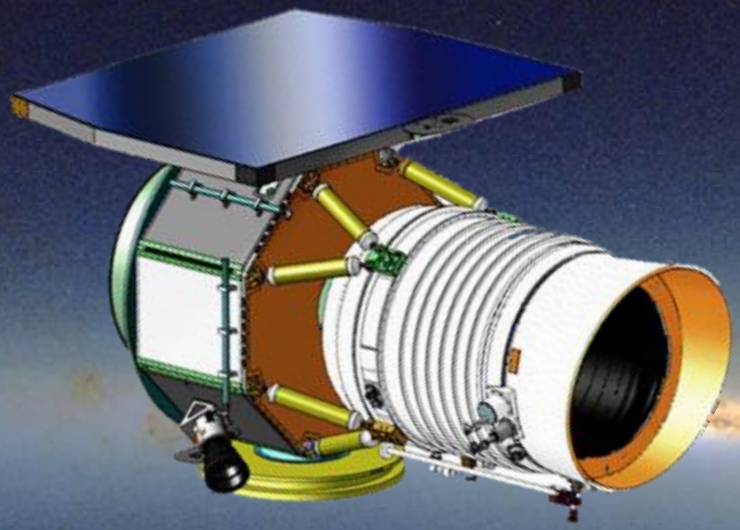


http://wise.astro.ucla.edu

UCLA • JPL • BALL • SDL • IPAC • UCB

WISE

Wide-field Infrared Survey Explorer



WISE will map the sky in infrared light, searching for the nearest and coolest stars, the origins of stellar and planetary systems, and the most luminous galaxies in the Universe.

WISE will deliver to the scientific community:

Over 1 million images covering the whole sky in 4 infrared wavelengths

Catalogs of ≈ 500 million objects seen in these 4 wavelengths

asteroids

brown dwarfs

Galaxy

ULIRGs

wise.astro.ucla.edu

Two decades ago IRAS gave us what is still our best view of the mid–infrared sky.

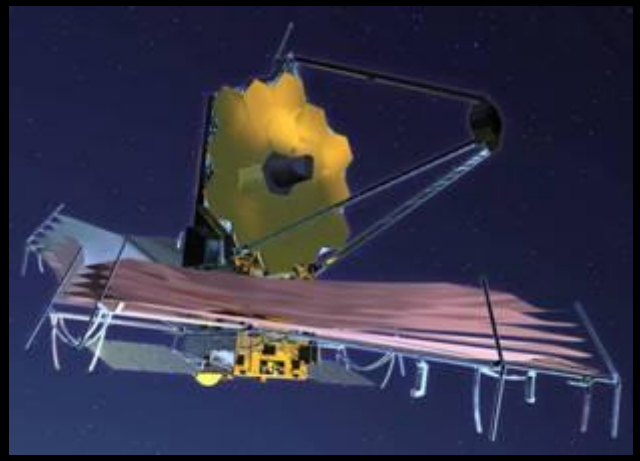

WISE will map the entire sky with resolution comparable to the view shown here.

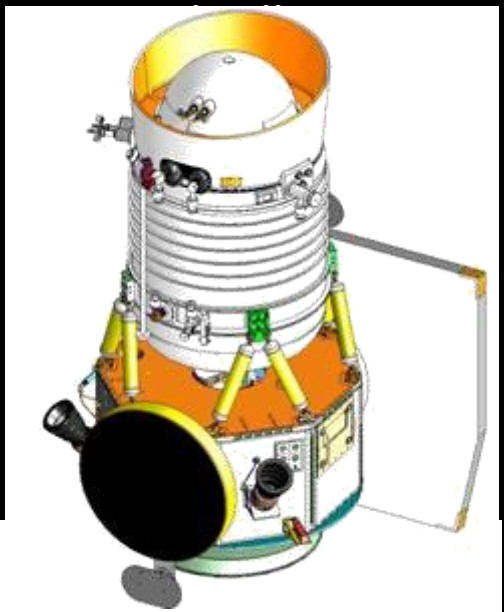
WISE Mission: Wavelengths

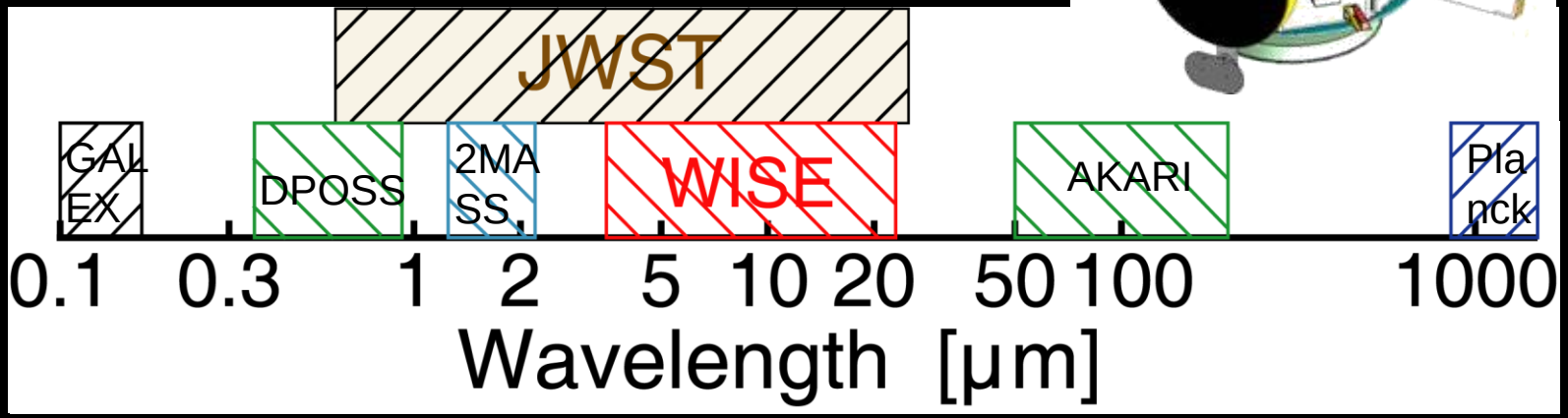
WISE will survey the sky in two near infrared channels:
3.4 and 4.6 μm

WISE will survey the sky in two mid-infrared channels:
12 and 22 μm

WISE Will Fill "the Gap"

