

Rare eleventh-century astrolabe discovery reveals Islamic–Jewish scientific exchange

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The Verona astrolabe. Credit: Federica Gigante

The identification of an eleventh-century Islamic astrolabe bearing both Arabic and Hebrew inscriptions makes it one of the oldest examples ever discovered and one of only a handful known in the world. The

astronomical instrument was adapted, translated, and corrected for centuries by Muslim, Jewish, and Christian users in Spain, North Africa, and Italy.

Dr. Federica Gigante, from Cambridge University's History Faculty, made the discoveries in a museum in Verona, Italy, and published them today in the journal *Nuncius*.

Dr. Gigante first came across a newly uploaded image of the astrolabe by chance on the website of the Fondazione Museo Miniscalchi-Erizzo. Intrigued, she asked them about it.

"The museum didn't know what it was and thought it might actually be fake," Dr. Gigante said. "It's now the single most important object in their collection."

"When I visited the museum and studied the astrolabe up close, I noticed that not only was it covered in beautifully engraved Arabic inscriptions but that I could see faint inscriptions in Hebrew. I could only make them out in the raking light entering from a window. I thought I might be dreaming, but I kept seeing more and more. It was very exciting."

"This isn't just an incredibly rare object. It's a powerful record of scientific exchange between Arabs, Jews, and Christians over hundreds of years," said Dr. Gigante.

"The Verona astrolabe underwent many modifications, additions, and adaptations as it changed hands. At least three separate users felt the need to add translations and corrections to this object, two using Hebrew and one using a Western language."

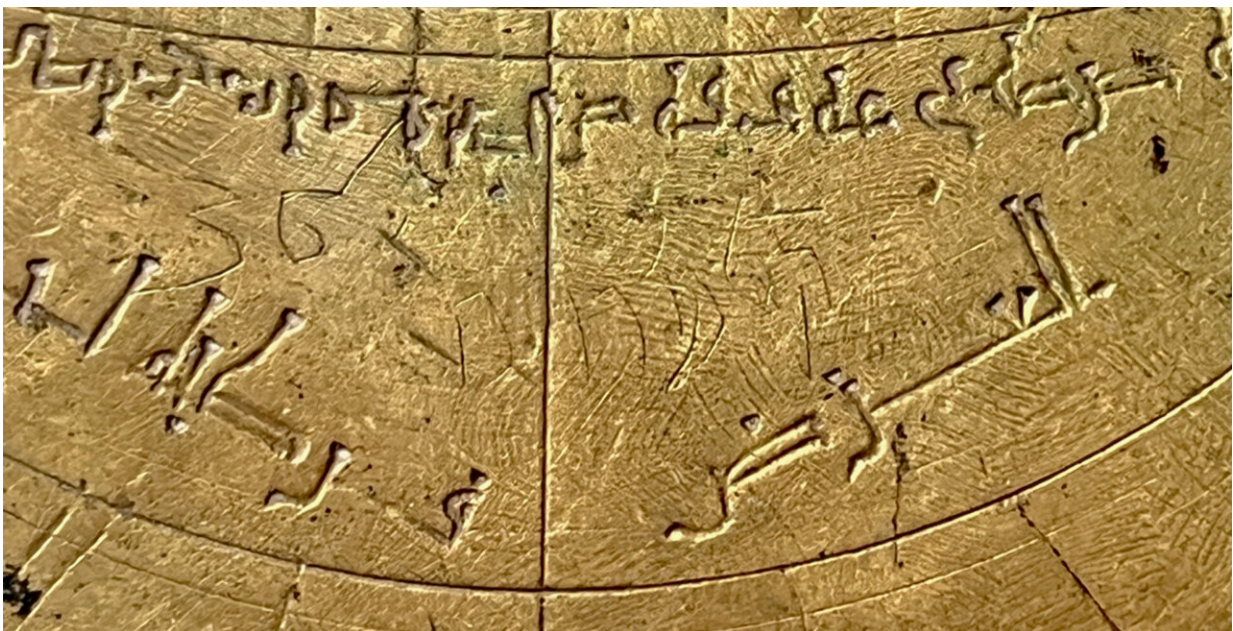
Astrolabes were the world's first smartphone, a portable computer that could be put to hundreds of uses. They provided a portable two-

dimensional model of the universe fitting in their user's hand, enabling them to calculate time and distances, plot the position of the stars, and even forecast the future by casting a horoscope.

Islamic Spanish origins

Dr. Gigante, an expert on Islamic astrolabes and previously a curator of Islamic scientific instruments, dated and located the creation of the "Verona astrolabe" by analyzing key scientific, design, construction, and calligraphic characteristics. She identified the object as Andalusian and—from the style of the engraving and the arrangement of the scales on the back—matched it to instruments made in Al-Andalus, the Muslim-ruled area of Spain, in the eleventh century.

One side of a plate is inscribed in Arabic "for the latitude of Cordoba, $38^{\circ} 30'$," while the other side "for the latitude of Toledo, 40° ," لعرض طليطلة م. Dr. Toledo at a time when it was a thriving center of coexistence and cultural exchange between Muslims, Jews, and Christians.



