

# New device in New Mexico turns back clock on astronomy

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A newly forged steel instrument that can pinpoint the path of stars and planets across the night sky using the naked eye is a throwback to the years just before the advent of telescopes, returning stargazers in the hills of northern New Mexico to the essentials of astronomy in the past.

Installed at St. John's College by graduates, the device is a remake of long-lost originals devised by Danish astronomer Tycho Brahe in the late 16th century to chart the location of stars and the orbits of planets.

It consists of four interlocking rings—forged of precision steel and aligned with the north star and equator—combined with a sliding viewfinder that is moved by hand to measure angles between the any celestial object, the horizon and the equator.

Lengthy, painstaking measurements from such an instrument in the late-1500s allowed Johannes Kepler to show that Mars revolved in an elliptical orbit around the sun, disproving the entrenched theory of the circular movement of heavenly bodies and setting off a search of new theories of planetary motion and forces.

"You can often learn things about how science was done in another age by recreating the artifacts and recreating the instruments," said William Donahue, a retired faculty member and laboratories director at St. John's College, whose campus overlooks Santa Fe. "This is a lot of fun because you get to do things that nobody has done for 300 years."

None of Brahe's original instruments have survived. Graduates of St. John's commissioned a functioning replica using Brahe's original drawings and illustrations. They hired British craftsman David Harber to assemble a precision instrument from surgical stainless steel. The venture cost upwards of \$100,000, Donahue said.

Static sculptures of Brahe's so-called armillary sphere proliferate in public parks, but few if any allow for detailed measurements like the one in Santa Fe. It is accurate to incremental angular measurements of one-sixtieth of a degree, or 1 arc minute.

The device is an obvious anachronism in an age of sky-charting smart phone apps—and a fitting addition to St. John's College, where students trace the evolution of math and science from ancient civilizations by studying original texts or their English translations.

Beyond St. John's, New Mexico's dark cloudless skies have attracted groundbreaking astronomical devices and student observatories.

They include New Mexico Tech's Magdalena Ridge Observatory, perched 2 miles (3 kilometers) above sea level near Socorro; a cluster of research telescopes at Apache Point Observatory; the iconic Very Large Array radio astronomy observatory where antennae span miles across the Plains of San Agustin; and recently assembled radio scopes that explore low frequencies for clues about cosmic evolution.

By contrast, the latest stargazing device in Santa Fe promises no scientific advances. Instead, it's something of a time portal into the travails of 16th century astronomy.

Donahoe, who translated Kepler's "Astronomia Nova" from Latin, says pinpointing the coordinates of bright stars and planets produces lots of "ah-hah moments" for student. The sphere is not yet part of the college

curriculum.

Measurements taken by Brahe were accurate enough to challenge fundamental astronomical conceptions and misconceptions and help pave the way for Isaac Newton's theory of gravity and the laws of motion, Donahue says.

Tracking orbits also was no easy feat in an age where mechanical clocks could be maddeningly inaccurate. Then came the telescope.

"In 1609 Galileo turned his telescope on the sky—and that changed everything," Donahue said.

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