NASA launches Nancy Grace Roman Space Telescope to survey dark energy, dark matter

Bryan Dyne
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NASA's Nancy Grace Roman Space Telescope lifted off from Launch Complex 39A at the Kennedy Space Center in Florida at 7:26 a.m. EDT Sunday aboard a SpaceX Falcon Heavy rocket. It separated from the launch vehicle 31 minutes into flight and is now on a three-month, million-mile journey to the second Sun-Earth Lagrange point, where it will begin the widest and deepest infrared survey of the sky ever attempted. Ground controllers at Goddard Space Flight Center in Greenbelt, Maryland began receiving telemetry seven minutes after launch.

Over the next five years, Roman is slated to measure light from more than a billion galaxies, detect around 100,000 planets beyond the solar system and map up to 20 billion stars in our own galaxy. Its primary mirror is 2.4 meters across, the same size as the Hubble Space Telescope's, but its field of view is at least 100 times larger. The primary detector is the Wide Field Instrument, a 300-megapixel infrared camera built around 18 detectors that will return 1.4 terabytes of data every day, the highest rate of any NASA astrophysics mission.

The mission is a vast international enterprise involving thousands of scientists, technicians and engineers who conceptualized, designed, built and launched the telescope, and thousands more who will maintain the spacecraft when it reaches its final orbit and use the data it collects. Those involved so far come from at least 130 different universities and institutions from 19 countries and across five continents. Roman is another demonstration of the incredible power of human labor when it is organized scientifically for social progress.

Roman Senior Project Scientist Dr. Julie McEnery commented during NASA's launch broadcast, "Roman is going to give us the data that we need to understand the nature of the universe we live in. We can make measurements of billions of galaxies. We can precisely measure the shape of hundreds of millions of galaxies. We can precisely measure the position and distance, and we can use that to measure how the structure in our own universe has grown over cosmic time.

"And when you combine those two pieces of information, we can get at the heart of the nature of dark matter, this is matter that does not shine in normal light, so it's invisible, and dark energy, which is some weird property of the universe that pushes things apart."

The central focus of the science to be done with the data collected will be a study of dark energy, the unexplained pressure accelerating the expansion of the universe and accounting for roughly 68 percent of all known mass/energy. Data collected by Hubble in the 1990s was some of the earliest direct evidence of this accelerating expansion.

Recent results from ground-based surveys have produced evidence that dark energy may not be constant at all but changing over cosmic time, a finding that, if confirmed, overturns the standard model of cosmology. Roman will test this with three independent methods that cross-check one another, including light detected from Type Ia supernovae, the distortion of distant galaxies caused by the gravity of intervening matter, known as gravitational lensing, and the remnant signals of vibrations in the plasma of the early universe, so-called baryon acoustic oscillations.

Roman will also be used to directly observe exoplanets using a newly developed Coronagraph Instrument designed to almost completely block light from distant stars, to the order of one-part-per-billion, to image their planets. It is also capable capturing the spectrum of said planets and the groundbreaking

capability will be used as a pathfinder for future missions.

And while these measurements by themselves will be extraordinarily insightful, the real value of Roman will emerge when combined with data collected from numerous other telescopes internationally. The mission was launched just months after the ground-based Vera C. Rubin Observatory, which is located in Chile, came online. And Roman will be joining the European Space Agency's (ESA) Euclid spacecraft at the Sun-Earth Lagrange Point 2. All three of these endeavors are designed to study the evolution of the universe in slightly different and ultimately complementary ways.

Data collected by Roman will also be supported by previous and new observations from both Hubble and the James Webb Space Telescope, as well as legacy data from the Kepler Space Telescope. And it will add to the body of knowledge collected by the Dark Energy Spectroscopic Instrument (DESI), which began dark energy surveys back in 2021.

At the same time, the development of the Roman space telescope reflects the downgrading of scientific research since that period, mirroring the degeneration of American capitalism itself. In 2010 the decadal survey of astronomy and astrophysics, the National Academies review through which the scientific community establishes its collective priorities, ranked a wide-field infrared survey telescope first among all proposed large space missions. That report estimated the cost at $1.6 billion and the launch for 2020. The concept was older still, descending from the Joint Dark Energy Mission studied by NASA and the Department of Energy in the early 2000s.

Roman launched six years behind that schedule at a total cost of roughly $4.3 billion, nearly three times the original estimate. And it likely would not have been made at all without two 2.4-meter mirrors donated to NASA by the National Reconnaissance Office in 2012, each worth about $250 million, though they forced many expensive changes to the mission, which was originally designed for a 1.5-meter mirror.

The telescope is also being launched amid the sixth month of the American assault on Iran, the fourth year of the US-NATO war against Russia in Ukraine and the ongoing war preparation against China. The Trump administration has requested $1.5 trillion for next year's military budget, nearly 350 times the total cost of Roman.

That a machine of Roman's caliber has been launched and will soon be in operation is certainly cause for celebration. It will answer numerous scientific questions that have been outstanding for years or even decades.

The telescope, however, also poses a social question of utmost importance: Why are such achievements rationed and fought over line by line made to justify themselves against war budgets and the enrichment of a financial oligarchy whose share of wealth is the highest ever recorded? The same international coordination and scientific understanding used to develop, build and launch Roman must be directed politically toward placing society itself on a higher, rationally planned social order, one that abolishes poverty, disease, dictatorship and war.