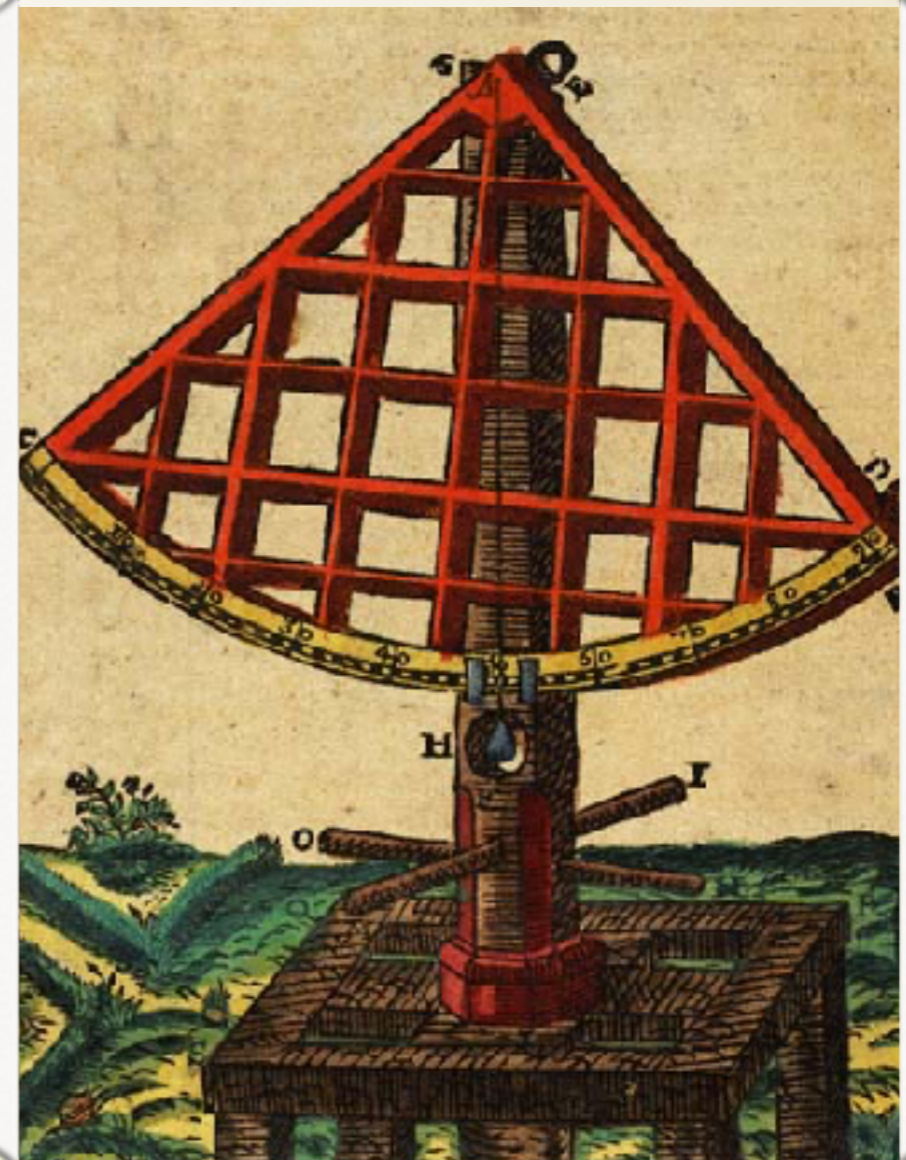


PRE-TELESCOPIC ASTRONOMICAL INSTRUMENTS

JEFF ADKINS
MDAS
JANUARY 2018

BEFORE THE TELESCOPE

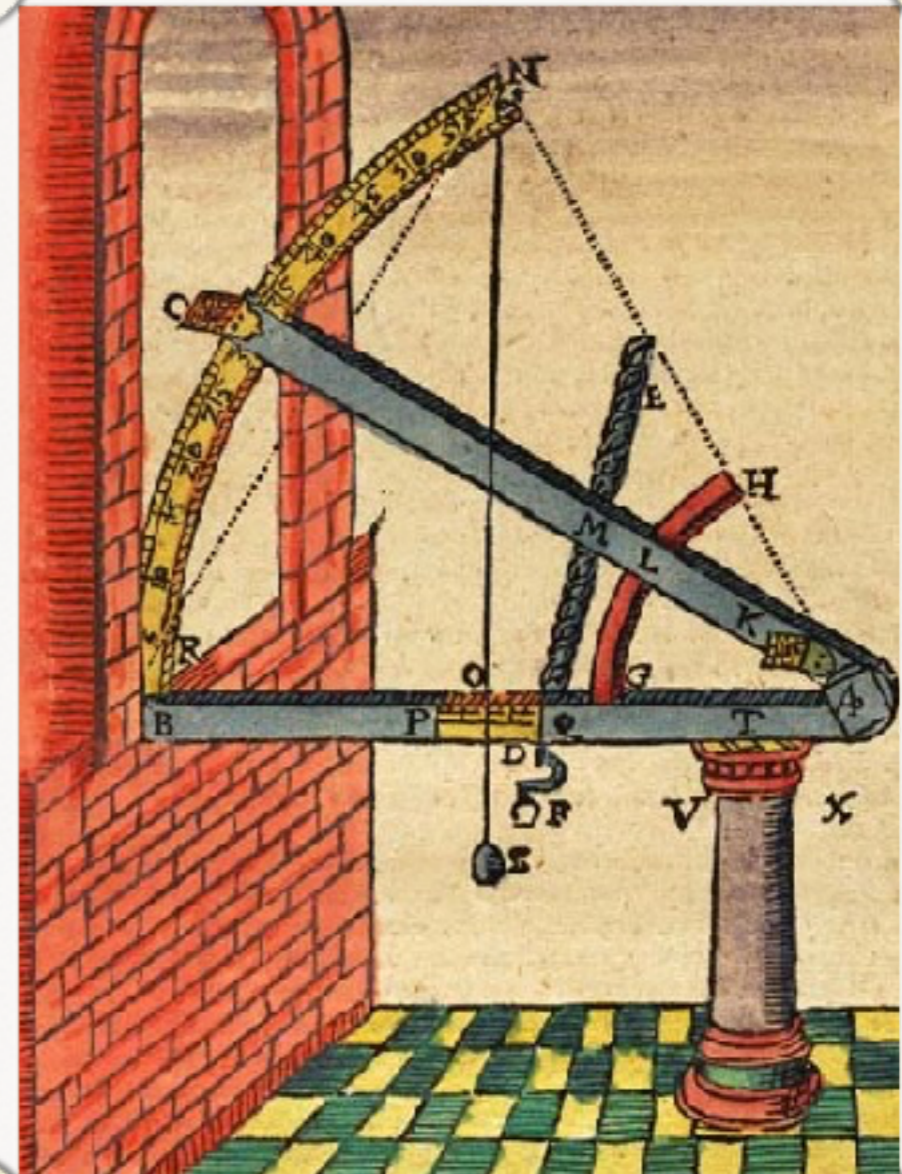
- What did astronomers use before the invention of the telescope in 1610?
- Primarily they plotted positions using angle-measuring tools
- We will investigate three of these: the quadrant, the cross-staff, and the astrolabe