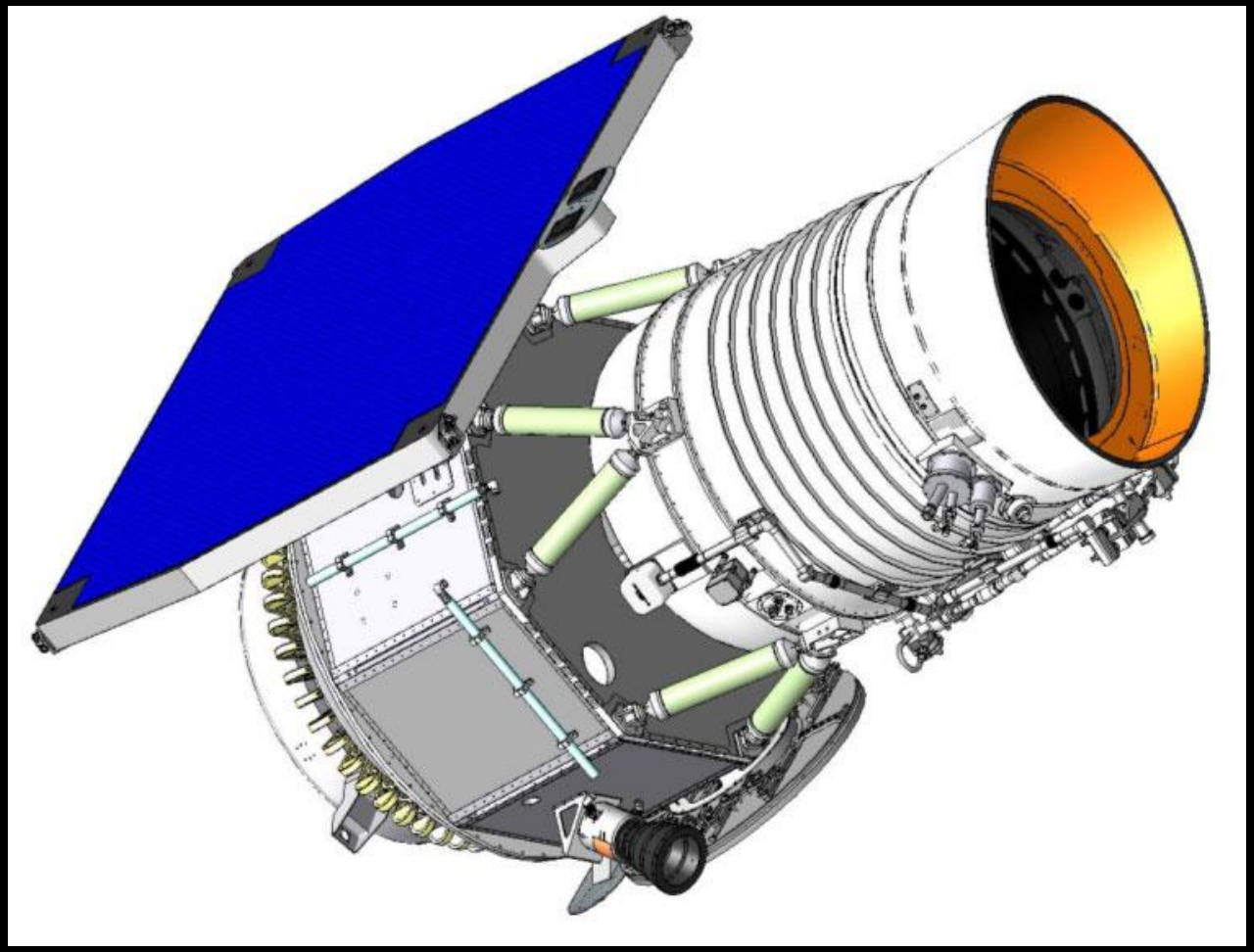






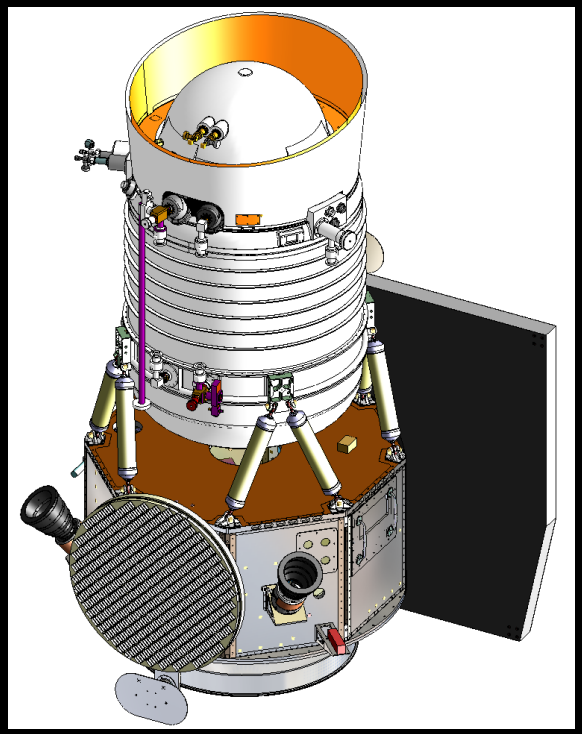
- WISE will fill the gap in wavelengths covered by sensitive all sky surveys
- Many pointed JWST observations will be in this wavelength gap

WISE Mission: Spacecraft



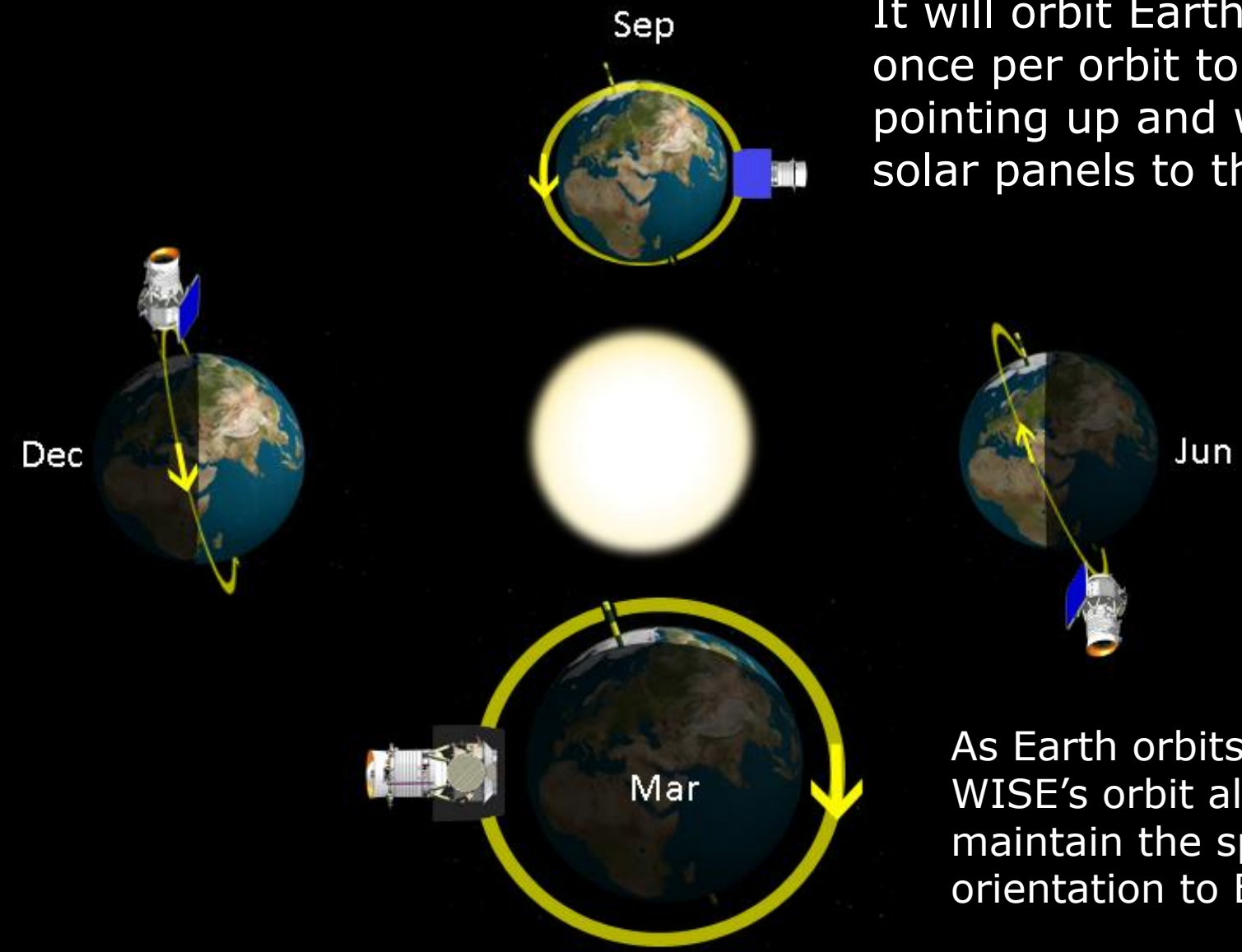
A cold 40 cm telescope in Earth orbit

Enabled by new megapixel infrared detector arrays



By being in space, the 40 cm WISE telescope is as powerful as 6,000 8-meter telescopes on the ground!

WISE Mission: Orbit



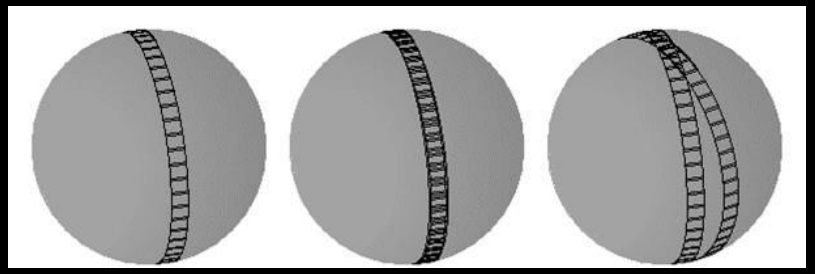
It will orbit Earth cart-wheeling once per orbit to always stay pointing up and will keep its solar panels to the Sun.

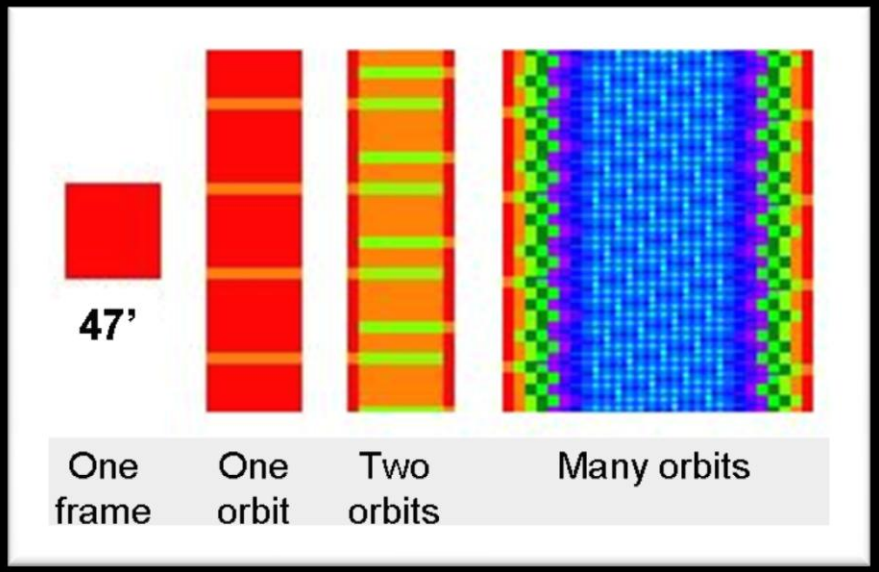
As Earth orbits the Sun, WISE's orbit also rotates to maintain the spacecraft's orientation to Earth and Sun

WISE Mission: Surveying

Each image exposure will last 11-sec and is matched to the orbit.

Each orbit, a circular strip of the sky is imaged.





As the orbit itself rotates, a slightly different strip is imaged.

