Could the first images from the Vera Rubin telescope change how we view space for good?

June 30 2025, by Manda Banerji, Phil Wiseman

Clouds of gas and dust that comprise the Trifid nebula (top) and the Lagoon nebula, which are several thousand light-years away from Earth. Credit: NSF–DOE Vera C. Rubin Observatory

We are entering a new era of cosmic exploration. The new Vera C Rubin Observatory in Chile will transform astronomy with its extraordinary ability to map the universe in breathtaking detail. It is set to reveal secrets previously beyond our grasp. Here, we delve into the first images

taken by Rubin's telescope and what they are already showing us.

These images vividly showcase the unprecedented power that Rubin will use to revolutionize astronomy and our understanding of the universe. Rubin is truly transformative, thanks to its unique combination of sensitivity, vast sky area coverage and exceptional image quality.

These pictures powerfully demonstrate those attributes. They reveal not only bright objects in exquisite detail but also faint structures, both near and far, across a large area of sky.

Cosmic nurseries—nebulae in detail

The stunning pink and blue clouds in this image are the Lagoon (lower left) and Trifid (upper right) nebulae. The word nebula comes from the Latin for cloud, and these giant clouds are truly enormous—so vast it takes light decades to travel across them. They are stellar nurseries, the very birth sites for the next generation of stars and planets in our Milky Way galaxy.

The intense radiation from hot, young stars energizes the gas particles, causing them to glow pink. Further from these nascent stars, colder regions consist of microscopic dust grains. These reflect starlight (a process known in astronomy as "scattering"), much like our atmosphere, creating the beautiful blue hues. Darker filaments within are much denser regions of dust, obscuring all but the brightest background stars.

To detect these colors, astronomers use filters over their instruments, allowing only certain wavelengths of light onto the detectors. Rubin has six such filters, spanning from short ultraviolet (UV) wavelengths through the visible spectrum to longer near-infrared light. Combining information from these different filters enables detailed measurements of the properties of stars and gas, such as their temperature and size.

Rubin's speed—its ability to take an image with one filter and then quickly move to the next—combined with the sheer area of sky it can see at any one time, is what makes it so unique and so exciting. The level of detail, revealing the finest and faintest structures, will enable it to map the substructure and satellite galaxies of the Milky Way like never before.

This image captures a small section of NSF–DOE Vera C. Rubin Observatory's view of the Virgo Cluster, offering a vivid glimpse of the variety in the cosmos. Credit: NSF–DOE Vera C. Rubin Observatory

Mapping galaxies across billions of light years

The images of galaxies powerfully demonstrate the scale at which the

Rubin observatory will map the universe beyond our own Milky Way. The large galaxies visible here (such as the two bright spiral-shaped galaxies visible in the lower right quarter of the picture above) belong to the Virgo cluster, a giant structure containing more than 1,000 galaxies, each holding billions to trillions of stars.

This image beautifully showcases the huge diversity of shapes, sizes and colors of galaxies in our universe revealed by Rubin in their full technicolor glory. Inside these galaxies, bright dots are visible—these are star-forming regions, just like the Lagoon and Trifid nebulae, but remarkably, these are millions of light years away from us.

The still image captures just 2% of the area of a full Rubin image, revealing a universe that is teeming with celestial bodies. The full image, which contains about 10 million galaxies, would need several hundred ultra-high-definition TV screens to display in all its detail. By the end of its 10-year survey, Rubin will catalog the properties of some 20 billion galaxies, their colors and locations in the sky, containing information about even more mysterious components of our universe, such as dark matter and dark energy. Dark matter makes up most of the matter in the cosmos, but does not reflect or emit light. Dark energy seems to be responsible for the accelerating expansion of the universe.

The UK's role

These unfathomable numbers demand data processing on a whole new scale. Uncovering new discoveries from this data requires a giant collaborative effort, in which UK astronomy is playing a major role. The UK will process around 1.5 million Rubin images and hosts one of three international data access centers for the project, providing scientists across the globe with access to the vast Rubin data. Here at the University of Southampton, we are leading two critical software development contributions to Rubin.

First of these is the capability to combine the Rubin images with those at longer infrared wavelengths. This extends the colors that Rubin sees, providing key diagnostic information about the properties of stars and galaxies. Second is the software that will link Rubin observations to another new instrument called 4MOST, soon to be installed at the Vista telescope in Chile.

Part of 4MOST's job will be to snap up and classify rapidly changing "sources," or objects, in the sky that have been discovered by Rubin. One such type of rapidly changing source is a stellar explosion known as a supernova. We expect to have cataloged more supernova explosions within just two years than have ever been made previously. Our contributions to the Rubin project will therefore lead to a totally new understanding of how the stars and galaxies in our universe live and die, offering an unprecedented glimpse into the grand cosmic cycle.

The Rubin observatory isn't just a new telescope—it's a new pair of eyes on the universe, revealing the cosmos in unprecedented detail. A treasure trove of discoveries await, but most interesting among them will be the hidden secrets of the universe that we are yet to contemplate. The first images from Rubin have been a spectacular demonstration of the vastness of the universe. What might we find in this gargantuan dataset of the cosmos as the ultimate timelapse movie of our universe unfolds?

Provided by The Conversation

Citation: Could the first images from the Vera Rubin telescope change how we view space for good? (2025, June 30) retrieved 5 October 2025 from https://phys.org/news/2025-06-images-vera-rubin-telescope-view.html