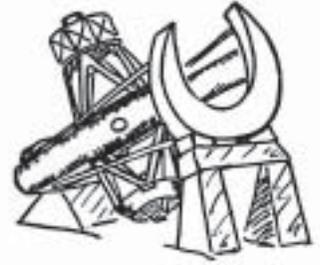


The Big Eye



The Newsletter of the Friends of Palomar Observatory Vol. 3, No. 3

Edwin Hubble Honored

On March 6th astronomer Edwin Hubble was honored by the U.S. Postal Service as a part of their American Scientists stamps series. Also immortalized was theoretical physicist John Bardeen, biochemist Gerti Cori and structural chemist Linus Pauling.

Here is the description that the U.S. Postal Service provided for Hubble: *Astronomer Edwin Hubble (1889-1953) played a pivotal role in deciphering the vast and complex nature of the universe. His meticulous studies of spiral nebulae proved the existence of galaxies other than our own Milky Way, paving the way for a revolutionary new understanding that the cosmos contains myriad separate galaxies, or "island universes."*



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Most of the great successes of Hubble's career were achieved not at Palomar but at Mt. Wilson. So it is only fitting that the dome of the 100-inch Hooker Telescope be shown behind him. The "spiral nebulae" referred to in the USPS description are what modern astronomers refer to as spiral galaxies.

Back in the 1920s no one was certain if they were part of our own Milky Way Galaxy or separate galaxies unto themselves. In 1923 Hubble used the 100-inch telescope to resolve and measure Cepheid variable stars in the Andromeda Galaxy (M31). Cepheid stars vary in brightness in a regular way that is directly proportional to their brightness. Once it is known how bright they really are and how bright they appear, it is possible to determine their distance.

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A Shot in the Dark

A team of astronomers has discovered a cosmic explosion that seems to have come from the middle of nowhere — thousands of light-years from the nearest galaxy-sized collection of stars, gas, and dust. This "shot in the dark" is surprising because the type of explosion, a long-duration gamma-ray burst (GRB), is thought to be powered by the death of a massive star.

"Here we have this very bright burst, yet it's surrounded by darkness on all sides," says Brad Cenko of the California Institute of Technology, Pasadena, Calif., lead author of the team's paper, which has been accepted for publication in *The Astrophysical Journal*. "The nearest galaxy is more than 88,000 light-years away, and there's almost no gas lying between the burst and Earth."

The blast was detected on January 25, 2007, by several spacecraft of the Inter-Planetary Network. Observations by NASA's Swift satellite pinpointed the explosion, named GRB 070125 for its detection date, to a region of sky in the constellation Gemini. It was one of the brightest bursts of the year, and the Caltech/Penn State team moved quickly to observe the burst's location with ground-based telescopes.

Using the team's robotic 60-inch telescope at Palomar Observatory in Calif., the astronomers discovered that the burst had a bright and fast-fading afterglow in visible light. This prompted them to observe the afterglow in detail with two of the world's largest telescopes, the 8-meter Gemini North telescope and 10-meter Keck I telescope, both near the summit of Hawaii's Mauna Kea.

What came next was a total surprise. Contrary to experience with more than a hundred previous GRBs, Gemini spectra revealed no signs of dense gas and dust absorbing the light of the after-glow.

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A trace of magnesium revealed that the burst took place more than 9.4 billion years ago, as deduced by the shift in wavelength of the afterglow's light, and that the surrounding gas and dust was more tenuous than the environment around any previous burst.