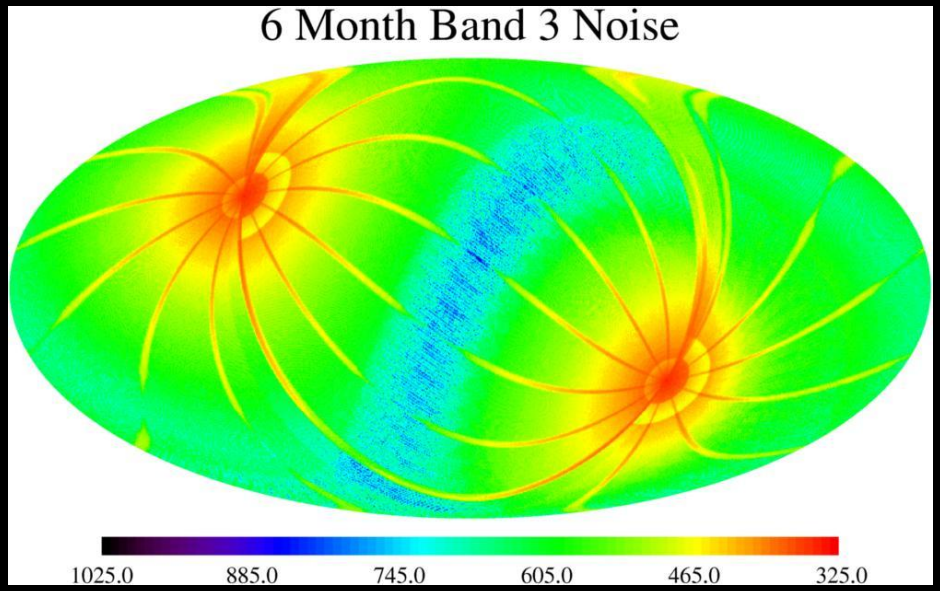
In 6 months, the entire sky is imaged

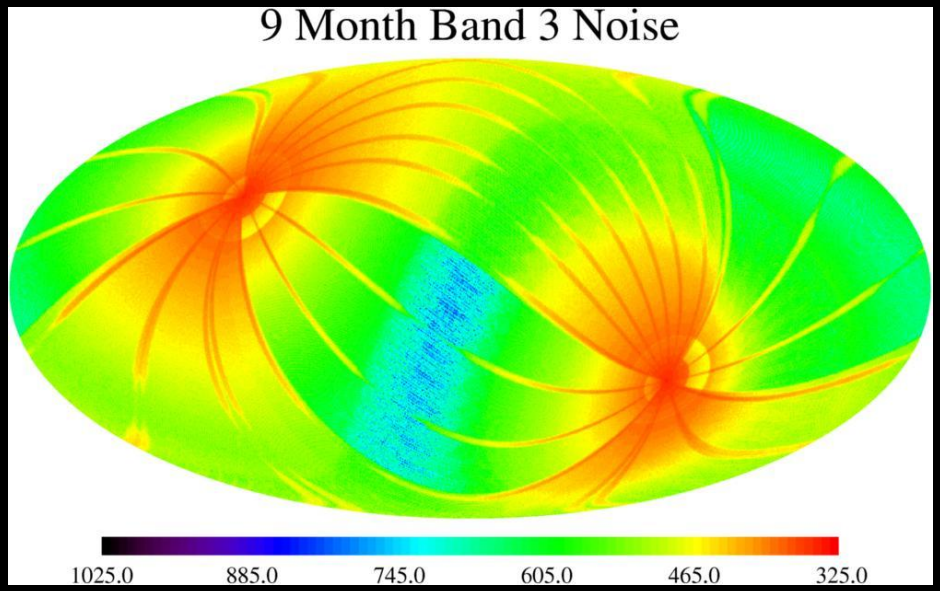
There will be 8 or more exposures at each position over more than 99% of the sky.

WISE Extended Mission

- Cryogen lifetime is expected to be 10 ± 1 months, allowing for a double coverage of one-half of the sky.
- WISE will continue observing until the cryogen runs out.
- This would allow variability studies on a 3 month time base and proper motion measurements on nearby brown dwarfs, and give better data on asteroids and higher sensitivity.

Sensitivity Maps

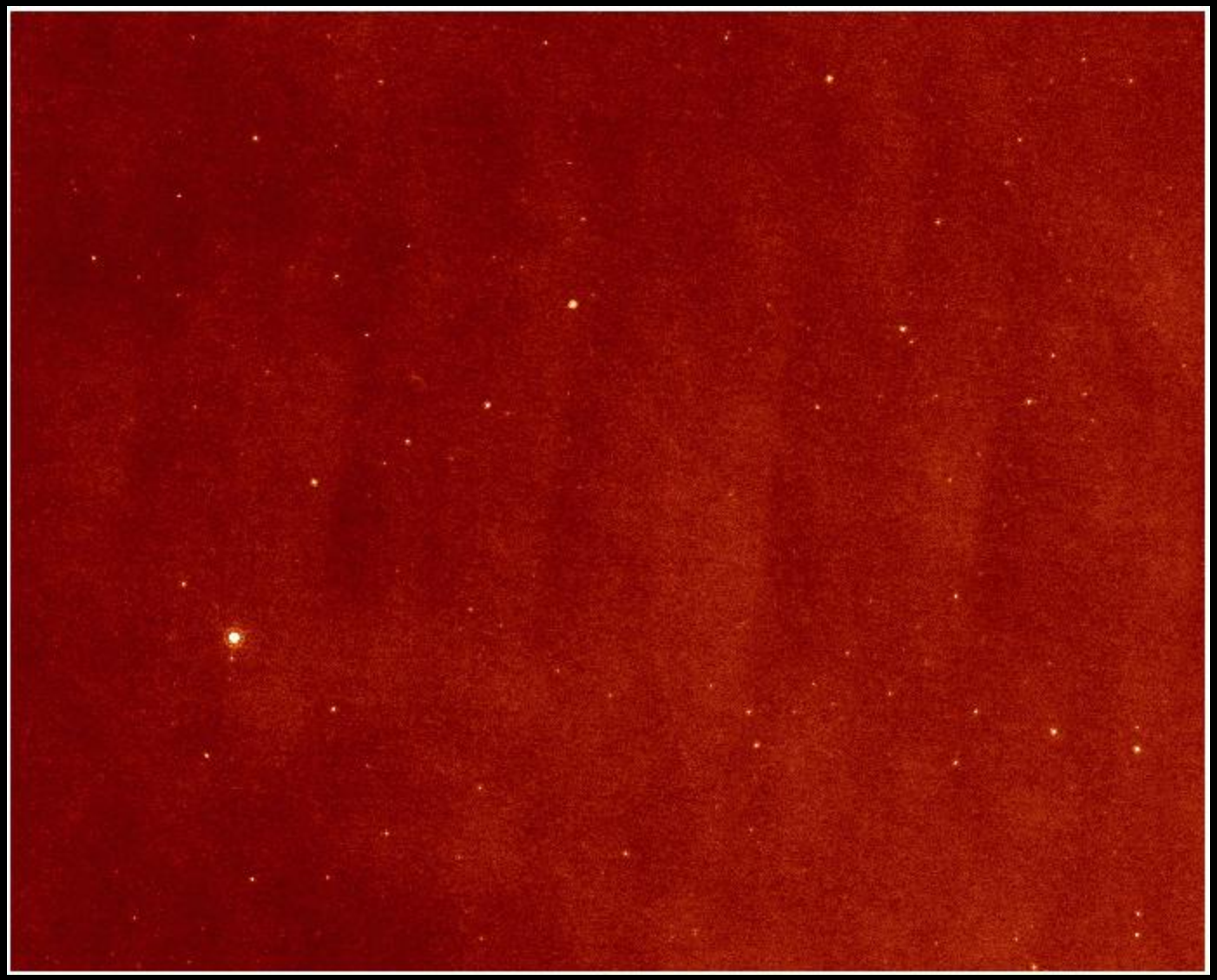




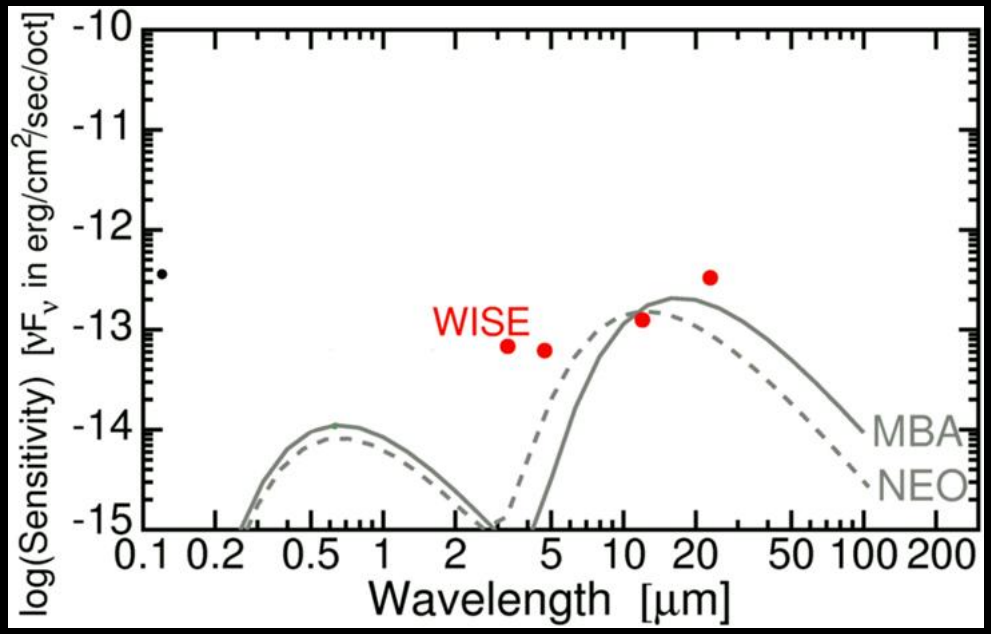
- Blue areas along the southern ecliptic are less covered due to the South Atlantic Anomaly. The partial second coverage allowed by a 9 month survey cuts out half of this undercovered portion of the sky.