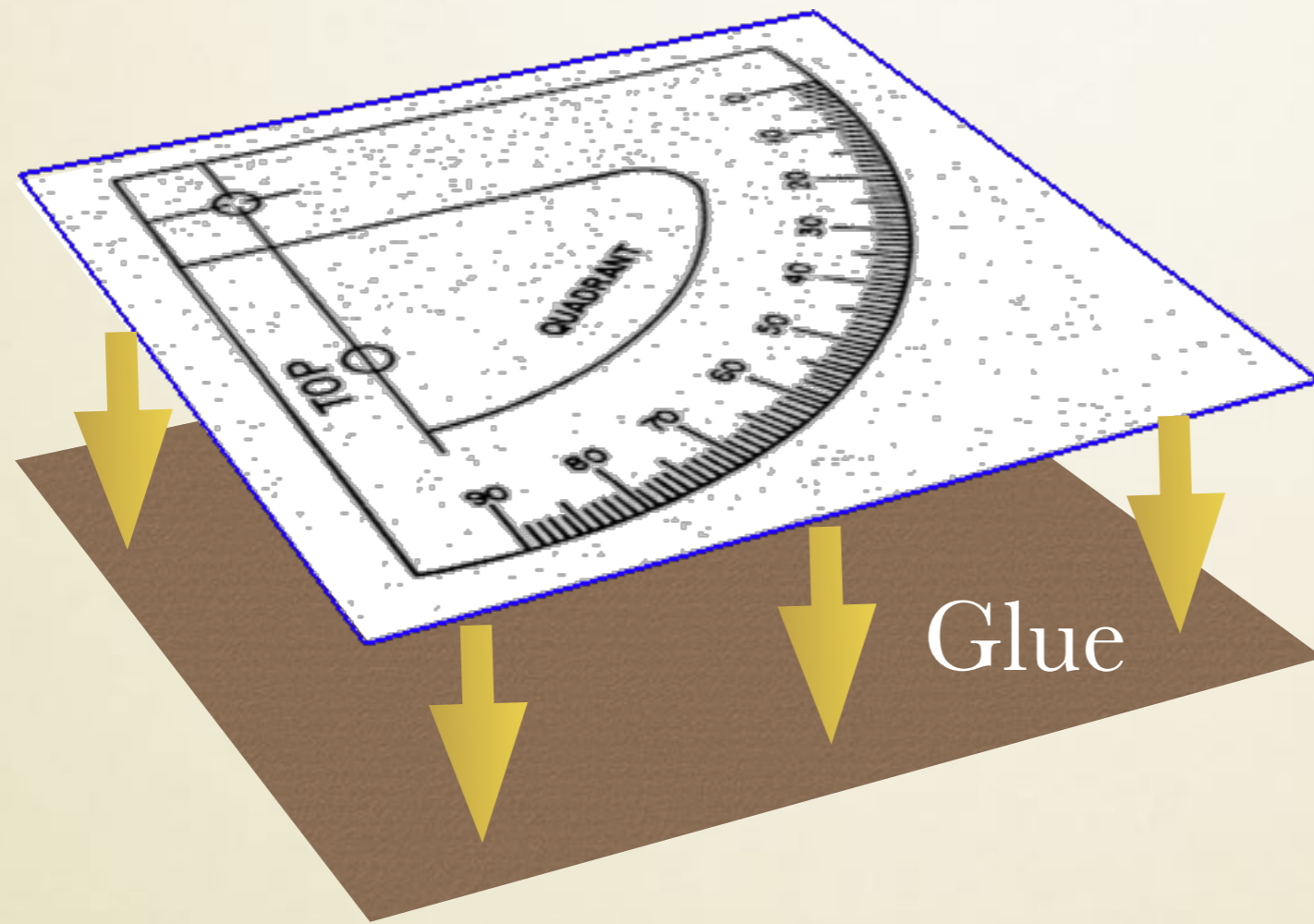
Tycho's Quadrant

THE QUADRANT

- Used to measure vertical angles
- Horizontal = 0
- Vertical (zenith) = 90
- Use gravity to establish a zenith line (plumb bob)

