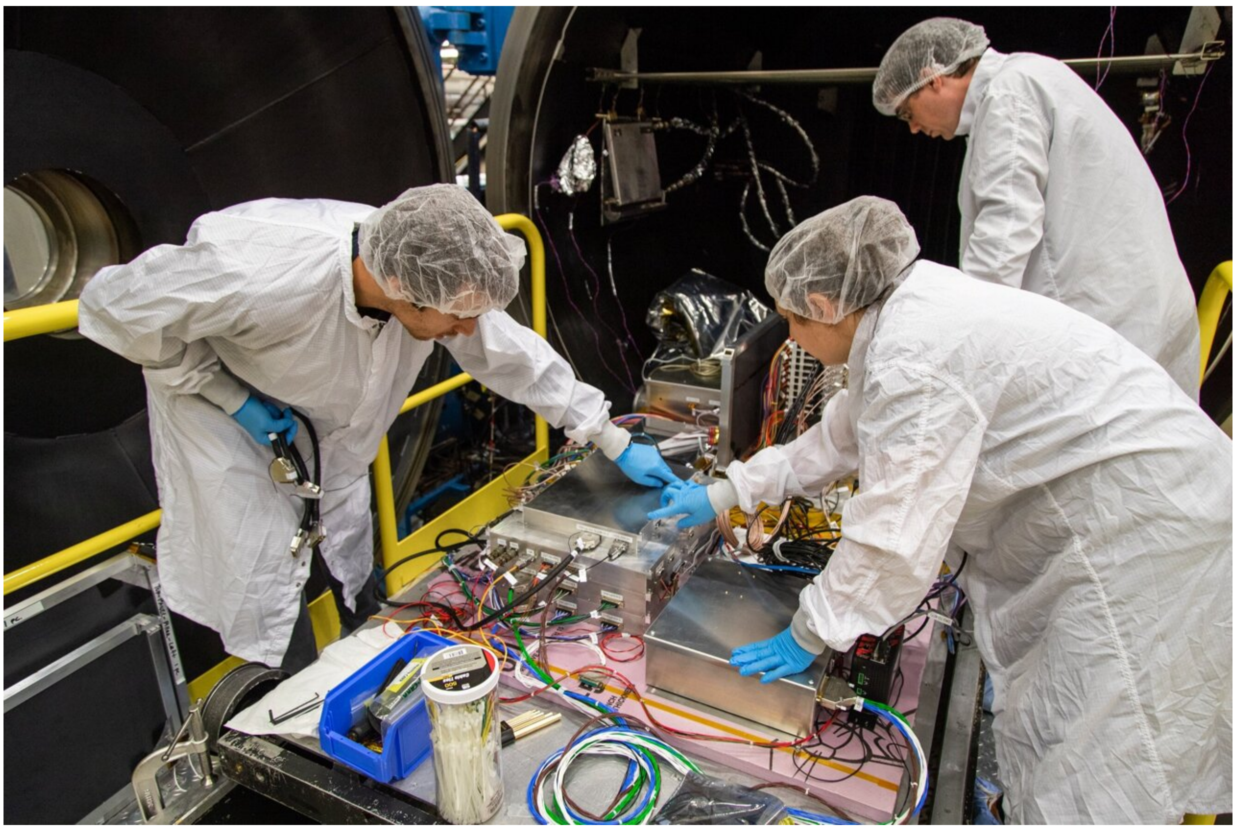
NASA's ComPair gamma-ray hunting mission prepares for balloon flight

July 20 2023, by Jeanette Kazmierczak



Team members work on the ComPair balloon instrument before it begins thermal vacuum chamber testing at NASA's Goddard Space Flight Center in Greenbelt, Maryland. ComPair project manager Regina Caputo (front right), graduate student Nicholas Kirschner (George Washington University, left), and research scientist Nicholas Cannady (University of Maryland Baltimore County, rear) examine ComPair's various components to determine what needs to be "harnessed," or connected via cable to power systems and the onboard computer. Credit: NASA's Goddard Space Flight Center/Scott Wiessinger

Engineers and scientists have shipped NASA's ComPair instrument to Fort Sumner, New Mexico, ahead of its scheduled August flight early in NASA's 2023 fall balloon campaign.

ComPair's goal is to test new technologies for studying gamma rays, the highest-energy form of light. It was assembled and tested at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

"The gamma-ray energy range we're targeting with ComPair isn't well covered by current observatories," said Carolyn Kierans, the instrument's principal investigator at Goddard. "We hope that after a successful balloon test flight, future versions of the technologies will be used in space-based missions."