WISE Will See Many Asteroids

- Spitzer 24 μm data in Taurus
- Most of the bright objects are asteroids!
- Size $0.7^{o} \approx$ WISE FOV
- Thermal IR provides diameters, needed for hazard assessment



WISE and Asteroids



Gaspra

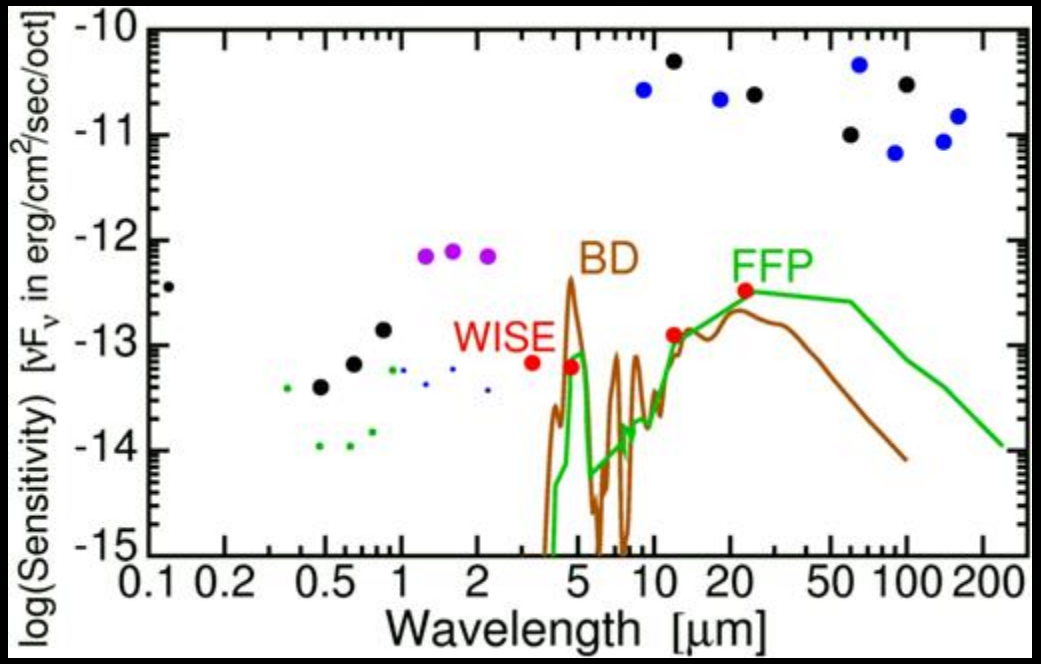
Asteroids move

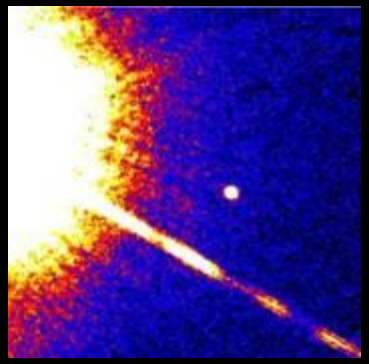
- Asteroids are much brighter in the IR than in the optical.
- They move in the hours between WISE frames.
- For asteroids with known orbits, WISE sensitivity will be slightly better than for fixed celestial objects:
  - –Asteroids generally move in the same direction that WISE scans and thus get more repeated observations than stars.
  - –Asteroids' movement across the sky greatly reduces the confusion noise from unresolved celestial sources.

WISE will find Potentially Hazardous Asteroids

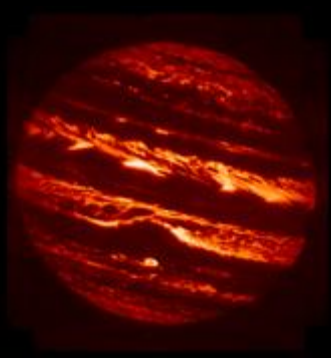
- Near Earth Objects pass within 0.3 AU of Earth.
  - NASA's NEO objective is to discover 90% of those larger than 1 km by end of 2008.
    - Approximately 1,100 NEOs larger than 1 km are expected, and more than 700 have been discovered so far.
  - WISE observations at 90° elongation will detect known asteroids with diameters larger than 1 km up to 2.8 AU from the Earth (3 AU from the Sun).
- Potentially Hazardous Asteroids (PHAs) are larger than 150 m in diameter and have orbits that approach within 0.05 AU of Earth's orbit.
  - There are currently over 1,000 known PHAs.
  - WISE will detect known 150 m PHAs up to 0.7 AU from Earth.

WISE and Brown Dwarfs

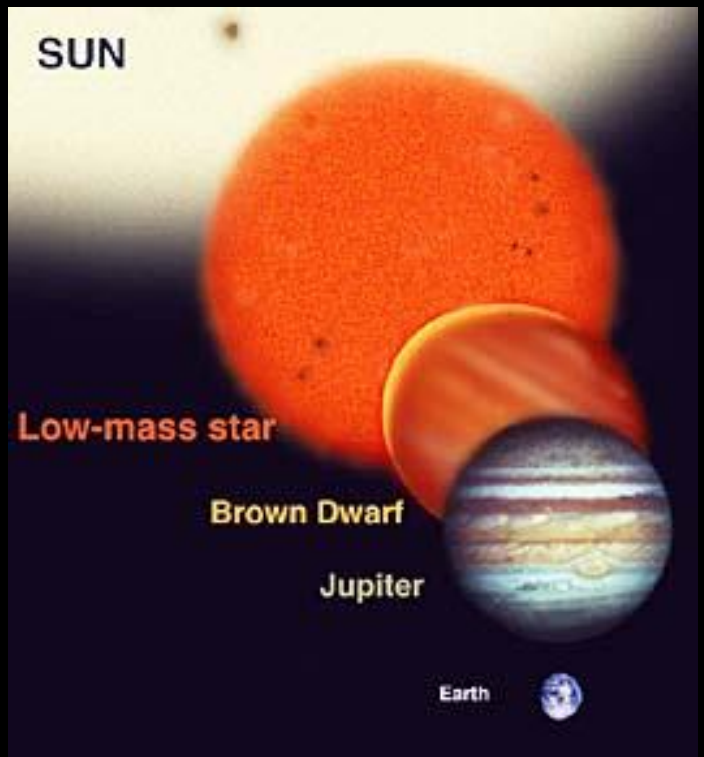




GL 229B

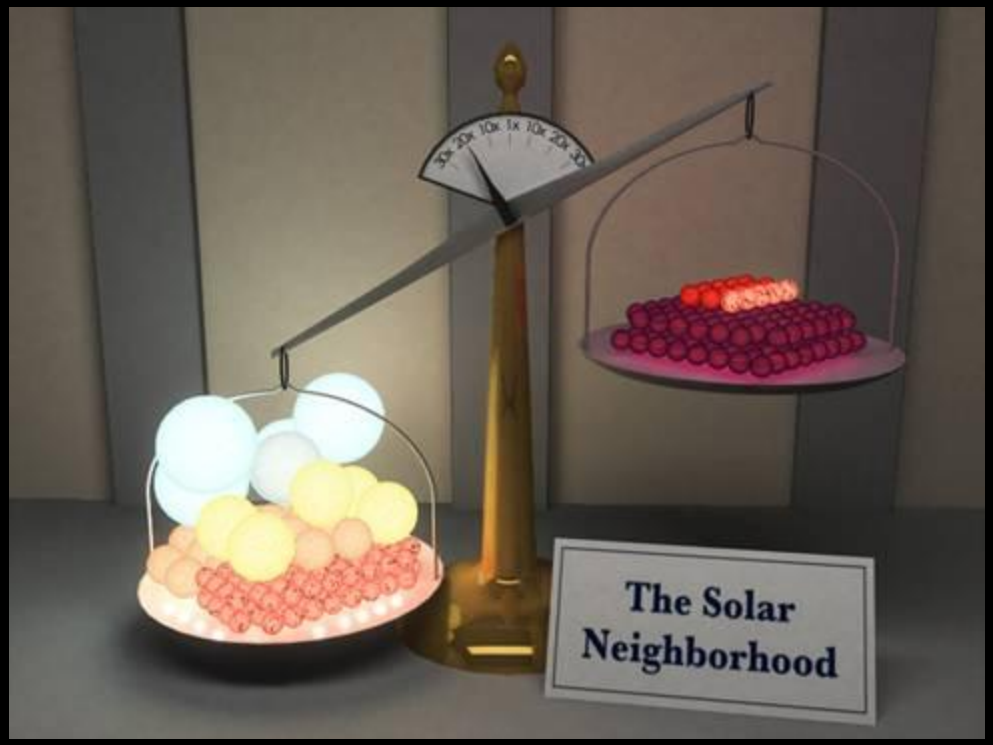


Jupiter at 5 μm



- Brown Dwarfs (BDs): stars with too little mass to fuse H into He.
- WISE 3.4 & 4.6 μm filters tuned to methane dominated BD spectra.
- WISE could identify Gliese 229B (10^{-5} $L_\odot$) to 150 light years, a free floating planet (FFP) like Jupiter (10^{-9} $L_\odot$) to 1 light year, BDs with T > 200 K (10^{-8} $L_\odot$) if closer than α Centauri.

WISE Science: Cool Stars



Red and Brown Dwarf stars are the most common type of star.

