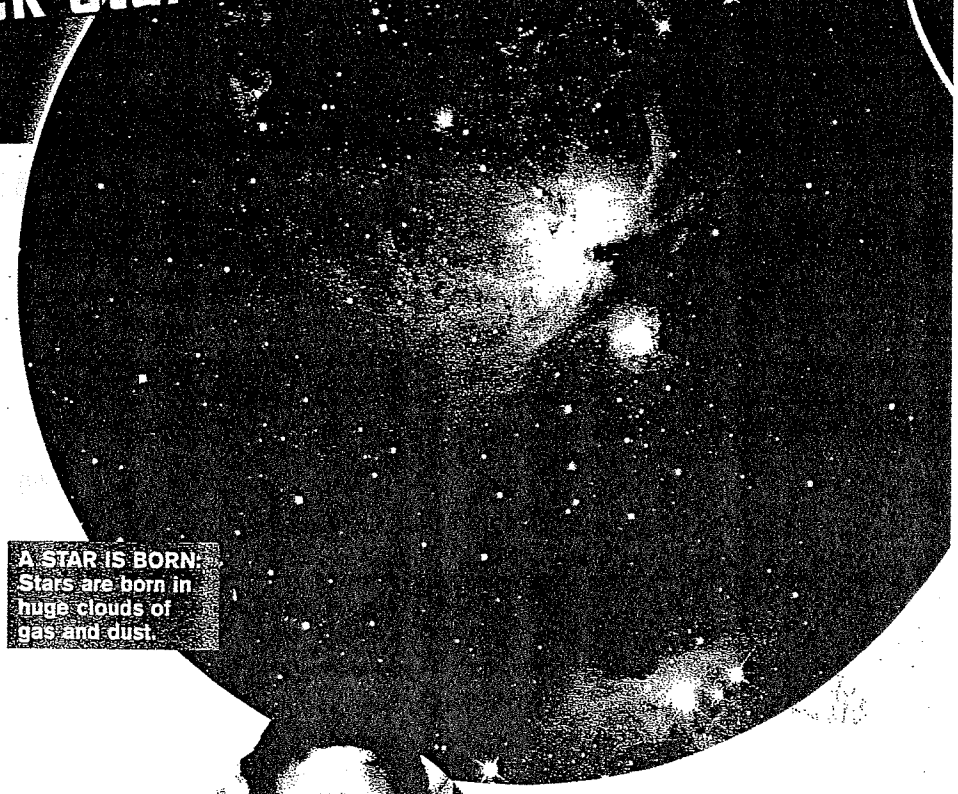
STAR TOUR

Scientists track stars from birth to death

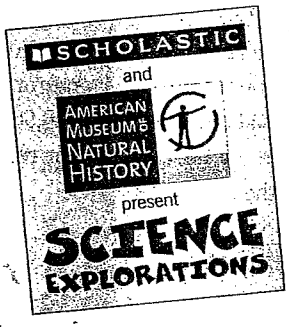


A STAR IS BORN: Stars are born in huge clouds of gas and dust.

When Mordecai-Mark Mac Low looks up at the night sky, he feels a special connection with the stars above. That's because everything on Earth except hydrogen, most of the helium, and a bit of lithium came from the stars. Without them, humans couldn't exist.

Billions of stars dot our *galaxy*, the Milky Way. But one in particular catches people's attention: the sun. "The sun is special for us because it's several hundred thousand times closer to us than any other star," says Mac Low, an astrophysicist at the American Museum of Natural History in New York.

Mac Low helped develop a new space show for the museum called *Journey to the Stars*. It gives viewers a personal introduction to the stars. Read on to see how Mac Low has learned enough about stars—which are much too far away to visit—to create the show.



MAC LOW is an astrophysicist at the American Museum of Natural History.

