The NPP PostDocument

NASA Postdoctoral Program Quarterly Newsletter

Volume 2, Issue 2 - July 2018

NASA POSTDOCTORAL PROGRAM

Administered by

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Universities Space Research Association

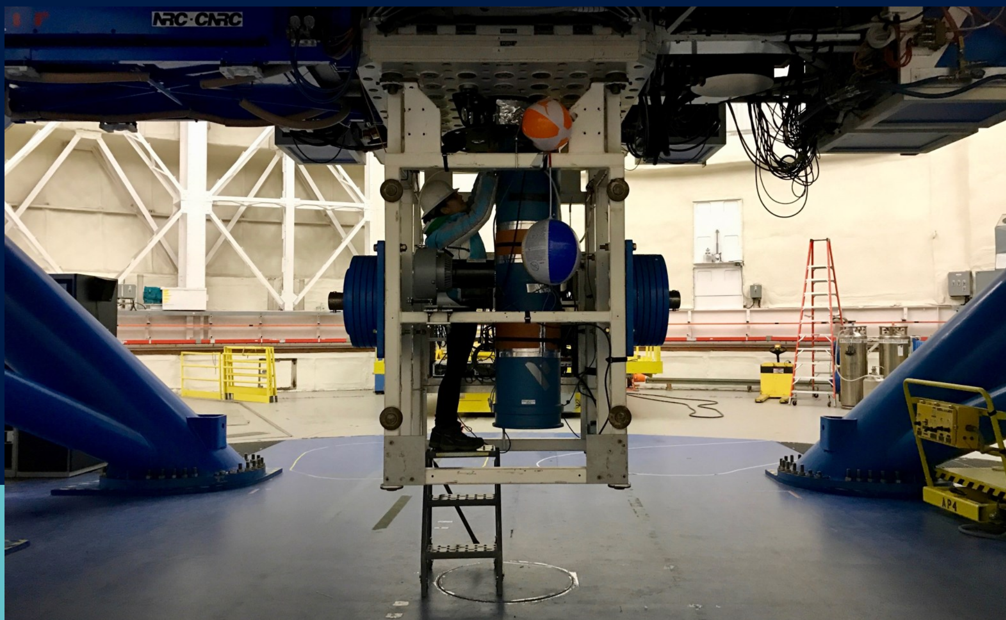


Image caption: Dr. Rohini Giles adjusts an instrument mounted on the Gemini North Telescope as part of her research on Jupiter in support of the Juno Mission.

Spotlight on Dr. Rohini Giles

Jet Propulsion Laboratory

Career Days in schools across the world boast little girls with pigtails in makeshift white lab coats with a toy stethoscope around their necks and a stuffed animal tucked safely under their arms proudly proclaiming their dreams to one day be a veterinarian, others don athletic uniforms and vow to play for their favorite professional sports team. The variety continues with the child-size business suits lugging around oversized briefcases with "lawyer" neatly printed on their nametags, and scuffed boots and worn overalls over tractor-branded t-shirts identifying the aspiring farmers in the group.

In those days, Dr. Rohini Giles might have carried around a mini chalkboard with scribbled equations to convey her intent to become a mathematician. Little did she know that her career one day would involve a hard hat and a dormant volcano.

IT'S ALL ABOUT JUPITER

A far cry from a chalk-dusted mathematician, Dr. Giles studies atmospheres of planets in our solar system. She works in a research group that studies all of the giant planets, but at the moment, she is focused on Jupiter. Why is Jupiter all the rage these days?

NASA launched the spacecraft Juno from Cape Canaveral, Fla., on Aug. 5, 2011. It reached Jupiter in July of 2016. The spacecraft is set to orbit Jupiter until 2021, circling the planet in 53-day orbits, skimming to within 3,100 miles above the planet's cloud tops. The main goal of the mission is to form a deeper understanding of Jupiter's atmosphere and general makeup. Read more here: https://www.nasa.gov/mission_pages/juno/overview/index.html

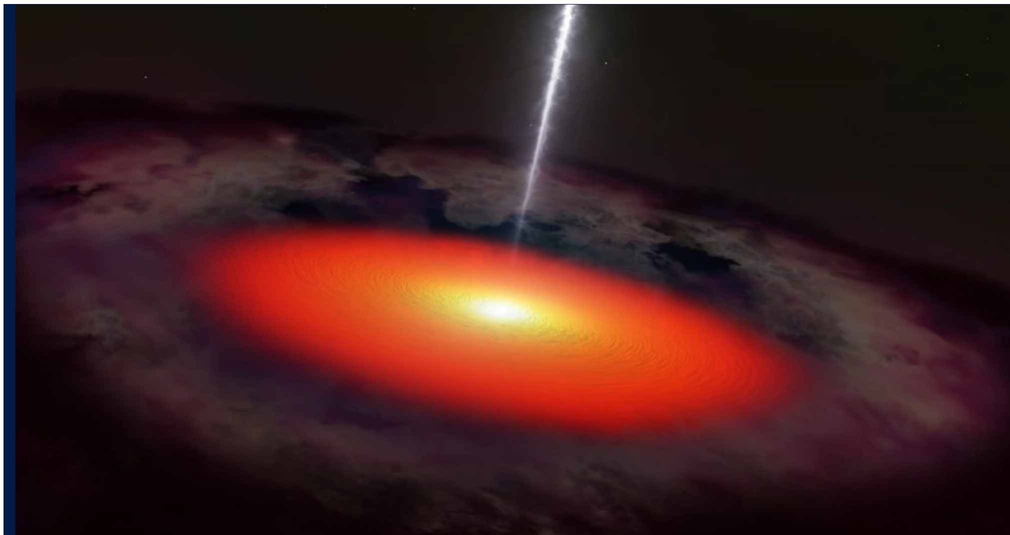
"What I do is directly in support of the mission," says Dr. Giles. "We take ground-based observations from NASA's Infrared Telescope Facility and the Gemini North telescope at similar times to the Juno perijoves [points in the orbit of the satellite nearest to Jupiter's center] in order to provide contextual information for the people who are then studying the data from the mission itself."

