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## ASTRONOMY

### Scientist's quiet observation ushered in modern astronomy

Tuesday, March 27, 2007 3:36 AM

BY TOM STATLER

A hundred years ago, a quiet but brilliant woman penned a sentence that ultimately changed the universe.

Born in New England, Henrietta Leavitt grew up in Cleveland and attended Oberlin College for three years before moving back to Massachusetts.

She finished her degree at what would become Radcliffe College, where she fell in love with astronomy. By 1907, she was head of photographic photometry at the Harvard College Observatory.

Leavitt had the job of examining decades' worth of photographs, searching for and cataloging stars whose brightness varied. The search had yielded nearly 2,000 new variable stars, and it was time to write up the results and publish the catalog.

But Leavitt, a skilled scientist, knew that she had more than just a big list of stars.

"It is worthy of notice," she wrote, "that in Table VI the brighter variables have the longer periods."

This dry comment laid the foundation for everything we now know about the structure and history of the universe. Leavitt had discovered the period-luminosity relation for Cepheid, or variable, stars.

Cepheids are massive stars, late in their lifetimes, that brighten and dim on a regular schedule. By a lucky quirk of nature, that cycle is tightly correlated with the star's intrinsic luminosity.

Ordinarily, it is fiendishly difficult to determine the luminosity of a star.

But with Cepheids, if you find one and measure its variability period, you can infer what its luminosity is. Knowing that, you can figure out how far away it must be in order to look as faint as it does.

The ability to measure the distances to objects hundreds of thousands of light-years away turned astronomers loose to map the cosmos in a way that had never before been imagined.

By 1918, Harlow Shapley had used Cepheids to map the positions of globular star clusters in space. These clusters, Shapley realized, swarm around the center of our galaxy.

With the help of the Cepheids, he located the galactic center and established the size of the Milky Way.

Only six years later, Edwin Hubble identified Cepheids in the Great Spiral Nebula in Andromeda and proved that the "nebula" was a galaxy in its own right -- our Milky Way's bigger brother.

By 1929, Hubble had shown that there were millions -- or more -- of galaxies in the universe, and that the galaxies are moving apart from each other as the universe itself expands.

The race was on to measure the rate of expansion, and with it, the age and destiny of our universe. At every step, Henrietta Leavitt's period-luminosity relation was the key.

Tom Statler is director of the Astrophysical Institute at Ohio University in Athens.

[statler@ohio.edu](mailto:statler@ohio.edu)

