WFIRST Science Information

WFIRST will have a Hubble-sized 2.4-meter mirror with a survey-sized 0.28 sq deg camera

- WFIRST's 300 Megapixel camera will have 100 times the field of view of Hubble at the same sensitivity (28th AB mag 1 in hour) and resolution (0.1 arcsec pixels).
- WFIRST will be the first telescope to combine excellent image quality with survey power.
- WFIRST will usher in the "Big Data" era for space-based astronomy.

WFIRST is responsive to the top scientific priorities of the 2010 Astronomy Decadal Survey

- WFIRST will address 16/20 key questions and 4/5 discovery areas from the Decadal.
- WFIRST will measure the history of dark energy and the acceleration of the Universe.
- WFIRST will discover thousands of "cold" exoplanets using microlensing and over 100,000 transiting exoplanets with measured host star distances.
- WFIRST will develop coronagraphy technology to directly image exoplanets.
- WFIRST will survey stellar and galactic populations across the Universe to exquisite depth and resolution.
- WFIRST will create a census of planets, small bodies, and near-Earth objects in the Solar System.

WFIRST will build the first wide-field and high-resolution maps of the universe through core surveys and pointed observations

- WFIRST can image 2000 sq deg down to 27th AB mag in four filters (0.5 to 2 microns) in just 1 year of observing time.
- WFIRST deep field surveys can image 10 sq deg fields down to 29th AB mag, at high cadence, in just a few months. These surveys can discover supernovae out to z = 2, as well as other local and extragalactic transient phenomena.
- Single images from WFIRST will yield survey-sized data sets, covering the equivalent of 100 pointings with Hubble or Webb.

100% of WFIRST's observing time is available and all mission data will be non-proprietary

- Anybody in the worldwide scientific community can write a proposal to use WFIRST.
- All WFIRST observations will be publicly available with no period of limited access. Guest Investigators can apply for grants to analyze data in the rich WFIRST archive.
- The specific implementation of core surveys and all Guest Observer time, as well as associated funding, remain to be competed and selected through peer review.
- The current Formulation Science Working Group will be disbanded in early 2021.

WFIRST will be an extremely powerful dark energy experiment.

- Compared to existing and planned observatories, WFIRST will be the most powerful supernova, weak lensing, and z = 1 to 2 spectroscopic facility per unit time.
- WFIRST will be an exquisite supernova cosmology experiment, unique in its level of precision, redshift range, and control of measurement and astrophysical systematics.

- WFIRST will be the best controlled weak lensing experiment, with unique depth, resolution, and control of measurement and astrophysical systematics.
- WFIRST will yield the densest large-scale map of structure at redshift 1 to 2 of any existing or planned facility.

WFIRST will complete the picture of planetary system architectures

- The WFIRST microlensing survey will discover thousands of exoplanets orbiting their host stars at distances not explored by Kepler or TESS, including over 100 Earth-mass planets.
- WFIRST will measure the frequency of free-floating exoplanets.
- WFIRST will discover over 100,000 transiting exoplanets

WFIRST will achieve the first high-performance space-based coronagraphy

- The coronagraph technology demonstration instrument on WFIRST will suppress starlight by factors of up to 1 billion to one. This is orders of magnitude better than current state-of-the-art ground or space-based capabilities.
- The WFIRST coronagraph is the foundation for future astronomy missions that will explore nearby worlds for signs of biosignatures.

WFIRST will enable Great Observatory astrophysics and planetary science breakthroughs across many astrophysical research themes

- WFIRST can survey for new dwarf planets and other small bodies in the Solar System.
- WFIRST can perform the first high-resolution surveys of the Milky Way plane to measure the structure of the disk and bulge, and to survey star forming regions and dust.
- WFIRST can discover and characterize the metallicity, age, and kinematics of tidal substructure in the Galactic halo, and in the halos of nearby galaxies.
- WFIRST can map strong and weak lensing in galaxy clusters out to large scales to constrain dark matter predictions.
- WFIRST can discover thousands of very high-redshift galaxies to study galaxy evolution over cosmic time and to characterize the epoch of reionization.
- WFIRST contributes to most of the “Key Science Questions” and “Discovery Areas” in Astro2010.

WFIRST will significantly enhance the scientific impact of other 2020s observatories.

- WFIRST surveys will observe large areas of the sky, discovering rare astronomical objects that can be followed up by JWST and ELTs.
- WFIRST’s high-resolution surveys will test and calibrate LSST’s photometric precision, astrometry, blending, and classification system. WFIRST will add valuable near-infrared colors to LSST’s visible imaging catalogs.
- WFIRST + LSST will significantly improve photometric redshift measurements and inference of the properties of stellar populations.