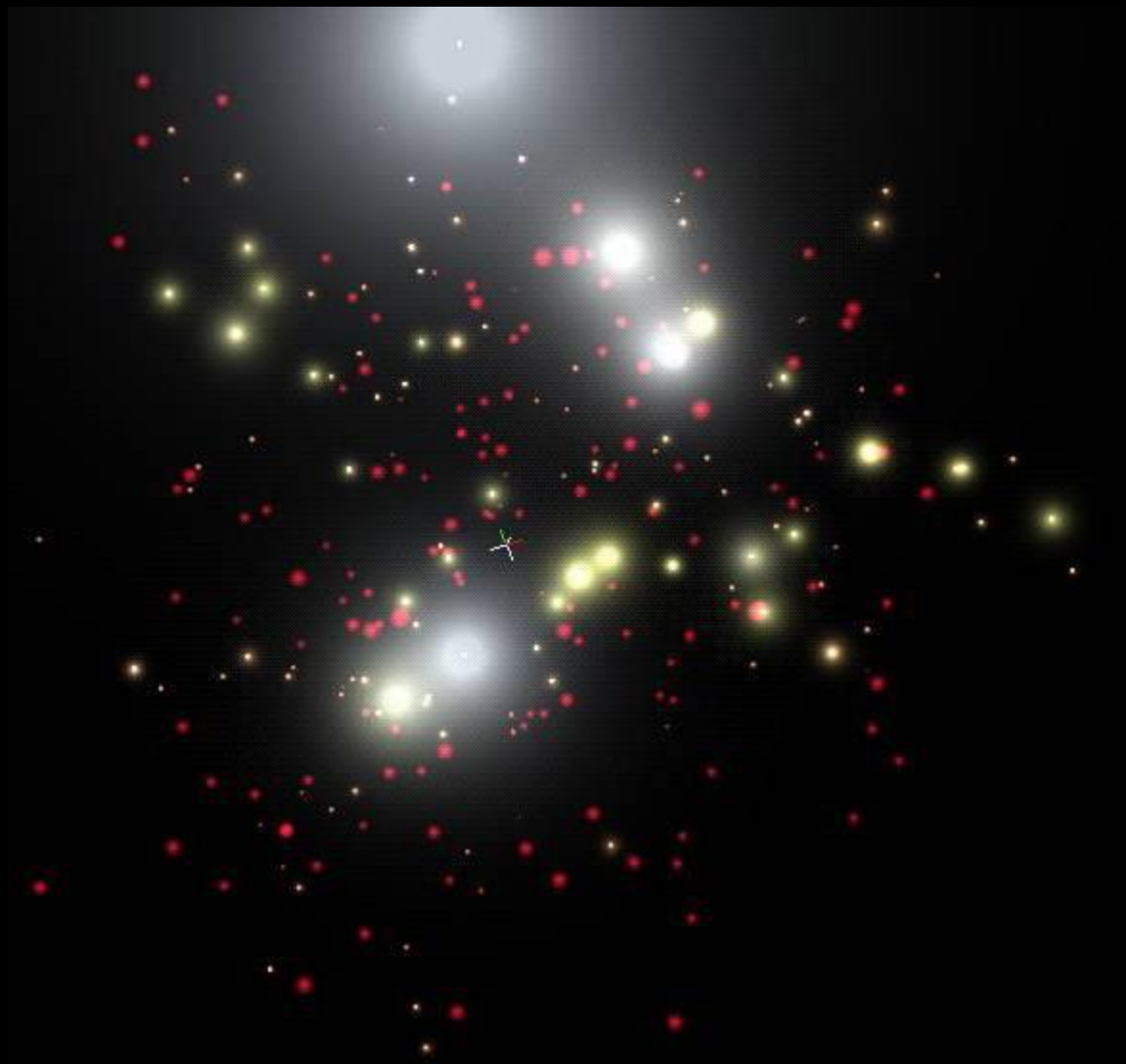
They have lowest masses and are the coolest stars.

They emit most of their energy in infrared light and are faint.

