



THE PRINCIPLE OF MEASURING THE ARBALESTRILLE

The **arbalestrille**, also called **Jacob's Staff**, is an ancient instrument used for measuring angles in astronomy and then for navigation: the angular distance between two celestial bodies or the angle between the horizon and a star. Navigators could estimate their latitude by measuring the height of the sun above the horizon.

Surveyors also used this tool to measure distances.

Jacob's Staff seems to have been invented in the fourteenth century by Levi ben Gerson.

This instrument resembles the **Kamal** used by the Arabs for navigation

Levi BEN GERSON or
GERSONIDE (1288 - 1344)

He was one of the most important biblical commentators of his time. He was also a mathematician, astronomer, philosopher and physician.

He described the use of the staff in his *Treatise on Trigonometry*

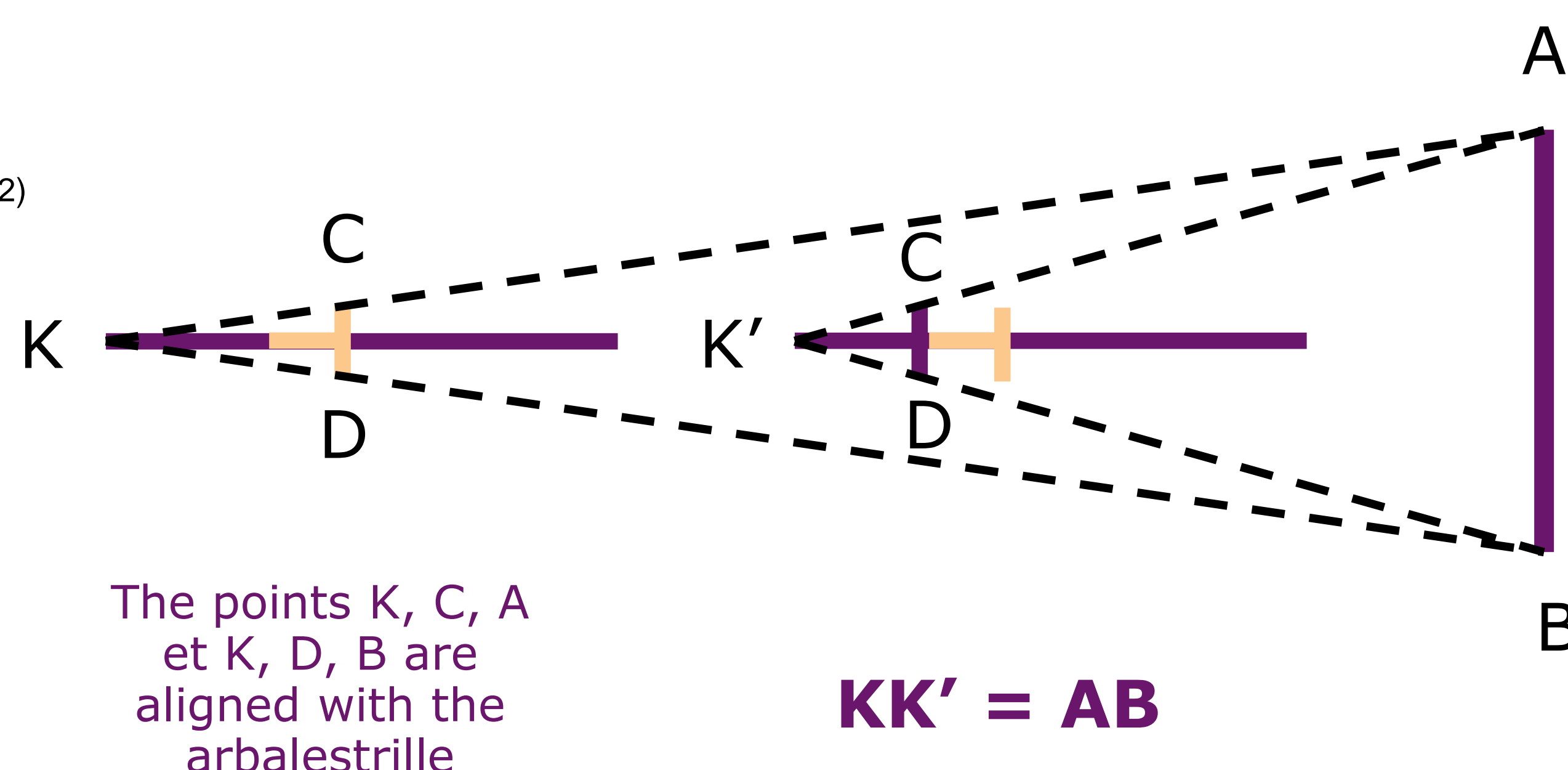
He conceived it as formed of two perpendicular rods (in the form of a cross), so that the shorter rod could slide on the other.

