Nova Cygni 1975: Astronomers' busy weekend

Anything new in the sky excites astronomers. A nova, by definition something new, is a kind of stellar explosion in which a previously faint or invisible star suddenly becomes very bright. Over the last weekend in August a particularly bright one—unprecedented in its rise in brightness—blew off in the constellation Cygnus. A previously invisible star suddenly flared to millions of times its former brightness and was easily visible to the unaided eye in the nighttime sky.

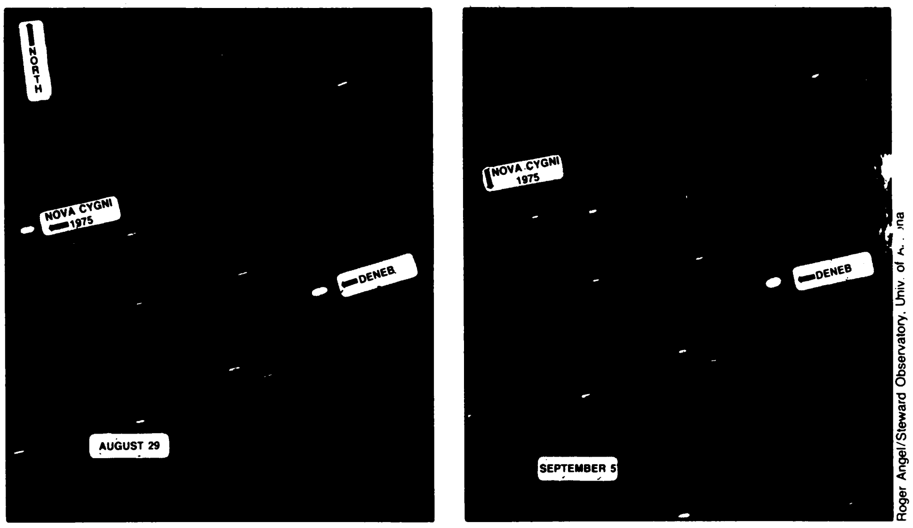
The first news of the nova came from Minoru Honda of Kurashiki, Japan. On Aug. 29 his report was cabled to the Smithsonian Astrophysical Observatory, which operates Astronomical Telegrams, the astronomers' express information network, by K. Osawa, director of the Tokyo Astronomical Observatory. Yet it should be remembered, as Brian G. Marsden points out in International Astronomical Union Circular 2826, that ". . . many hundred independent discoveries . . . must have been made of the nova during the 24 hours following its rise to naked-eye brightness . . . ."

But it was Osawa's telegram that started the wires humming, and in all the world's astronomical observing centers, telescopes were turned toward Nova Cygni 1975. By Sept. 2, when Marsden put out the first circular on the nova, dozens of reports had come in. Even as late as Sept. 5, Marsden told SCIENCE NEWS, "I've hardly had any rest since that nova blew off." Reports came from such far-flung locations as Dushanbe, capital of the Tadzhik Soviet Socialist Republic in central Asia; Norway; Tel Aviv; Saskatoon; Arecibo, and of all places, Thunderbolt, Ga.

The Cygnus object was unusually bright even for a nova. "It is certainly an unusual object," observes Roger Angel of the University of Arizona. It is so unusual that some early observers thought it might be a supernova (among them C. de Vegt, U. K. Gehlich and Lubos Kohoutek of the Hamburg Observatory), but spectra that were obtained by the second or third day of observation look typical of a nova. The nova reached a peak brightness better than second magnitude, brighter than Polaris, the Pole star. One observer, P. Tempesti of the Collurania Observatory in Teramo, Italy, put it at 1.79. This is brighter than all but 30 stars in the entire sky.

Attempts to detect radio emission at 10.6 gigahertz using the 46-meter telescope of Canada's Algonquin Radio Observatory and a look for X-ray emission by the United Kingdom's Ariel satellite found nothing significant.

Searchers of sky survey charts at the



Nova Cygni 1975 and how it faded from peak brightness (Aug. 29). Compare Deneb.

nova's location (right ascension 21 hours 9 minutes 52.85 seconds, declination +47 degrees 56 minutes 41.3 seconds) fail to find anything visible before the nova down to 20 or 21 magnitudes.

Thus at peak brightness the nova had risen about 19 magnitudes and possibly more. This means it had flared to at least 40 million times its former brightness. (Each change of one magnitude multiplies brightness by 2.512.)