WISE Science: Cool Stars

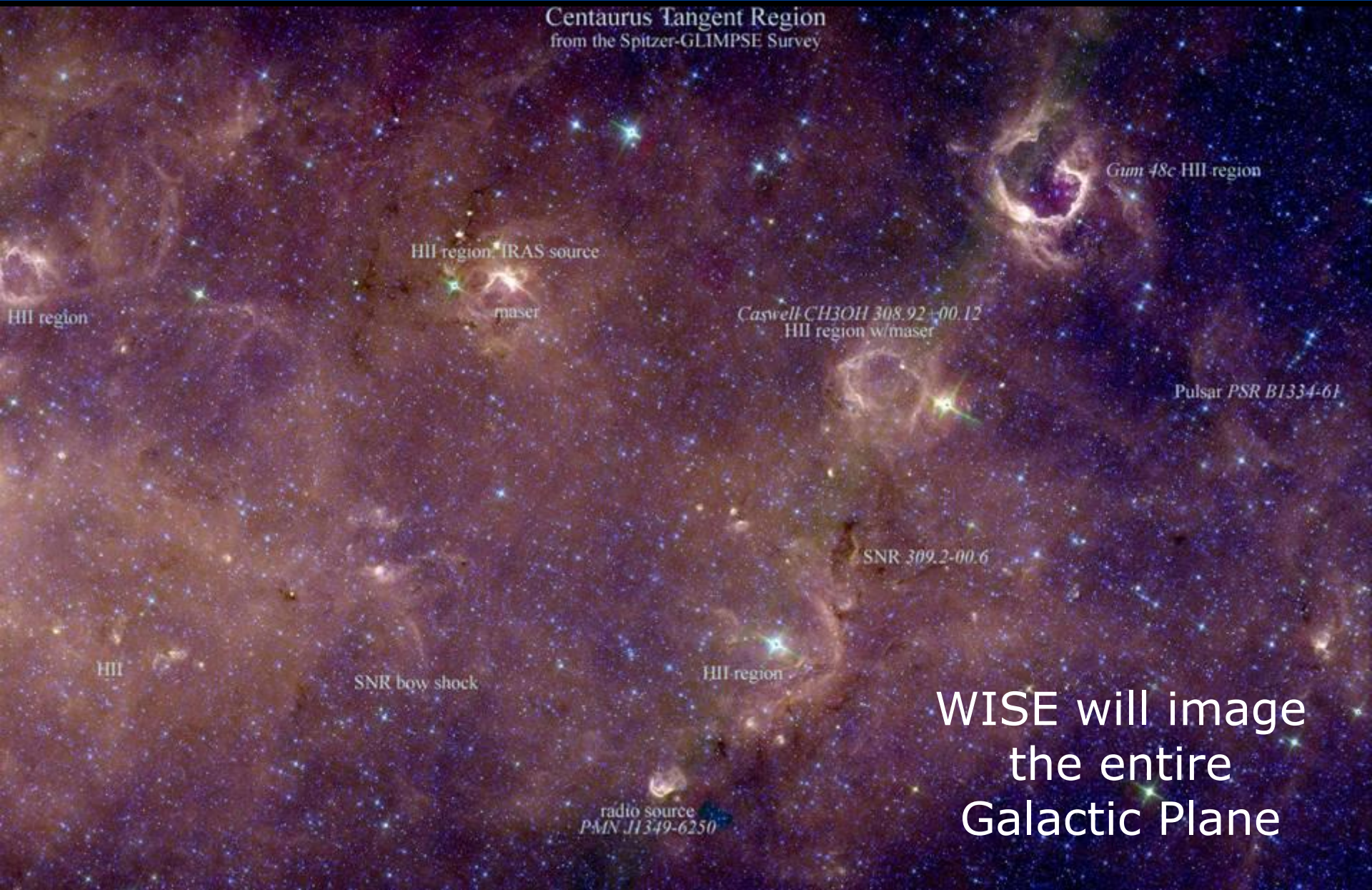
Known Stars within 25 light-years

WISE Science: Cool Stars



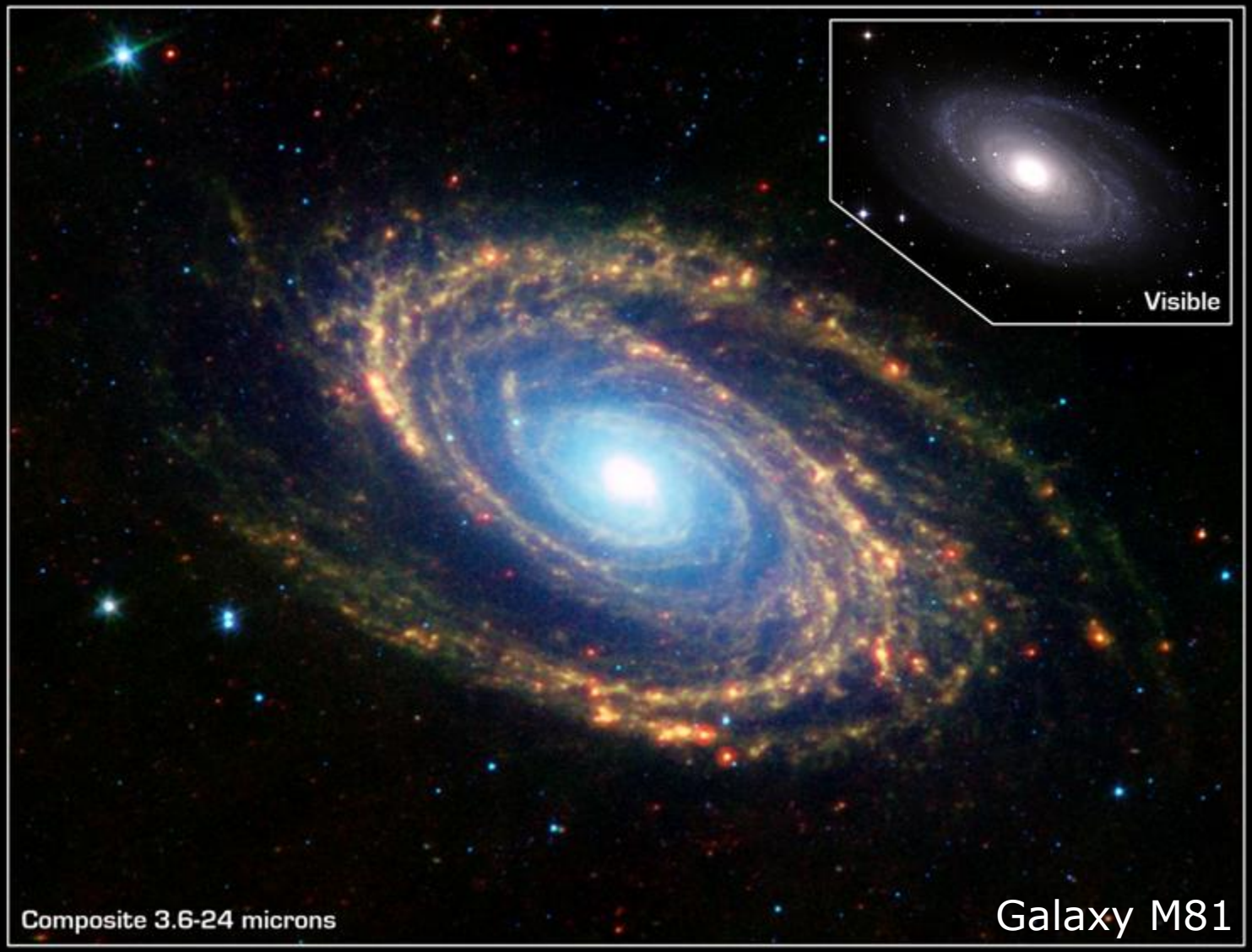
WISE Stars within 25 light-years

WISE Science: The Milky Way

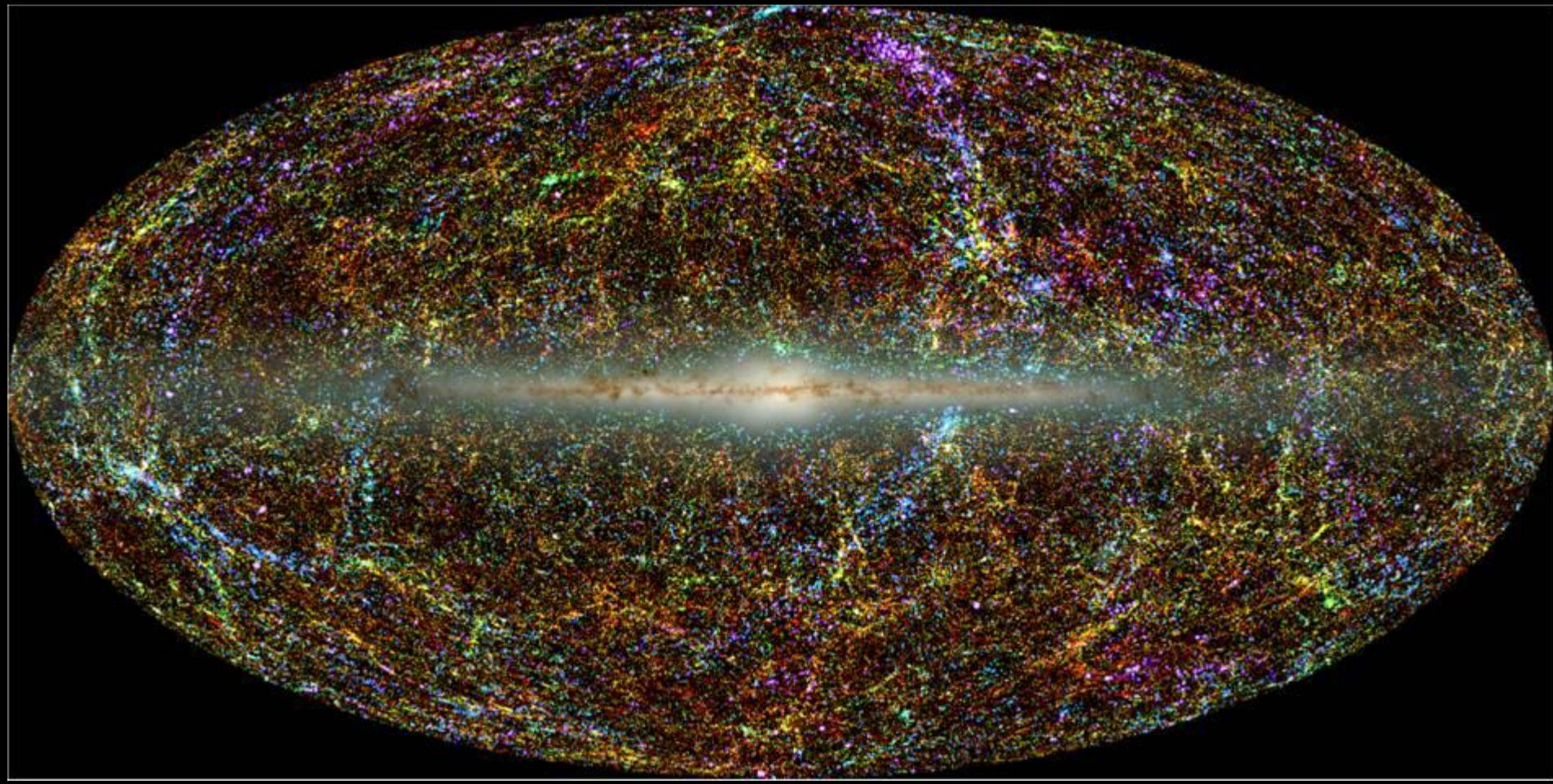


WISE Science: Extragalactic

WISE will image all nearby galaxies



WISE Science: Cosmology

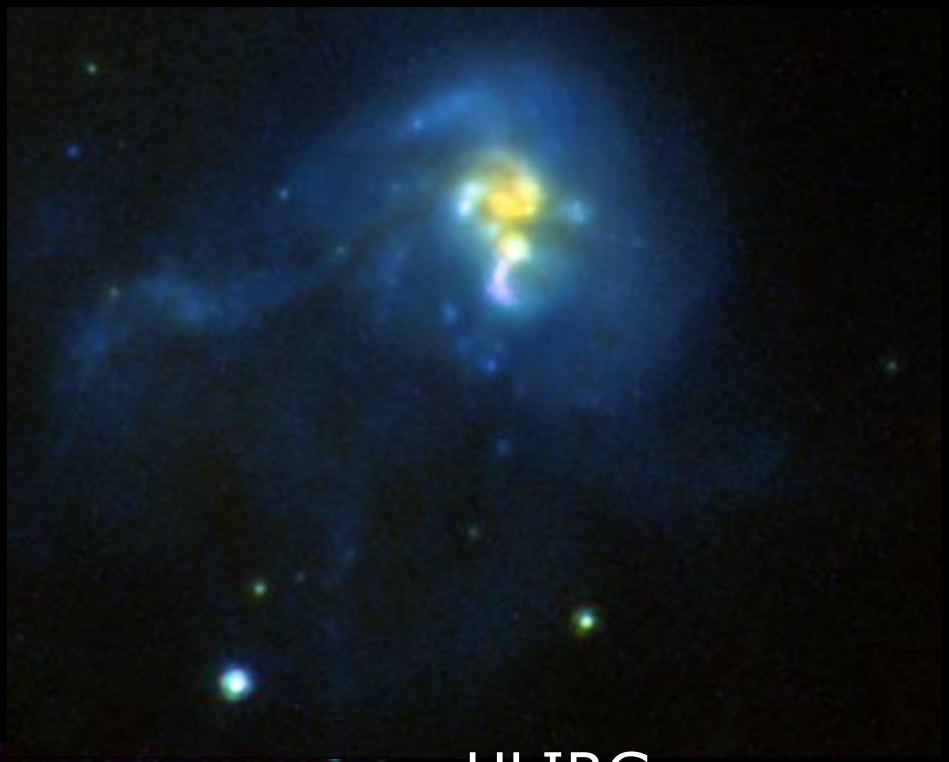


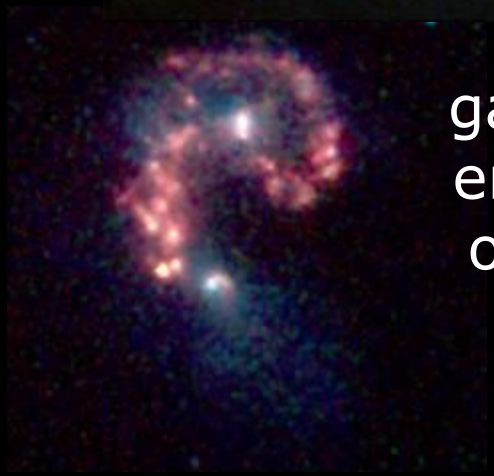
2MASS Surveyed Large Scale Structure out to 1.3 Billion Light-years (z ~ 0.1)

WISE will survey out to 6.7 Billion Light-years (z ~ 0.5)

