Sighting of a Supernova

It is the first nearby supernova since the invention of the telescope; astronomers are treating it like the find of a lifetime

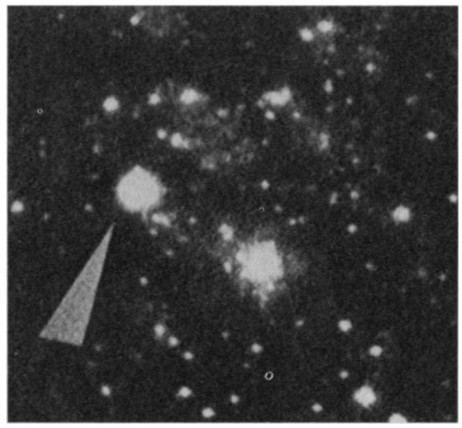
One of the odder quirks of professional astronomers is that they rarely take the time to look at the sky. They rarely need to: most of the objects they study are invisible to the naked eye in any case. Thus, it surprises no one in the field that the discovery of the most waited-for astronomical event in 400 years—the eruption of a nearby supernova—fell to the amateurs.

At the Carnegie Institution's Las Campanas Observatory in the Andes of Northern Chile, for example, Oscar Duhalde, a native Chilean who serves as operator at the observatory's 1-meter telescope, first noticed the supernova shortly after midnight on the night of 23–24 February, when he happened to glance up at the Large Magellanic Cloud. The exploding star had only reached fourth magnitude at the time, which made it relatively dim to the naked eye. But even then it was the brightest single object in the cloud, which is itself one of the landmarks of the southern sky. (Like its companion, the Small Magellanic Cloud, the large cloud is an irregular dwarf galaxy that orbits the Milky Way some 170,000 light-years out.)

Simultaneously, and only a few hundred meters away, Ian Shelton was working at the observatory's seldom-used 25-centimeter telescope. Shelton is not a professional astronomer—he is employed by the University of Toronto to assist researchers visiting the university's 60-centimeter instrument—but he does have a personal interest in astrophotography. As it happens, his project that night was a 3-hour exposure of the Large Magellanic Cloud. And, as it also happens, he decided to develop his plate right away that night instead of waiting.

Six hours later, at 9 a.m. EST, the telegram from Chile arrived at Brian Marsden's office at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts. Marsden is in charge of the Central Bureau for Astronomical Telegrams, which serves as the official clearinghouse for astronomical discoveries. Once a finding is confirmed, he explains, his office alerts astronomical installations all over the world by telegram, telex, printed circulars, and computer mail.

In this case, confirmation was not a problem. "Almost simultaneously with the news from Chile, we got a call from the Australians," Marsden says. An amateur astronomer in Nelson, New Zealand, Albert F. C. D. Jones, had seen the eruption while scanning for variable stars and supernovas in the region of 30 Doradus, a huge region of ionized gas and active star formation located in the cloud. Jones, who has been monitoring variable stars since the end of World War II, immediately notified the head of the Variable Star Association of the Royal Society of New Zealand, who in turn notified the Anglo-Australian Observatory in New South Wales.



The Large Magellanic Cloud: 26 February 1987. *In this image, released by the Cerro Tololo Interamerican Observatory, supernova 1987A is indicated by an arrow. Just to the right is the diffuse nebula 30 Doradus.*

With confirmation in hand, Marsden accordingly sent out the formal alert—although by this time, the informal word was already spreading through the community with galvanizing speed.

Supernovas per se are nothing new, of course. Indeed, they are quite common in the universe, arising in at least two different situations. In Type I supernovas, a white dwarf pulls in matter from a normal companion star until the mounting density and pressure triggers a runaway thermonuclear explosion. In the less common and somewhat dimmer Type II supernovas, a very hot, massive young star consumes all its hydrogen fuel, becomes unstable, and destroys itself.

Either way, supernovas are responsible for creating most of the heavy elements in the universe by violent nucleosynthesis, as well as for roiling and energizing the interstellar medium. Astronomers have found that the Milky Way is littered with expanding shells of gas from ancient supernovas. And they have observed active supernovas routinely in other galaxies. But when it comes to more detailed observations, they have been frustrated by a statistical fluke. Theory suggests that a supernova should occur somewhere in the Milky Way every 15 to 50 years. And yet no supernova has gone off in our neighborhood since the ones seen by Tycho Brahe in 1572, and Johannes Kepler in 1604—both just before the invention of the telescope. Thus the community has a sense of experiencing the find of a lifetime.

"It turns out that a supernova is a terrific lightbulb for material you don't ordinarily get a look at," Robert Kirshner of the Harvard-Smithsonian Center for Astrophysics told *Science*. For example, his spectra from the International Ultraviolet Explorer spacecraft have already revealed numerous absorption features from cool gas in our own galaxy and in the Large Magellanic Cloud. Even more intriguing, the spectra also reveal material right in the vicinity of the supernova that was ejected by stellar winds or other eruptions shortly before the explosion. And finally, he says, the spectra show the ejecta from the explosion itself: a massive, turbulent shell of material moving outward at some 15,000 kilometers per second.

Back in Chile, meanwhile—not to mention at every other observatory in the Southern Hemisphere—the telescopes are swiveling toward the Large Magellanic Cloud at every opportunity. "Being this close, the supernova is bright" says Robert Williams, director of the Cerro Tololo Interamerican Observatory. "And that means we have a glut of photons, so that we can observe it at wavelengths such as the infrared and—with IUE—the ultraviolet, where we just couldn't observe supernovas before."

Also, the evidence now suggests that the object is a Type II supernova, says Williams. And because it is close, "we can now, for the first time, study the progenitor star." Indeed, a 12th-magnitude candidate for the progenitor has already been identified in previous images of the cloud. By a stroke of luck, moreover, the star had been studied spectroscopically well before the explosion. Known as Sanduleak-69.202, it is (or was) a very hot, very massive supergiant star of spectral class B3. This is generally the kind of star that theorists expect to go supernova, says Williams, so it fits. But now, he says, "we may be able to find out precisely why and how it did it." ■

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