Close up of the Verona astrolabe showing inscribed Hebrew, Arabic and Western Numerals. Credit: Federica Gigante

The astrolabe features Muslim prayer lines and prayer names, arranged to ensure that its original intended users kept to time to perform their daily prayers.

The signature inscribed on the astrolabe reads / لاسحاق [...]يونس صنعة, that is, "for Ishāq [...]/the work of Yūnus." This was engraved sometime after the astrolabe was made, probably for a later owner.

The two names, Ishāq and Yūnus, that is, Isaac and Jonah in English, could be Jewish names written in the Arabic script, a detail that suggests that the object was at a certain point circulating within a Sephardi Jewish community in Spain, where Arabic was the spoken language.

A second, added plate is inscribed for typical North African latitudes, suggesting that another point of the object's life, it was perhaps used in Morocco or Egypt.

Hebrew inscriptions

Hebrew inscriptions were added to the astrolabe by more than one hand. One set of additions is carved deeply and neatly, while a different set of translations is very light, uneven, and shows an insecure hand.

Dr. Gigante said, "These Hebrew additions and translations suggest that at a certain point, the object left Spain or North Africa and circulated among the Jewish diaspora community in Italy, where Arabic was not

understood, and Hebrew was used instead."

Unusually, one of the Hebrew additions, engraved neatly above the Arabic marking for latitude 35° , reads "34 and a half" rather than "34 $\frac{1}{2}$ ", which suggests that the engraver was not an astronomer or astrolabe maker.

Other Hebrew inscriptions are instead translations of the Arabic names for astrological signs, for Scorpio, Sagittarius, Capricorn, Aquarius, Pisces, and Aries.

Dr. Gigante points out that these translations reflect the recommendations prescribed by the Spanish Jewish polymath Abraham Ibn Ezra (1089–1167) in the earliest surviving treatise on the astrolabe in the Hebrew language written in 1146 in Verona, exactly where the astrolabe is found today.



Close up of the Verona astrolabe showing Hebrew inscribed (top left) above Arabic inscriptions. Credit: Federica Gigante

Jewish Verona

Twelfth-century Verona hosted one of the longest-standing and most important Jewish communities in Italy. Ibn Ezra's treatise assumes pre-existing knowledge of the astrolabe among the Verona Jewish community, showing that the instrument must already have been popular.

Ibn Ezra's description has a lot in common with the "Verona astrolabe," which would have been in circulation by the time Ibn Ezra was in

Verona. He warned his readers that an instrument must be checked before use to verify the accuracy of the values to be calculated.

Dr. Gigante suggests that the person who added the Hebrew inscriptions might have been following such recommendations.

Incorrect corrections

The astrolabe features corrections inscribed not only in Hebrew but also in Western numerals, the same we use in English today.

All sides of the astrolabe's plates feature lightly scratched markings in Western numerals, translating and correcting the latitude values, some even multiple times. Dr. Gigante thinks it is highly likely that these additions were made in Verona for a Latin or Italian language speaker.

In one case, someone lightly scratched the numbers "42" and "40" near the inscription reading "for the latitude of Medinaceli, $41^{\circ} 30'$."

Dr. Gigante said, "Not only do both numerals differ from the value given in the Arabic, they don't agree between themselves. It may be that a later user of the instrument thought the original Arabic value was wrong and amended it. But the correct, modern value for the latitude of Medinaceli is $41^{\circ} 15'$," indicating that the Arabic value was more accurate than either amendment."

Elsewhere on the instrument, Gigante found similar conflicting and erroneous amendments relating to the latitudes of Cordoba and Toledo.

Star map

The astrolabe features a "rete"—a pierced disk representing a map of the

sky—which is one of the earliest known made in Spain. Remarkably, it features similarities with the rete of the only surviving Byzantine astrolabe made in AD1062 as well as with those of the earliest European astrolabes, made in Spain on the model of Islamic ones.

A calculation of the star position allows a rough timing of the sky for which it was created. Dr. Gigante explains that "due to a phenomenon called the precession of the equinoxes, whereby the earth rotates on its axis not in a straight line, but in a 'wobbly' manner, like a spinning top about to stop, the stars' apparent positions above our heads change constantly, about 1 degree every 70 years."

By analyzing the position of the stars on the rete, it is possible to calculate that they were placed in the position that stars had in the late 11th century, and that they match those of other astrolabes made, for example, in AD 1068.

Later life

The astrolabe is thought to have made its way into the collection of the Veronese nobleman Ludovico Moscardo (1611–81) before passing by marriage to the Miniscalchi family. In 1990, the family founded the Fondazione Museo Miniscalchi-Erizzo to preserve the collections.

"This object is Islamic, Jewish and European, they can't be separated," Dr. Gigante said.

More information: F. Gigante, A Medieval Islamic Astrolabe with Hebrew Inscriptions in Verona: The Seventeenth-Century Collection of Ludovico Moscardo, *Nuncius* (2024). [DOI: 10.1163/18253911-bja10095](https://doi.org/10.1163/18253911-bja10095)

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