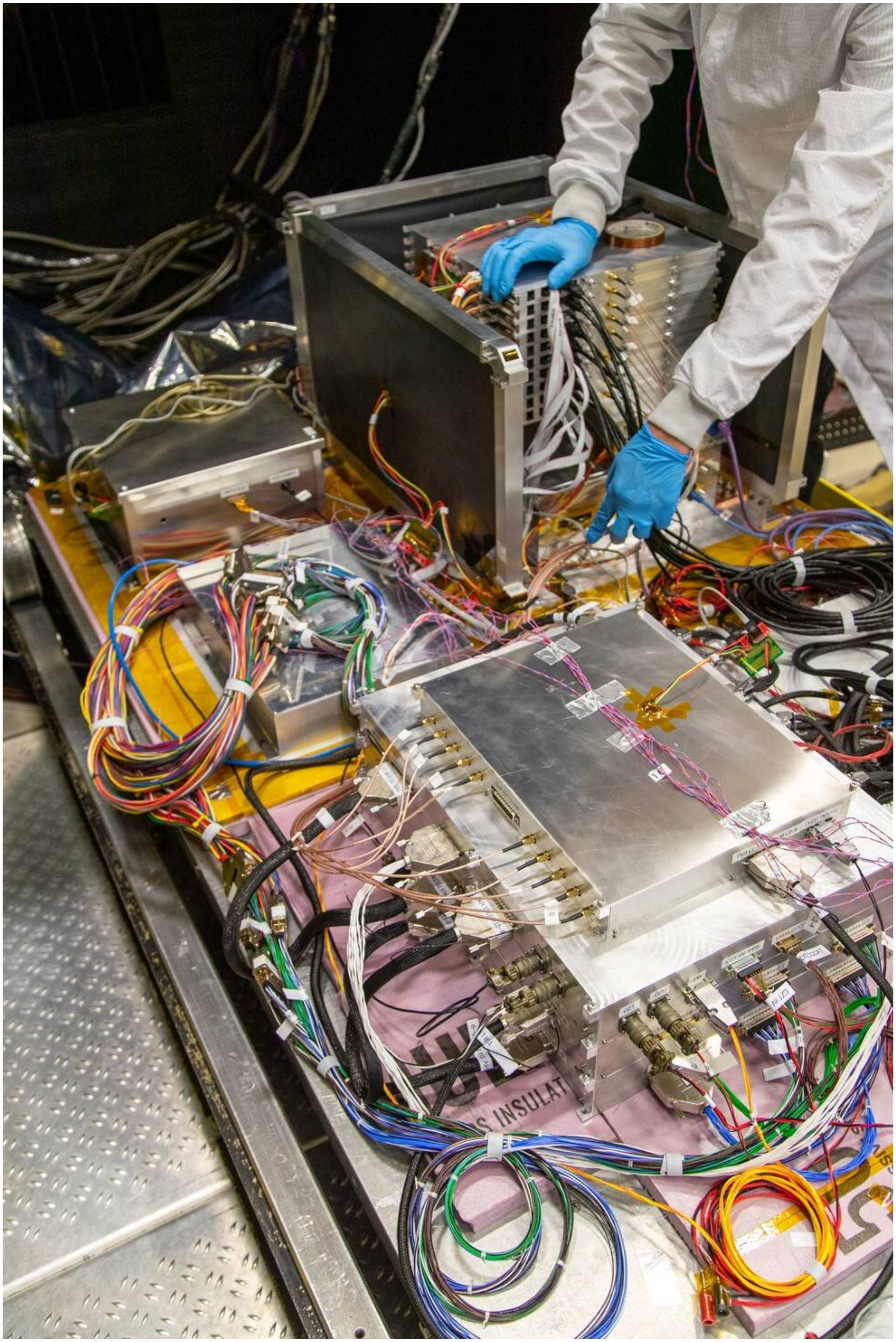
ComPair is designed to detect gamma rays with energies between 200,000 and 20 million electron volts. (For comparison, the energy of visible light is 2 to 3 electron volts.) Supernovae and gamma-ray bursts, the most powerful explosions in the cosmos, glow brightest in this range, as do the most massive and distant active galaxies, which are powered by supermassive black holes. Scientists know this because they see a fraction of the light emitted by these galaxies with NASA's Fermi Gamma-ray Space Telescope, which observes higher-energy gamma rays.

ComPair team members prepare the instrument for thermal vacuum testing. Once closed, the chamber will begin to simulate conditions the mission will experience during its balloon flight, which will take it to about 133,000 feet (40,000 meters), or nearly four times the cruising altitude of a commercial airliner. Credit: NASA's Goddard Space Flight Center/Scott Wiessinger

ComPair gets its name from the two ways it detects and measures gamma rays: Compton scattering and pair production. Compton scattering occurs when light hits a particle, such as an electron, and transfers some energy to it. Pair production happens when a gamma ray grazes the nucleus of an atom. The interaction converts the gamma ray into a pair of particles—an electron and its antimatter counterpart, a positron.

The ComPair instrument has four major components:

- A tracker containing 10 layers of silicon detectors that determines the positions of incoming gamma rays
- A high-resolution calorimeter that precisely measures lower-energy Compton-scattered gamma rays
- Another calorimeter that measures the higher-energies of electron-positron pairs
- An anticoincidence detector that notes the entry of high-energy charged particles called cosmic rays, allowing ComPair's other instruments to ignore them



A member of the ComPair team places a hand atop the instrument. ComPair contains four main components: the tracker, a high-resolution low-energy calorimeter, a high-energy calorimeter, and an anticoincidence detector. The tracker and calorimeters are stacked on top of each other and study gamma rays. The anticoincidence detector notes the entry of high-energy charged particles called cosmic rays, allowing ComPair's other detectors to ignore them. Credit: NASA's Goddard Space Flight Center/Scott Wiessinger

The mission team assembled all the components and tested them in a large thermal vacuum chamber at Goddard to assess how they'll function at balloon altitudes. The next step is to fly the instrument. The flight will carry ComPair to a height of about 133,000 feet (40,000 meters), or nearly four times the cruising altitude of a commercial airliner.

ComPair will piggyback with one of the primary balloon payloads that will fly during NASA's annual Fort Sumner balloon campaign. NASA's scientific balloons offer frequent, low-cost access to near-space to conduct scientific investigations and technology maturation in fields such as astrophysics, heliophysics, and atmospheric research, as well as training for the next generation of leaders in engineering and science.

ComPair is a collaboration among Goddard, the Naval Research Laboratory in Washington, Brookhaven National Laboratory in Upton, New York, and Los Alamos National Laboratory in New Mexico.

Provided by NASA's Goddard Space Flight Center mission-balloon.html