WISE Science: Extragalactic

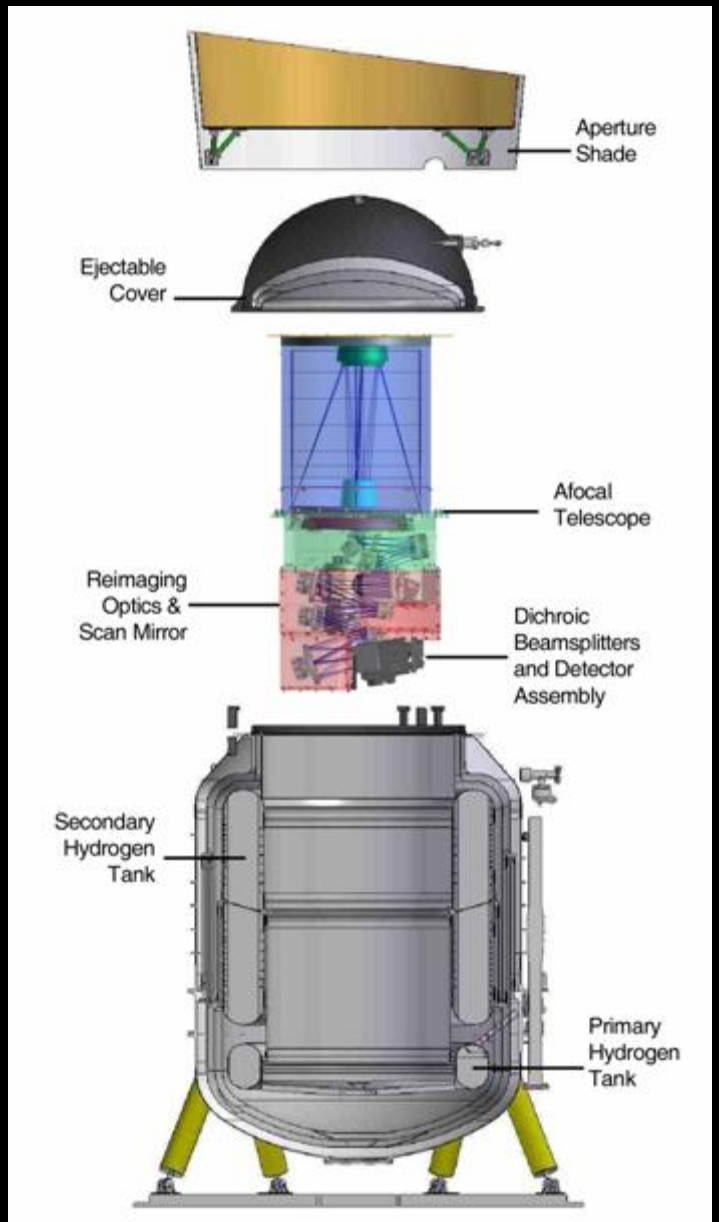
WISE will find the most luminous galaxies in the Universe:
Ultra-luminous Infrared Galaxies (ULIRGs)

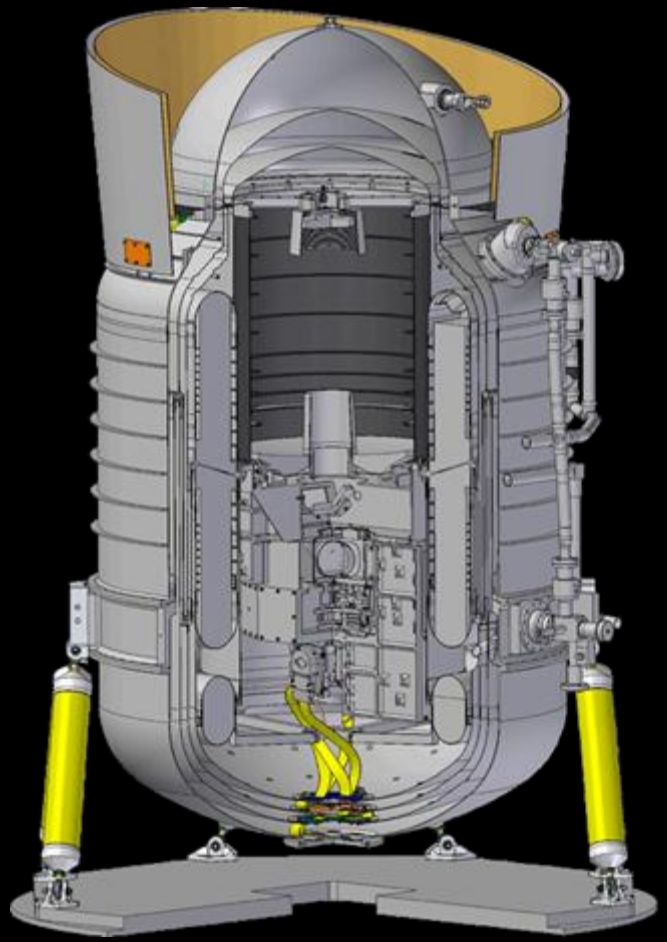




ULIRGs are galaxies with dust-enshrouded bursts of star formation. They are often mergers of galaxies.