According to Luigi Jacchia of the Smithsonian Astrophysical Observatory, this is the greatest rise in brightness ever recorded for a nova. One which exhibited nearly the same change was Nova CP Puppis in 1942, which rose 16.5 magnitudes (4 million times) at least. Jacchia suggests that the great change in brightness indicates that both of these may be virgin novas, blowing off for the first time.

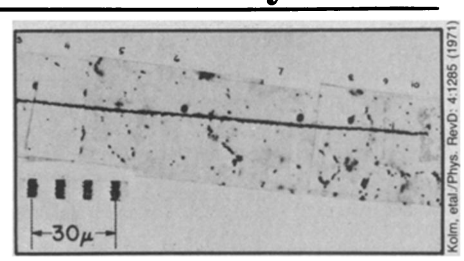
Unlike a supernova, which puts an end to star's life, novas may happen cyclically in the life of star. The theoretical picture, according to Jacchia, is that novas happen to stars in extremely close binaries, stars of the class named for W Ursae Majoris.

The two members of the binary are so close that they distort each other's shapes, and matter flows from one to the other. The star that becomes a nova is a dark star that has just about finished burning its supply of hydrogen. A new supply of hydrogen falls on it from its companion, but that hydrogen is on the outside, not in the middle as it should be for properly controlled burning. "God knows what can happen then," says Jacchia. "Suddenly the hydrogen can ignite, and that may cause an explosion."

The nova flares up and then settles back to roughly where it was. The 1942 nova settled back to about 14 magnitudes below maximum. Nova Cygni 1975 began dropping off at about one magnitude a day. By Sept. 5, a week after its first appearance, it was down to the limits of naked-eye sight, about sixth magnitude, but the fading rate had slowed to half a magnitude a day. It usually takes years for a nova to get back to where it started. When it does the cycle can begin again. The time period can range from a generation or so for novas that change only a few magnitudes to 10,000 or 100,000 years for those like Puppis or Cygni. □

Monopole claim: Storm of scrutiny

The four physicists who published a claim to the discovery of a magnetic monopole (SN: 8/23-30/75, p. 118) now find themselves the center of a raging storm of dubiety. They expected this when they published, and they meet it good naturedly. One of them, P. Burford Price of the University of California at Berkeley (the others are Edward K. Shirk of Berkeley and Weymar Zack Osborne and Lawrence S. Pinsky of the University of



Part of the emulsion track that Kolm once suspected might be a monopole.

Houston), started a lecture in Washington last week by inviting the audience to interrupt at will: "I've had a fair amount of experience in the last two weeks dealing with hecklers."

They knew it would happen when they made such an epochal claim on the basis of a single track in a cosmic-ray detector. A magnetic monopole would be a particle carrying an elementary unit of magnetic charge. Its existence would open a whole new range of physics, but it is something in which most physicists have been unwilling to believe.

Crucial to the argument that it was a monopole is the appearance of the track in a block of photographic emulsion and the rate at which the object performed ionizations in the stack of Lexan plastic sheets that made up the bulk of the detector. The appearance of the emulsion track determines speed. Osborne says this particle had half the speed of light, or possibly slightly less.

A magnetic particle going through Lexan should ionize at the same rate all the way down so that a graph of ionization against depth comes out a straight line. The data in this case could be well fit by a straight line.

But there is enough spread in the data points so that Luis W. Alvarez, also of Berkeley, whom Price describes as "the chief devil's advocate," can try to fit them to a zig-zag line he says could have been made by a nucleus that merely did something a little unusual. Alvarez's nucleus starts out as element 78, has a nuclear reaction in the detector losing two protons to become element 76, proceeds along the curve for element 76 a while, then becomes element 73 and zags again. Price admits that such a thing is possible. But he says that if one accepts the emulsion data on the speed, Alvarez's scenario wouldn't hold, because a nucleus of that weight going at half the speed of light would have stopped in the detector. This object didn't.

"Nobody will accept it on that basis," says Henry H. Kolm of the Francis Bitter National Magnet Laboratory at M.I.T. One track in an emulsion simply isn't enough. You can know the average properties of an emulsion extremely well, Kolm points out, but an emulsion isn't perfectly homogeneous, and your one track may have come through an anomalous place. Four years ago Kolm had a track (see photo) that looks much like the Price group's. He got quite excited about it. One expert on emulsion tracks, Hermann Yagoda, was impressed, saying it looked like nothing he had ever seen, but another, P. H. Fowler, said it could have been a helium 3 nucleus. So Kolm refrained from a claim. He no longer uses emulsions, preferring time-off-flight detectors. In the end, Kolm told SCIENCE NEWS, the only sure way to convince people of a monopole is to trap it in something, then extract it and accelerate it with a magnetic field.