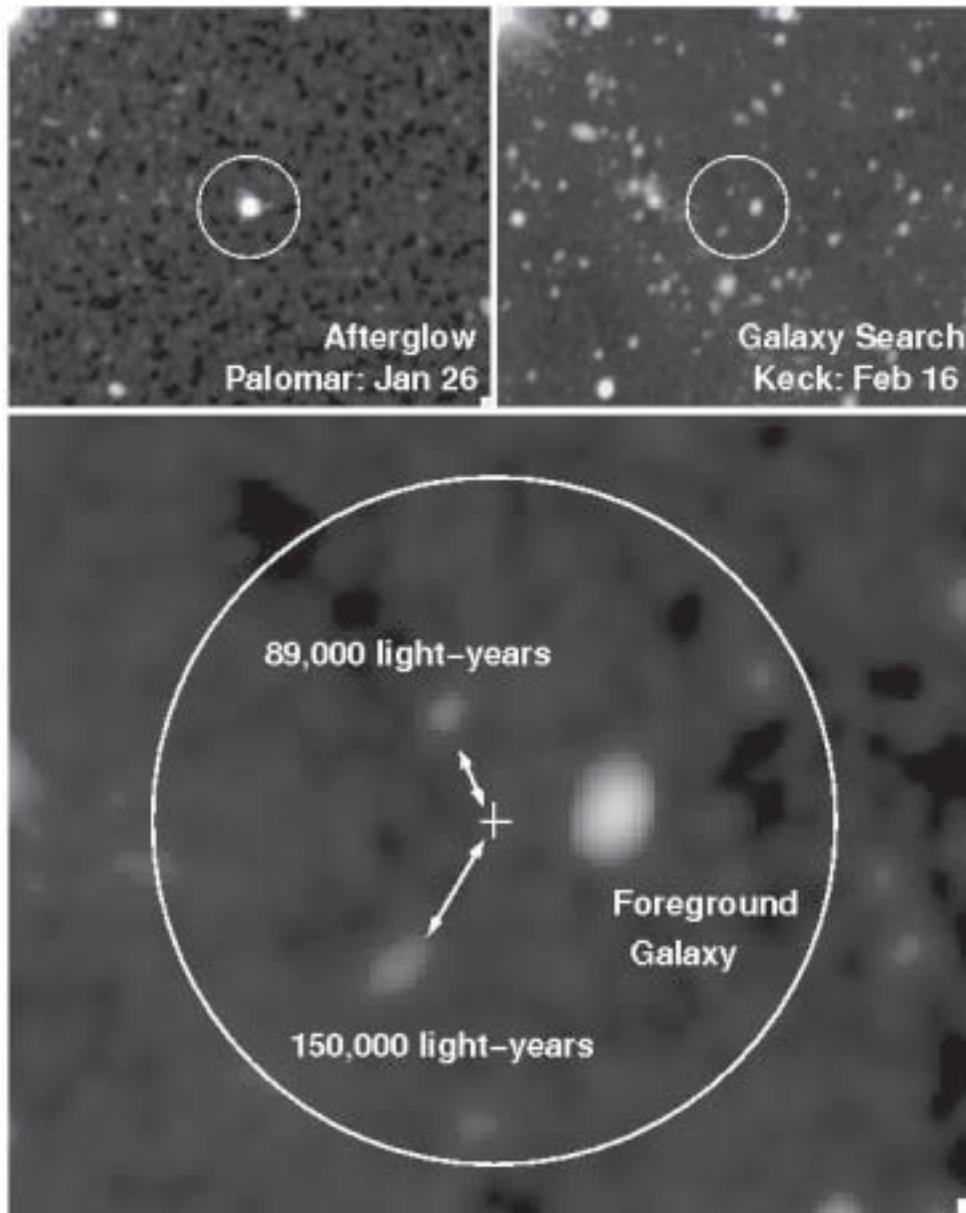
To further pin down the environment that could produce such an unusual explosion, the group obtained Keck images of the location of GRB 070125 long after its afterglow light had faded away. Surprisingly, the resulting images showed no galaxy at this location. "A Keck image could have revealed a very small, faint galaxy at that distance," says coauthor Derek Fox of Penn State. Astronomers have amassed a great deal of evidence that GRBs are triggered by the explosive deaths of massive stars, which live very short lives. Because of their short lifespans, massive stars don't have time to wander far from their birthplaces, usually dense clouds of gas and dust inside respectable-size galaxies. So GRB 070125 raises the perplexing question of how a massive star could be found so far away from any galaxy.

"Big stars live fast and die young, without much time to move around," says Fox. "So if this massive star died far away from any galaxy, the key question is, how did it manage to be born there?" The formation of massive stars requires similarly massive aggregations of gas and dust, which are usually found in bright galaxies.