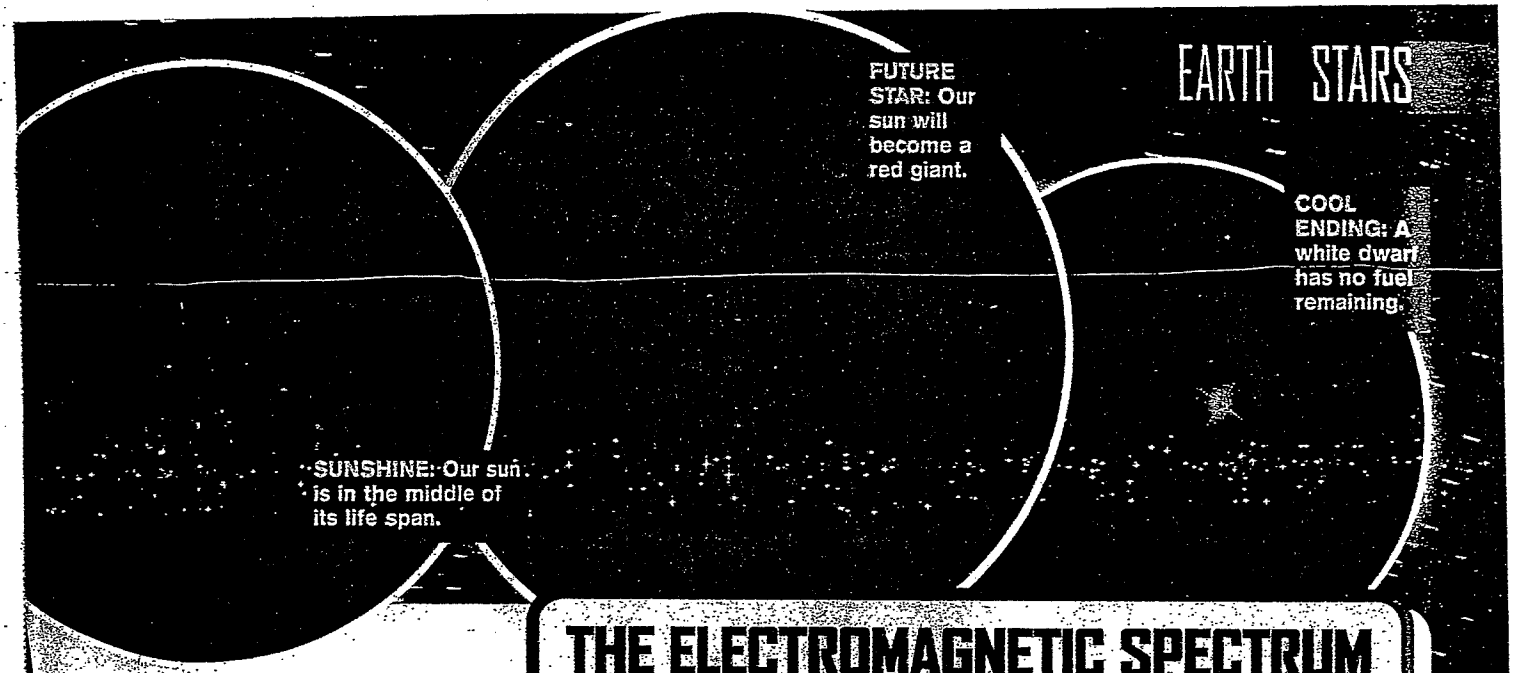
STELLAR STUDIES

Stars are huge balls of glowing gas. They are made up mostly of hydrogen, and they make energy by combining hydrogen atoms into helium in a process called *nuclear fusion*. This energy is what makes stars shine.

Stars emit light at all wavelengths along the *electromagnetic spectrum* *(see diagram, p. 21)*. The hottest stars emit most of their light at *ultraviolet* wavelengths, whereas the coolest stars shine most brightly at *infrared* wavelengths. Telescopes gather this light, allowing scientists like Mac Low to figure out a star's age and how it will develop.

Like living things, stars go through life stages: They are born out of *interstellar gas clouds*. After burning steadily for billions of years, a lower-mass star like the sun loses its outer layers and becomes a *white dwarf*, while a higher-mass star explodes as a *supernova*, leaving behind a

LEFT: STOCKTREK IMAGES/CORBIS; SUN: FRIEDRICH SAURER/PHOTO RESEARCHERS, INC.



neutron star or a black hole. More-massive stars are hotter and brighter. They burn their fuel more quickly and die younger.

TRACKING A STAR

Once Mac Low spots a young star—like those in the *Orion Nebula*—he wants to know how that star will grow into a "teenager" and then into an "adult." But finding out can be tricky. "We obviously can't follow the lifetime of any individual star, because it would take billions of years," says Mac Low. "So we have to find other ways of doing it."

Astronomers like Mac Low look at many stars at different stages of their "lives" to determine how any single star will develop. They compare the stars that they see with computer models to understand why stars look like they do at different ages.

LIGHTS OUT!

All stars eventually run out of hydrogen and die—as even our sun will do. Scientists calculate that the sun has about 5 billion years worth of fuel left. Once its fuel level gets close to empty, the sun will balloon up to 100 times its original size, engulfing Mercury and Venus. This puffy star, called a *red giant*, will gradually lose its surface material to space. The star's remaining core will stay behind as a white dwarf and cool off like a cinder from a campfire for billions of years.

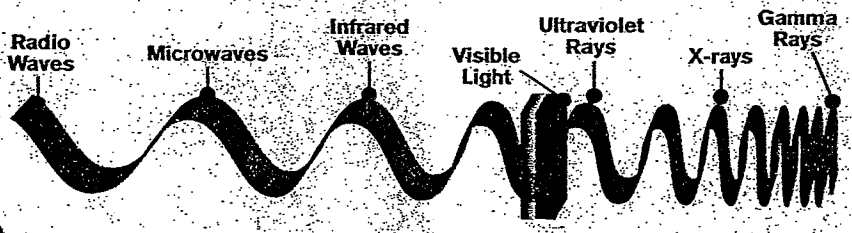
Not all stars go out so quietly. The heftiest stars end their lives in supernova explosions, which blast the star's guts out into space.

The material ejected from red giants and supernovas contains vital ingredients for making new stars. And that's exactly what happens, Mac Low says. The chemical elements expelled by dying stars get recycled, and new stars are born. ✵

—Jeanna Bryner

THE ELECTROMAGNETIC SPECTRUM

Waves in the electromagnetic spectrum are arranged in order of *wavelength* (distance between a wave's peaks). As wavelength decreases, the wave's energy increases.



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Did you know that *mass*—or the amount of material in an object—determines the lifetime, brightness, and temperature and color of a star? Lower-mass stars are small, dim, cool, and red, while medium-mass stars, like our sun, are brighter, hotter, and yellow. The most massive stars are blazing hot, blue-tinged stars that live fast and die young as supernovas. To learn more about stars, ask your teacher, go see *Journey to the Stars* at the American Museum of Natural History or at your local planetarium, or visit: www.amnh.org.

BACKGROUND: MITSUSHI OKADA/CORBIS; LOWE D. FINNIN/AMNH