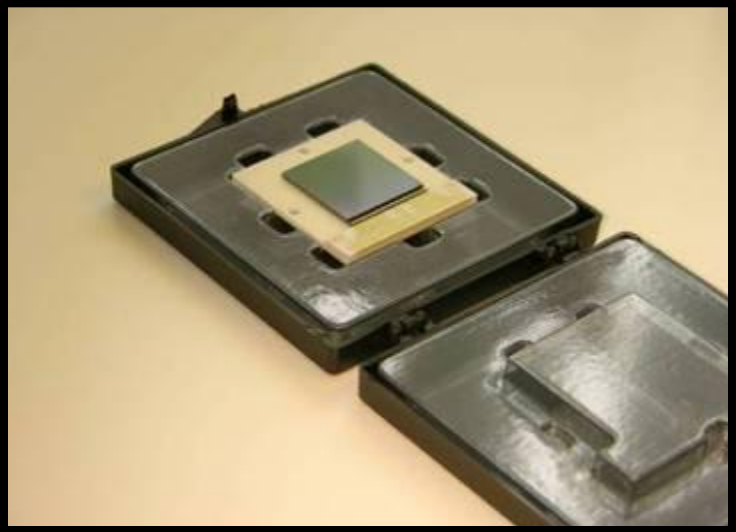
WISE Mission: Payload





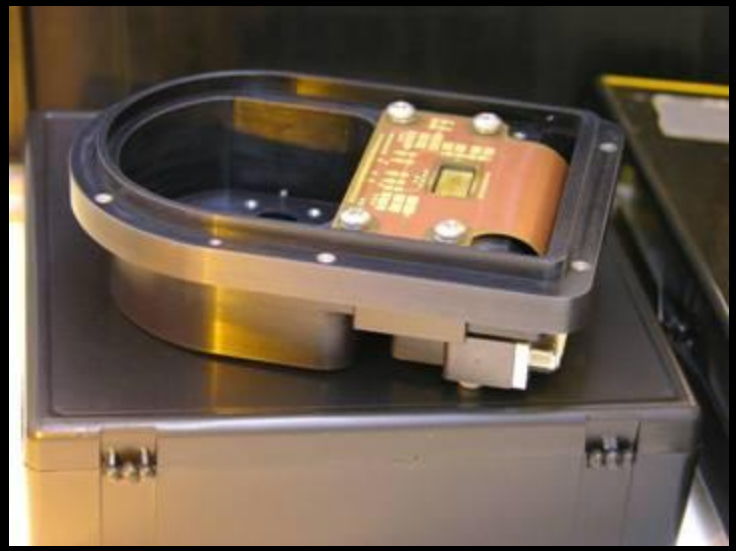
WISE Mission: Detectors

Mid Infrared Detector Array



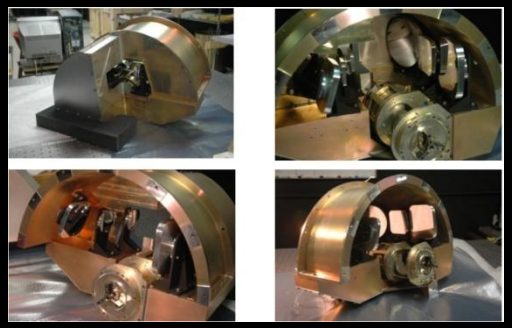
1024^2 Si:As Detector

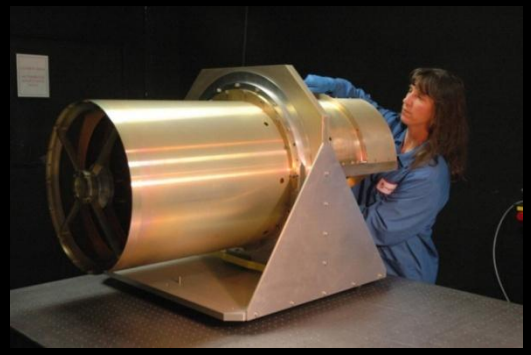
Near Infrared Detector Array



1024^2 HgCdTe Detector in Focal Plane Mount Assembly

WISE Mission: Payload



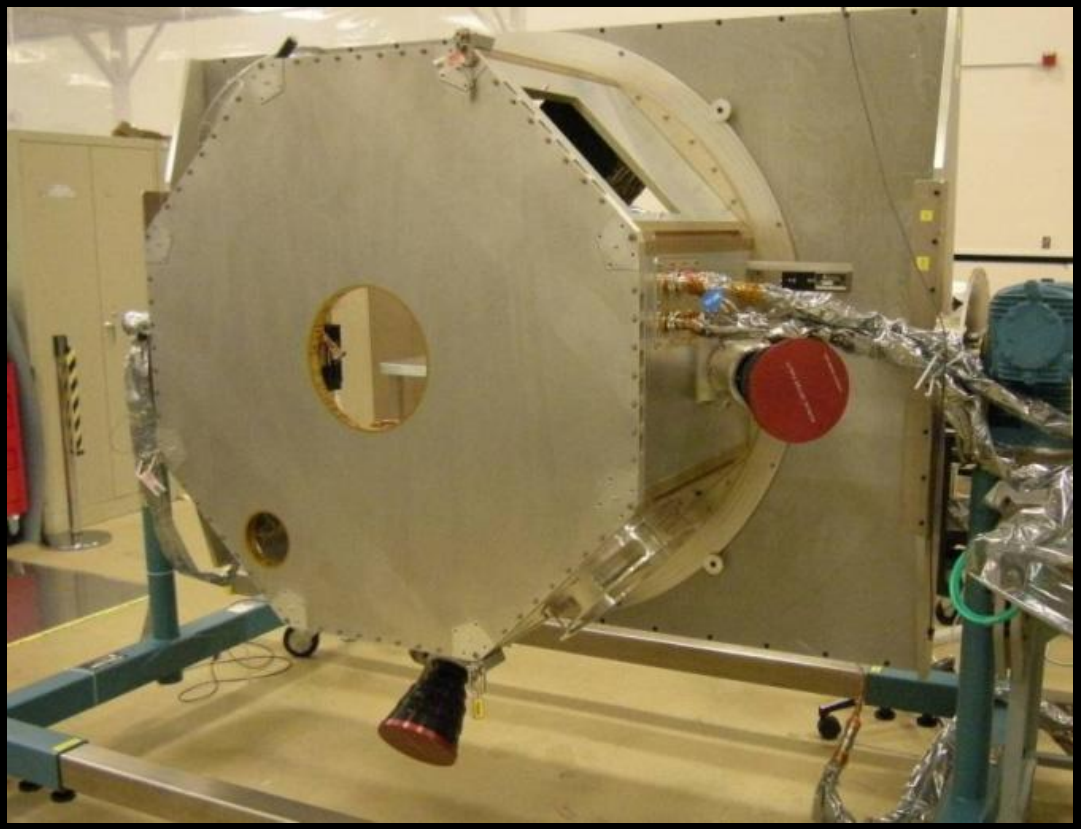


WISE Mission: Cryostat

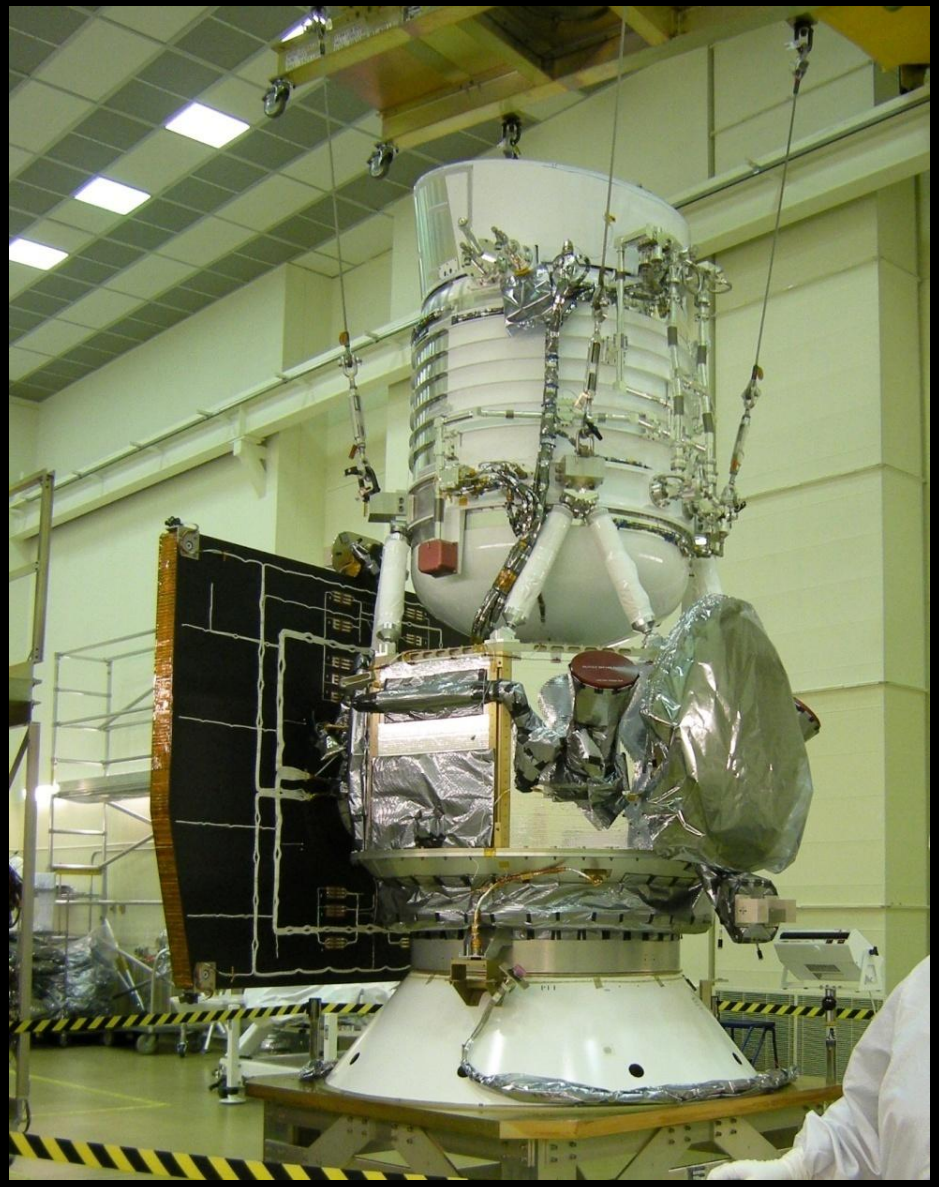
WISE Mission: Payload

WISE Mission: Spacecraft

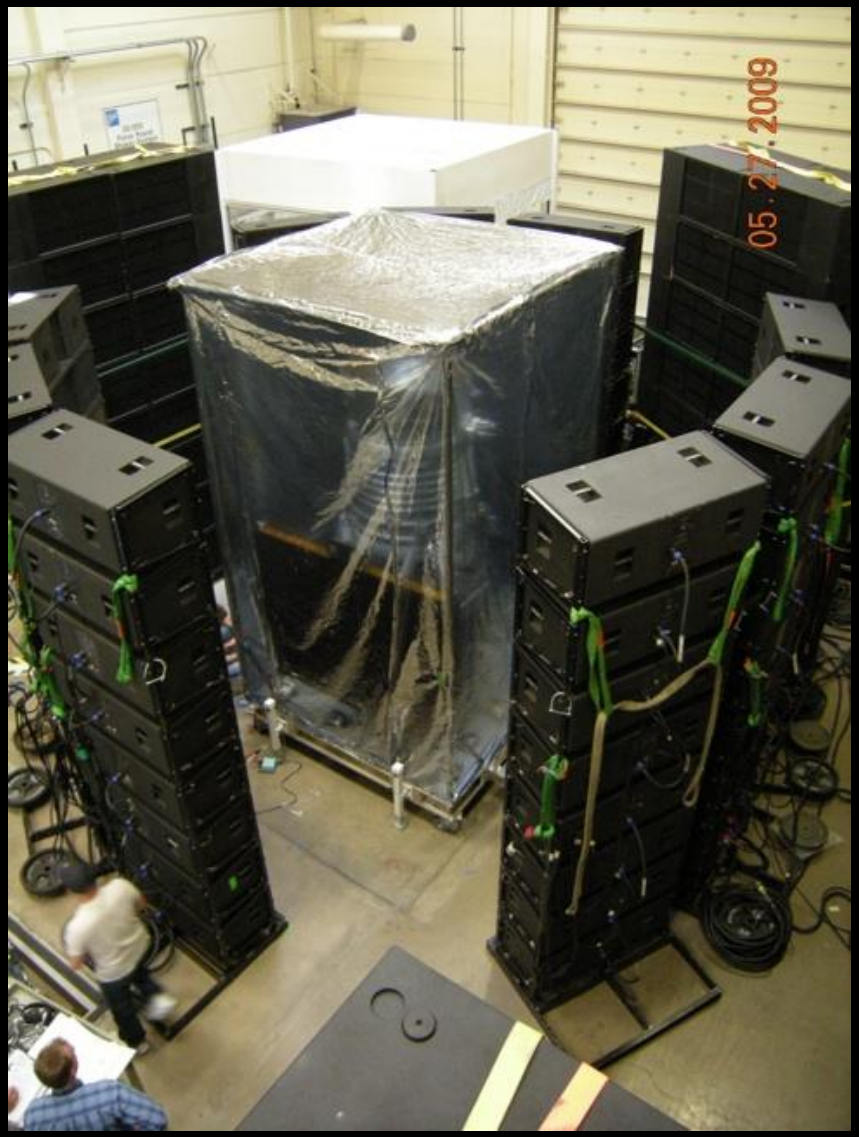
WISE Mission: Spacecraft



WISE Mission: Flight System



WISE Testing



- Vibration, thermal vacuum, optical performance and acoustic tests are completed.
- Arrived at VAFB

WISE Mission: Flight System and Science Team

WISE Launch: December 14 2009

WISE Milestones

- WISE was initially proposed as Next Generation Sky Survey in 1998
  - Selected for Phase A study, but not flight
- Re-proposed in 2001
- Initial Confirmation Review 2004 August 25
- Mission Confirmation Review 2006 October 13
- Mission Critical Design Review 2007 June 18 – 21

- Launch December 14 2009
  - 1 month In-Orbit Checkout
  - 6 months survey (baseline - 9 months extended)
- Preliminary data delivery (1st 50% of survey) 6 months after end of survey
- Final data delivery 17 months after end of survey (L + 2 yrs in baseline case)
  - Image Atlas
  - Source Catalog
  - Accessible via IRSA (InfraRed Science Archive) at IPAC