One possibility is that the star formed in the outskirts of an interacting galaxy, as seen in the famous Hubble Space Telescope picture of the "Tadpole" galaxy, UGC 10214. "In the local universe, about one percent of star formation happens in tidal tails, on the outskirts of two interacting galaxies," says Cenko. "So it might even make sense to find one in 100 gamma-ray bursts in such an environment."

If this idea is correct, it should be possible to detect the tidal tail hosting GRB 070125 by taking a long exposure with the Hubble Space Telescope. "That's definitely our next stop," says Cenko.

"Many Swift discoveries have left astronomers scratching their heads in befuddlement," adds Swift lead scientist Neil Gehrels of NASA Goddard Space Flight Center in Greenbelt, Md. "But this discovery of a long GRB with no host galaxy is one of the most perplexing of all."



A mysterious shot in the dark revealed by Palomar's 60-inch Telescope

Palomar Stories: Ben Traxler

Most of the people from the early years at Palomar are no longer around to tell their stories in person but we can keep the stories alive by continuing to share them with others.

One character in Palomar history is Ben Traxler. He did a variety of jobs at the observatory. In the early days of building the dome and telescope, the visitors gallery was built for people who wanted to come up and get a glimpse of the world's largest telescope as it was being built. Before the glass was put in place in the visitors gallery, it was enclosed with chicken-wire. The visitors asked so many questions of the workers that they were distracted from the complex tasks at hand. Finally Ben Traxler, after being interrupted numerous times, put a neatly printed sign on the outside of the enclosure that read:

**DON'T TALK TO THE PRISONERS
ASK THE GUARD**

On another occasion, Ben Traxler along with Olin Wilson passed the time by crafting a sign that they put on the concrete replica of the mirror that is still located outside the back door of the dome that said:

**THIS FLYING SAUCER, DRAWN HERE BY THE GREAT LIGHT-GATHERING POWER OF THE
TWO-HUNDRED INCH TELESCOPE, HAS BROUGHT VISITORS FROM OTHER WORLDS WHO
ARE CURRENTLY GUESTS OF THE GOVERNMENT**

However, a women visitor fled to the Forest Service office down the mountain, demanding to be protected from the spacemen and the sign by the concrete disc was taken down.

Ben Traxler was an Electrician but also the Night Assistant, which is the official title of the telescope operator, at the 200-inch telescope. Edwin Hubble had showed up at Palomar in January 1949 to take the first images in this telescope. He brought his favorite guiding eyepiece with him from Mt. Wilson. The eyepiece lacked an illuminating light so Ben Traxler offered to install one inside the eyepiece for him. He drilled the barrel of the eyepiece and carefully mounted a small light. When he was finished, he wiped out the brass shavings inside the eyepiece with a cloth, also wiping off the crosshairs on the lens by mistake.

This rendered the eyepiece unusable and Dr. Hubble was Aghast! There wasn't time to return to Mt. Wilson to get another eyepiece before this observing session. Ben remembered hearing that opticians have used spiderwebs for crosshairs in eyepieces. He went to his garage, found a black widow spiderweb, and used those strands to make new crosshairs. He glued then in place with one strand stretched tight but the other crossed it in a bit of a drunken manner. It wasn't perfect but the eyepiece was usable. Those same raunchy crosshairs were still in use several months later when he peered into the eyepiece that Edwin Hubble had brought with him.

This Palomar Story, like the one on John Strong in the last issue, was adapted from *The Perfect Machine*, by Ronald Florence – on sale in the Observatory Gift Shop.



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Hubble found that the Cepheids in M31, and thus the galaxy itself, are 1 million light-years distant. (Modern figures put the distance at 2.9 million light years.) The only conclusion was that M31 and the other "spiral nebulae" were separate galaxies, completely distinct from our Milky Way. Hubble pushed the bounds of known space even further with his 1929 discovery that the universe is expanding. This had a profound influence on cosmology and was the first clue pointing towards the Big Bang.

If you are interested in reading about the life of Edwin Hubble Gale E. Christianson's Hubble biography *Edwin Hubble: Mariner of the Universe* is highly recommended.

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