The images from the telescope are at a very high spatial resolution and provide a global view of Jupiter's entire disk. "I can see all of these really intricate cloud structures," says Giles, "They are quite different to the data from the spacecraft, which can only see a small part of the planet at a time. It's useful for the Juno Team to see how their observations fit into the global picture of Jupiter and that's what our observations provide.

"As well as supporting the Juno mission, I use the observations of Jupiter to measure the chemical composition of the planet's atmosphere and its cloud structure.

This Issue

Continued on page 3



The discovery of a high-energy neutrino on Sept. 22, 2017, sent astronomers on a chase to locate its source -- a sueprmassive black hole in a distant galaxy. NASA's Goddard Space Flight Center

Have Travel Questions?

Refer to the NPP Travel Manual

https://npp.usra.edu/shared/program/npp/pdfs/NPP_Travel_Manual_FINAL.pdf

In your Fellow Portal. Go to Main Menu > My Travel Requests > NPP Travel Manual

Sara Buson's Data Analysis Helps Locate extragalactic source of "ghost particles"

Goddard Spaceflight Center

Since the very beginning of her science carrier, Dr. Buson's research has focused on the most violent phenomena and powerful objects in our Universe, such as active galactic nuclei (AGN). To conduct her research she has been using the NASA Fermi Large Area Telescope, a broad field-of-view, pair-conversion telescope sensitive to gamma-rays. Dr. Buson has been looking to our Universe from different angles, combining the information encoded in the different means available from Nature: electromagnetic signals, especially gamma rays, elusive astrophysical neutrinos and, ultimately, linking these two messengers to the "cosmic monsters" responsible for the extremely energetic particles that constantly hit Earth from deep in outer space, the so called "cosmic rays". Cosmic rays are charged subatomic particles that represent a puzzle for astronomers. They can reach energies up to 100 million times greater than any attained by human-made particle colliders, such as CERN's Large Hadron Collider. In extreme cases, a single cosmic ray particle, despite its microscopic size, can carry as much momentum as a Major League fastball. Their birthplaces are thought to be the most violent astrophysical environments known in our Universe, e.g. stars collapsing into a black hole (gamma-ray bursts), expanding shock waves generated in supernovae remnants, flows of particles blasted/swallowed by supermassive black holes at the centers of active galaxies. However, the sources of these cosmic rays have been yet a century-old mystery. When these particles wander throughout our galaxy and hit Earth, their paths are bent by the magnetic fields of the Sun and Earth so that the information about their origin gets lost.

The same sources from which these highly energetic cosmic rays originate produce other types of particles: neutrinos and gamma-rays. Neutrinos and gamma-rays are neutral and can travel unimpeded throughout space. As a matter of fact, these two messengers point straight back to their origin and can be used to trace the intergalactic pace back, revealing their emitter. However, gamma-rays and neutrinos can be produced independently, and in different processes unrelated to cosmic rays.

NEWSWORTHY

Check out Michael Irving's coverage of the story in New Atlas on July 12, 2018.

Neutrinos Linked With Cosmic Source for the First Time by Katia Moskvitch with Quanta Magazine

Catching both the accompanying gamma-rays and neutrino at the same time, shot from the same direction in the sky is the smoking gun to identify the objects responsible for cosmic rays. This will tell astronomers the exact sky locus where to spot the cosmic monster.

Neutrinos are nearly massless, ghostly particles that rarely interact with matter and, as such, challenging to detect. Since it became operational in 2010, only a few high-energy (>TeV) neutrinos got trapped in the world's largest neutrino detector, i.e. the IceCube Observatory at the South Pole. None of those however has been capable of providing useful insights about its astrophysical origin as no accompanying gamma-rays were detected. The exiting detection happened on September 22, 2017, at 4:54 p.m. EST, when a high-energy neutrino was detected by the sensors of IceCube and, soon after, its sky-localization was found positionally consistent with a known Fermi-LAT gamma-ray AGN, i.e. TXS 0506+056. This triggered an intensive series of follow up observations throughout the whole electromagnetic spectrum.

In her latest work, Dr. Buson's has conducted a detailed investigation to determine the chance probability that the gamma-ray source and the neutrino could actually be related. Carried out in collaboration with IceCube and several other astronomer teams, the work will be published by Science, and the result announced by a National Science Foundation (NSF) press conference planned on July 12. The outcome of this investigation points out a suggestive hint favoring the physical connection of the high-energy neutrino to the gamma-ray AGN. After an almost century-old hunt, the galaxy TXS 0506+056 is the first extragalactic object that astronomers may have been able to link to both neutrinos and gamma-rays and, possibly, to cosmic rays.

Pictured : Sara Buson