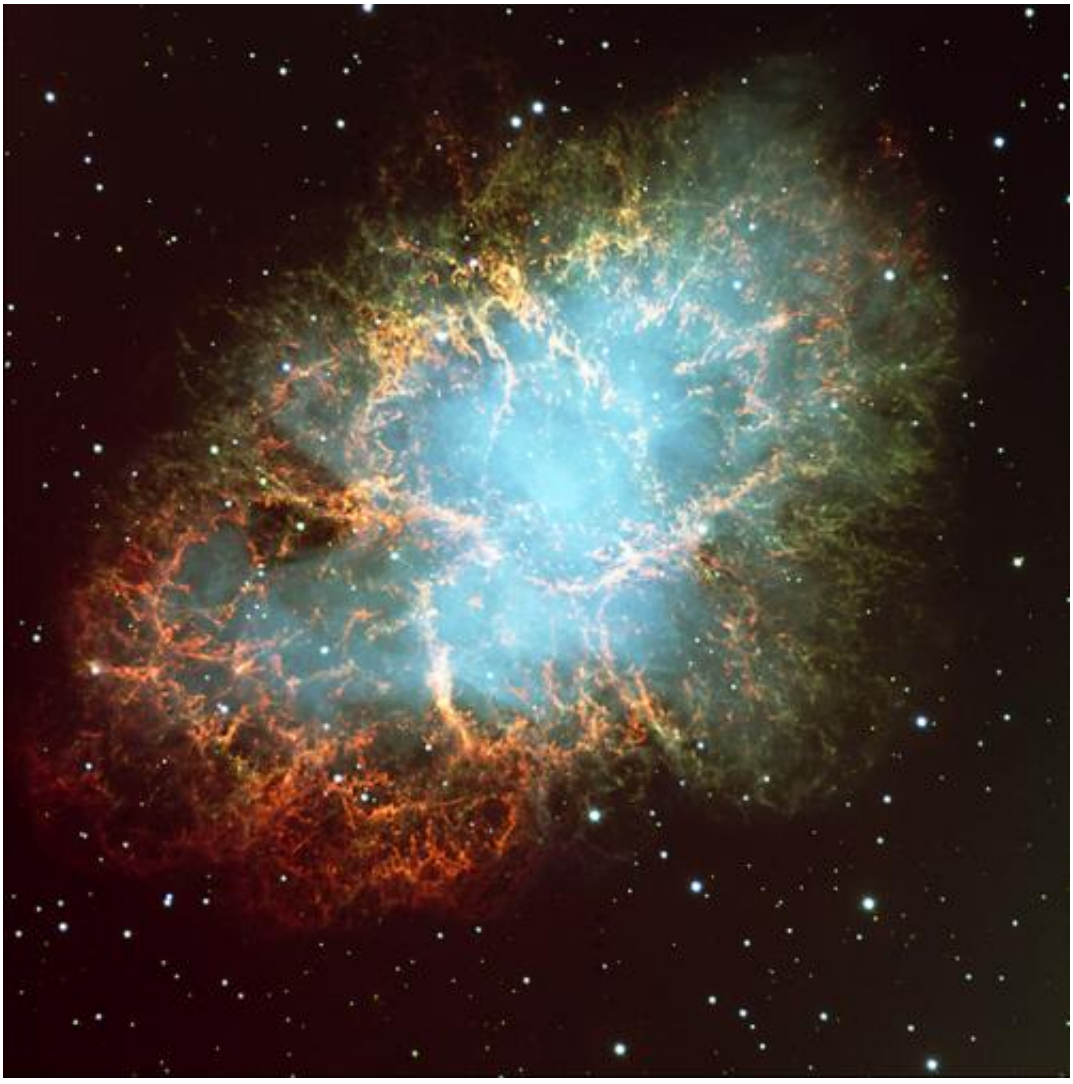
Highest energy photons ever recorded coming from Crab Nebula

June 26 2019, by Bob Yirka



The Crab Nebula. Credit: NASA

A very large team of researchers affiliated with several institutions in China and Japan has measured the highest energy photon ever recorded. In their paper published in the journal *Physical Review Letters*, the group describes their study of data from the Tibet Air Shower Gamma Collaboration and what they found.

The Tibet Air Shower Gamma Collaboration is an observatory in the Tibetan Plateau and the people that run it. It consists of 600 particle detectors built on a 65,000-square-meter parcel of land. Its objective is to detect subatomic particles emanating from space. The detectors there observe the debris from photons colliding with particles in the Earth's atmosphere and cosmic rays, which are mostly protons and atomic nuclei. The team members with this new effort were focused on photons that make their way to Earth from far-off places. To measure them, the researchers excluded muon detections, leaving only particles associated with photon collisions. The researchers were able to calculate the energy of a given photon using data from the particles that it struck.

The researchers report that they found what they believe to be 24 photon-initiated showers, with photon energies above 100 trillion electron volts—one of which registered 450 TeV. These finds represent the first measurements of high energy photons over 100 TeV and the highest ever recorded.

The researchers also used the data from the collaboration to track the paths of the photons, and found they originated in the Crab Nebula, the remains of a supernova that was first observed in 1054 AD. The Crab Nebula is located in the Perseus Arm of the Milky Way, approximately 6,500 light years away.

The research team has been studying high-energy photons that make their way to Earth as part of an effort to understand why they have so much energy. Current theory suggests that the photons get their energy

from other high-energy particles via inverse Compton scattering, in which photons absorb the energy of high-energy particles when they collide, for example, during supernovae. The photons themselves are believed to have been created by processes involved in the Big Bang.

More information: M. Amenomori, et al. First detection of photons with energy beyond 100 TeV from an astrophysical source, *Physical Review Letters* (2019). journals.aps.org/prl/abstract/ … ysRevLett.123.051101 ,

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