In actuality, it was made up of a ruler with a square section (*arrow*) and of four transoms sliding perpendicularly to it. For observations, a single transom was chosen according to the height of the star at the time of observation.

It was usually made of hard wood (ebony, pear, etc.) but sometimes of ivory or brass and wood.



Illustration from Practical Navigation (John Sellers, 1672)
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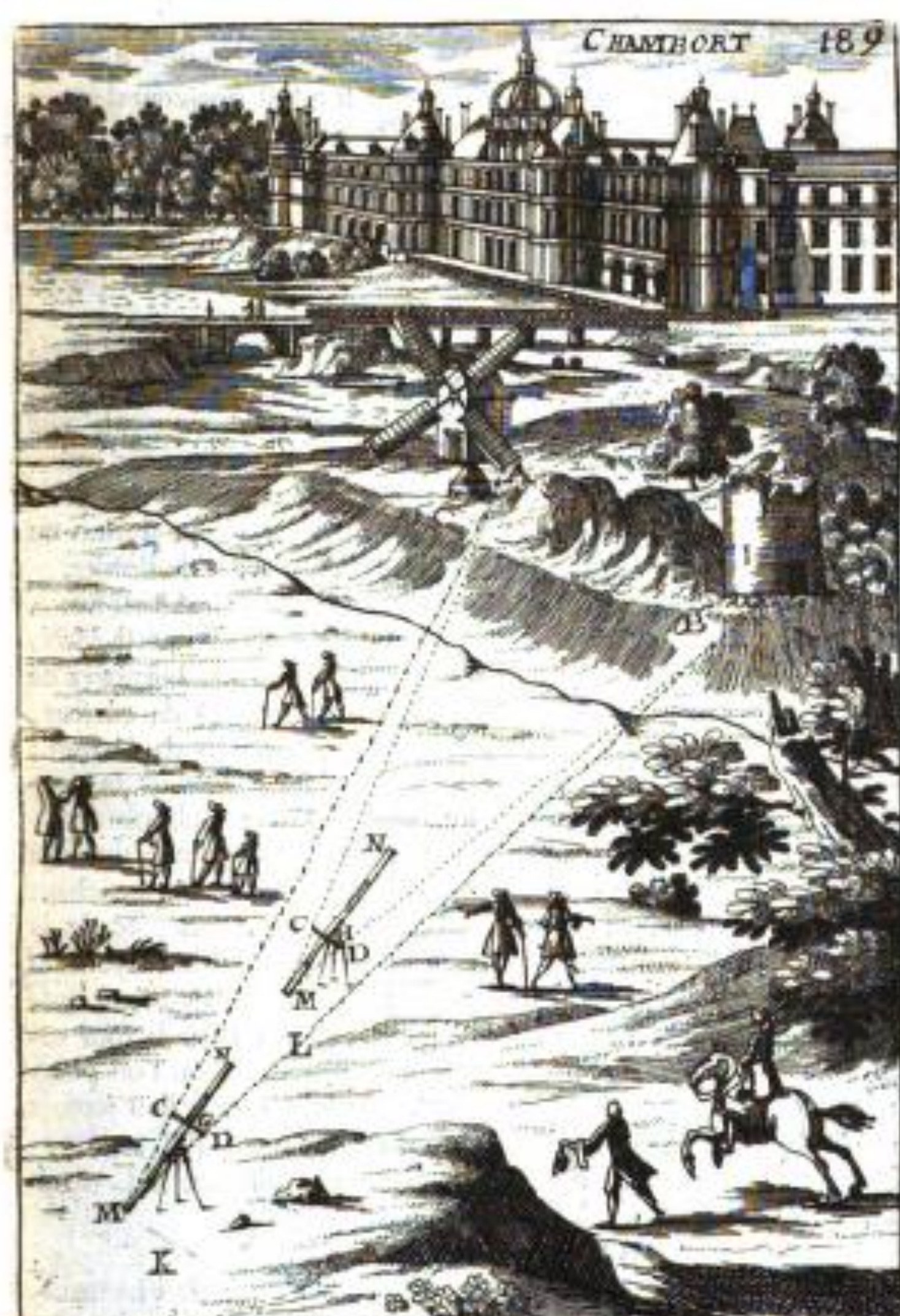


Using the arbalestrille to measure a distant length

The observer is located at K at a certain distance from the object AB to be measured. He chooses a transom and moves it along the shaft in order to achieve the alignments K, C, A and K, D, B .

Then the transom is moved along the length of the shaft (one graduation) and the observer advances to K' to achieve the new alignments K', C, A and K', D, B .

The required length AB is equal to the length KK' .



Practical Geometry volume 2 (1702)
Alain Manesson Mallet

