Hubble launches large ultraviolet-light survey of nearby stars

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This is a ground-based telescopic photo of the Large Magellanic Cloud (LMC), a satellite galaxy of our Milky Way. The galaxy is one of several select targets of a new initiative with NASA's Hubble Space Telescope called ULLYSES (UV Legacy Library of Young Stars as Essential Standards). The program is looking at over 300 stars to build an ultraviolet-light catalog for capturing the diversity of stars, from young to old. The program's goal is to give astronomers a much better understanding of the birth of stars and how this relates to everything from planets to the formation and evolution of galaxies. The LMC contains hot, massive, blue stars, similar to the primitive composition of early galaxies, so astronomers can gain insights into how their outflows may have influenced early galaxy evolution billions of years ago. The target stars are from Hubble archival observations (yellow circles) and new observations (blue circles) under the ULLYSES program. Credit: NASA, ESA, J. Roman-Duval (STScI), ULLYSES program, and R. Gendler

Stars are not created equal. They span a broad range of sizes, ages, and temperatures from diminutive red, cool, low-mass stars to opulent blue, hot, massive stars. Our Sun is roughly midway between these populations. Because stars are the universe's LEGO blocks for building immense galaxies, astronomers are always seeking a much better understanding of their birth and death. Stars' behavior over their lifespan relates to everything from planets to the formation and evolution of galaxies.

To better understand stars and their evolution, the Space Telescope Science Institute has launched an ambitious new initiative with the Hubble Space Telescope called ULLYSES (UV Legacy Library of Young Stars as Essential Standards). The comprehensive program will build a dataset that can be used to create a spectral library of stellar "templates" for capturing the diversity of stars. This is ensuring a legacy

dataset for a wide range of astrophysical topics. Located above the obscuring atmosphere, Hubble's ultraviolet sensitivity makes it the only observatory currently capable of studying stars at those wavelengths of light. Young low-mass stars and massive monster stars radiate a lot of their energy in ultraviolet light.

The universe would be a pretty boring place without stars. Without them, the universe would remain a diffuse plasma of mostly hydrogen and helium from the big bang.

As the basic building blocks of the cosmos, stellar nuclear fusion furnaces forge new heavy elements, enriching their parent galaxy. The radiant energy from stars potentially nurtures the emergence of life on the most favorably located planets, as it did on Earth.

To better understand stars and stellar evolution, the Space Telescope Science Institute (STScI) in Baltimore, Maryland, has launched an ambitious new initiative with NASA's Hubble Space Telescope, called ULLYSES (UV Legacy Library of Young Stars as Essential Standards).

ULLYSES is Hubble's largest observing program ever in terms of the amount of time Hubble will dedicate to it. More than 300 stars will be included. Ultraviolet (UV) light from the target stars is being used to produce a library of the spectral "templates" of young, low-mass stars from eight star-forming regions in the Milky Way, as well as fully mature high-mass stars in several nearby dwarf galaxies including the Magellanic Clouds.

"One of the key goals of ULLYSES is to form a complete reference sample that can be used to create spectral libraries capturing the diversity of stars, ensuring a legacy dataset for a wide range of astrophysical topics. ULLYSES is expected to have a lasting impact on future research by astronomers around the world," said program lead Julia Roman-Duval