Price has something not quite that convincing up his sleeve—a longshot chance that the track was made while the detector was on the ground instead of flying from a balloon. The detector was stored in Houston for four months between the flight and the etching of the tracks. For storage it was cut into three pieces that were stacked on top of each other. The present data came from the middle piece. If matching tracks can be found in the top and bottom pieces, the track was made on the ground. Anything that made that track after coming through the atmosphere has to be a monopole, Price contends.

In spite of the criticism, even the critics seem to hope that maybe this time. . . . Milton G. White of Princeton University, participating in a search for monopoles that go faster than light, says his experiment (at FermiLab in Illinois) will now be modified to look for monopoles at ordinary speeds. And Kolm says, "Someday they may be able to claim it was a monopole on the basis of subsequent observations." □

Seafloor volcanoes and a sunken island

The New England Seamount chain, a line of extinct undersea volcanoes stretching from the continental margin, about 200 miles off Cape Cod, eastward halfway toward the Mid-Atlantic Ridge, offers a tempting site at which to study one of the more fashionable ideas in the plate tectonics view of the earth: the "hotspot theory." The shifting plates of the earth's surface, goes the theory, move across rising hotspots of molten material from deep within the mantle, which leave a tracing of their presence by raising strings of volcanic features such as the Hawaiian Islands or, for that matter, the New England Seamounts. Leg 43 in the travels of the Deep Sea Drilling Project's wide-ranging research vessel, the Glomar Challenger, addressed the question, but came up with a considerably less-than-conclusive answer.

The Challenger's drill team sent its bits into two parts of the chain, the Nashville and Vogel Seamounts, which are about 180 miles apart. The holes penetrated 1,289 and 1,706 feet into the sediments on the seamount's flanks, too shallow to place the dates of the peaks' volcanic origins but deep enough to reveal that both were at least active at about the same time, some 75 to 85 million years ago, and that both have been extinct since then.

Two holes are hardly a complete sampling of the lengthy chain. Their spacing, however, is great enough to make the geologically brief span of time significant. If the hotspot mechanism holds, says an official of the Scripps Institution of Oceanography, which manages the DSDP, the North American continent with its eastward-trailing flank of ocean crust would appear to have been moving very rapidly indeed when it passed over the hotspot. An alternative could be that the chain was volcanically active simultaneously along much of its length (at least the part between the two sampled seamounts), which evokes images of a vast string of volcanoes, hundreds of miles long, together venting the energies of the seething earth through a titanic chasm beneath the widening Atlantic.

During the same leg of its journey, which began at Istanbul, Turkey, and ended at Norfolk, Va., the Challenger discovered a section of submarine ridge believed to be "by far the most deeply subsided former island so far reported from the ocean basins." Angled southwest from the southern edge of the Grand Banks, the ridge yielded shallow-water reef material showing evidence of the ancient presence of rainwater—yet the samples were taken from more than 2.5 miles below sea level. Volcanic rock recovered from the bottom of the sample hole suggests that the ex-island was once an unusually upthrust portion of the Mid-Atlantic Ridge that began its descent through the depths more than 105 years ago.

The long-submerged island may also be important to paleobiologists, who will have an expanded role in the Deep Sea Drilling Project's upcoming International Phase of Ocean Drilling. The core samples reveal that after the island had sunk some 6,000 to 8,000 feet beneath the waves, about 70 to 50 million years ago, it began to be inundated by a steady fall of sediment from the waters overhead containing vast quantities of microscopic organisms called nannoplankton and foraminifera. This rain of now fossilized lifeforms appears to contain a continuous record extending from the late Cretaceous—the time of dinosaurs—into the Tertiary Age. Unlike other such "sediment calendars," both land and sea, which often contain critical gaps, the sediments from the former island may thus reveal clues about the little-known time some 65 million years ago when many species of marine life, as well as dinosaurs, mysteriously became extinct. □

Viking 2 Mars-bound

And then there were two. Viking 2, following replacement of a troublesome antenna assembly, took off from Cape Canaveral Sept. 9, following some 4.8 million miles behind its Viking 1 predecessor on the road to Mars. Due to reach Mars orbit next Aug. 7, Viking 2's lander section is targeted for a region called Cydonia, just south of Mars' north polar hood, where the chance of moisture could bear on the chance for life. □