of STScI.
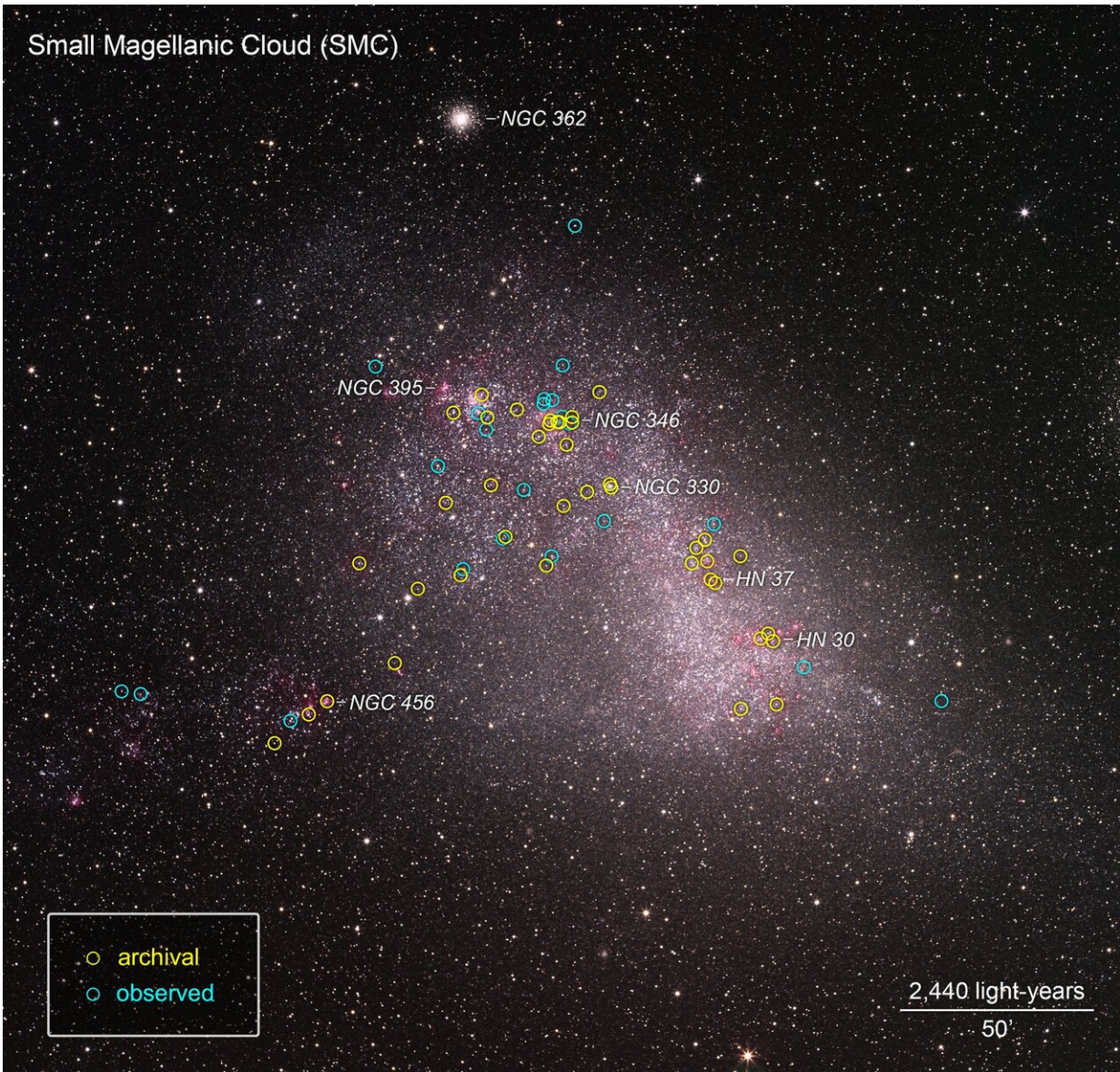
This is a ground-based telescopic photo of the Small Magellanic Cloud (SMC), a satellite galaxy of our Milky Way. The galaxy is one of several select targets of a new initiative with NASA's Hubble Space Telescope called ULLYSES (UV Legacy Library of Young Stars as Essential Standards). The program is looking at over 300 stars to build an ultraviolet-light catalog for capturing the diversity of stars, from young to old. The program's goal is to give astronomers a much better

The Institute is now releasing the first set of ULLYSES observations to the astronomical community. These early targets are hot, massive, blue stars in several nearby dwarf galaxies.

Hubble is located above Earth's atmosphere, which filters out most UV radiation from space before it reaches ground-based telescopes. Hubble's ultraviolet sensitivity makes it the only observatory up to the task because young stars radiate a lot of their energy in the UV as they grow chaotically in fits and starts while feeding on infalling gas and dust.

The program's goal is to give astronomers a much better understanding of the birth of stars and how this relates to everything from planets to the formation and evolution of galaxies. Astronomers want to learn how young low-mass stars affect the evolution and composition of planets forming around them. Intense UV radiation pulls apart molecules and penetrates circumstellar disks, where planets form, influencing their chemistry and affecting how long the disks survive. This has a direct bearing on planet habitability, atmospheric escape, and chemistry. "This unique collection is enabling diverse and exciting astrophysical research across many fields," Roman-Duval said.

In addition, the torrential outflows of hot gas from fully mature stars that are much more massive than our Sun shape their environments in

dramatic ways. By targeting massive stars in nearby galaxies with low abundances in heavy elements, similar to the primitive composition of early galaxies, astronomers can gain insights into how their outflows may have influenced early galaxy evolution billions of years ago.

The design and targets of these observations were selected in partnership with the astronomical community, allowing researchers from around the world to help develop the final program as well as have the opportunity to organize coordinated observations by other space- and ground-based telescopes at different wavelengths of light.

STScI scientific and technical staff are designing software specifically related to the development of databases and web interfaces to ensure wide access to the library by the astronomical community. Tools for high-level science products and spectroscopic analysis are being developed. All of the data are stored in STScI's Mikulski Archive for Space Telescopes (MAST).

The ULLYSES program is building a legacy for the future, creating a comprehensive database that astronomers will use for research for decades to come. The archive also complements the portions of the star-formation story that will soon be obtained with infrared-light observations from NASA's upcoming James Webb Space Telescope. Working together, both Hubble and Webb will provide a holistic view of stars and the star-formation history of the universe.

Provided by ESA/Hubble Information Centre