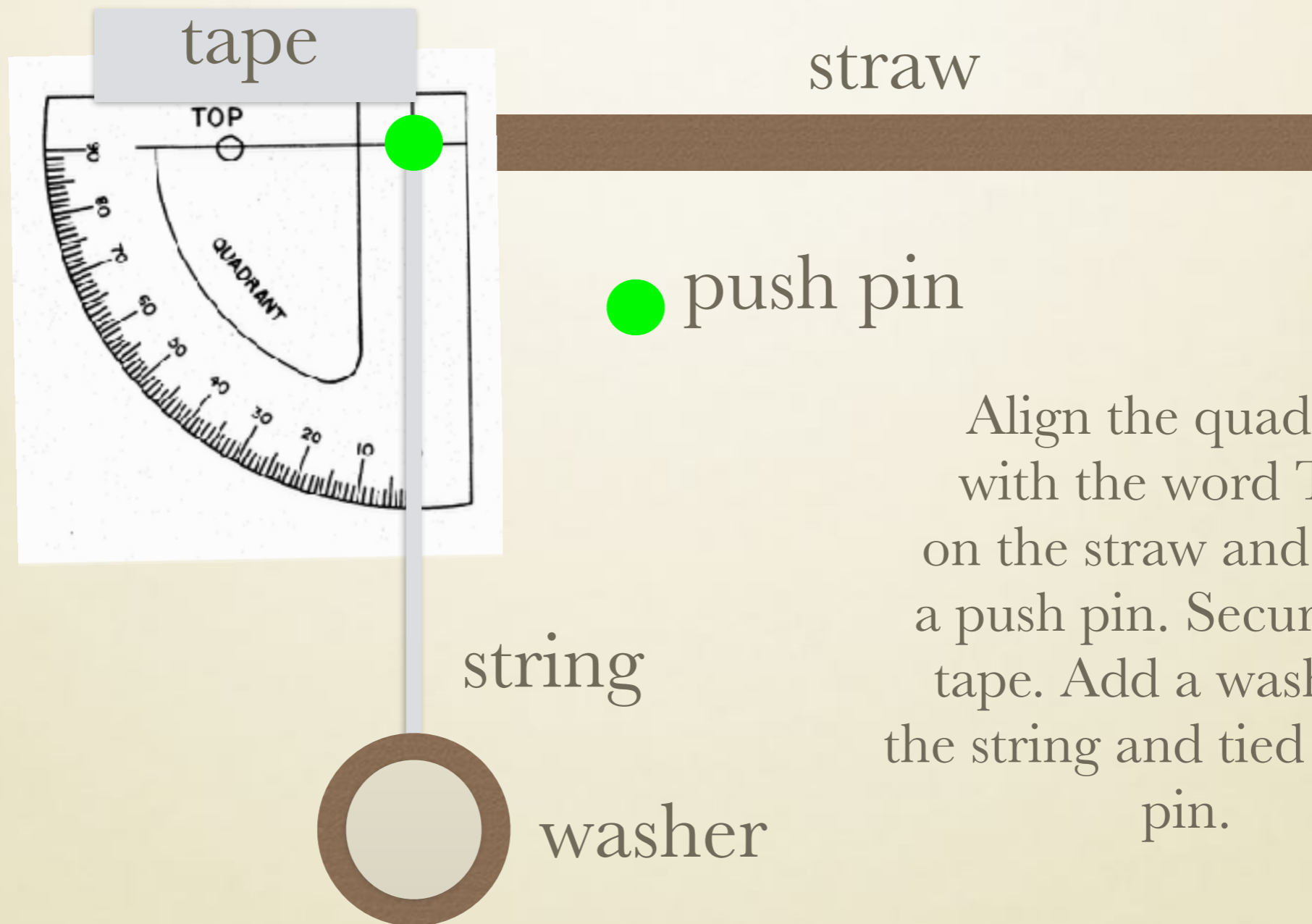


ASSEMBLING A QUADRANT



Glue the
quadrant
onto construction
paper.

ATTACH PLUMB BOB AND TAPE TO METERSTICK

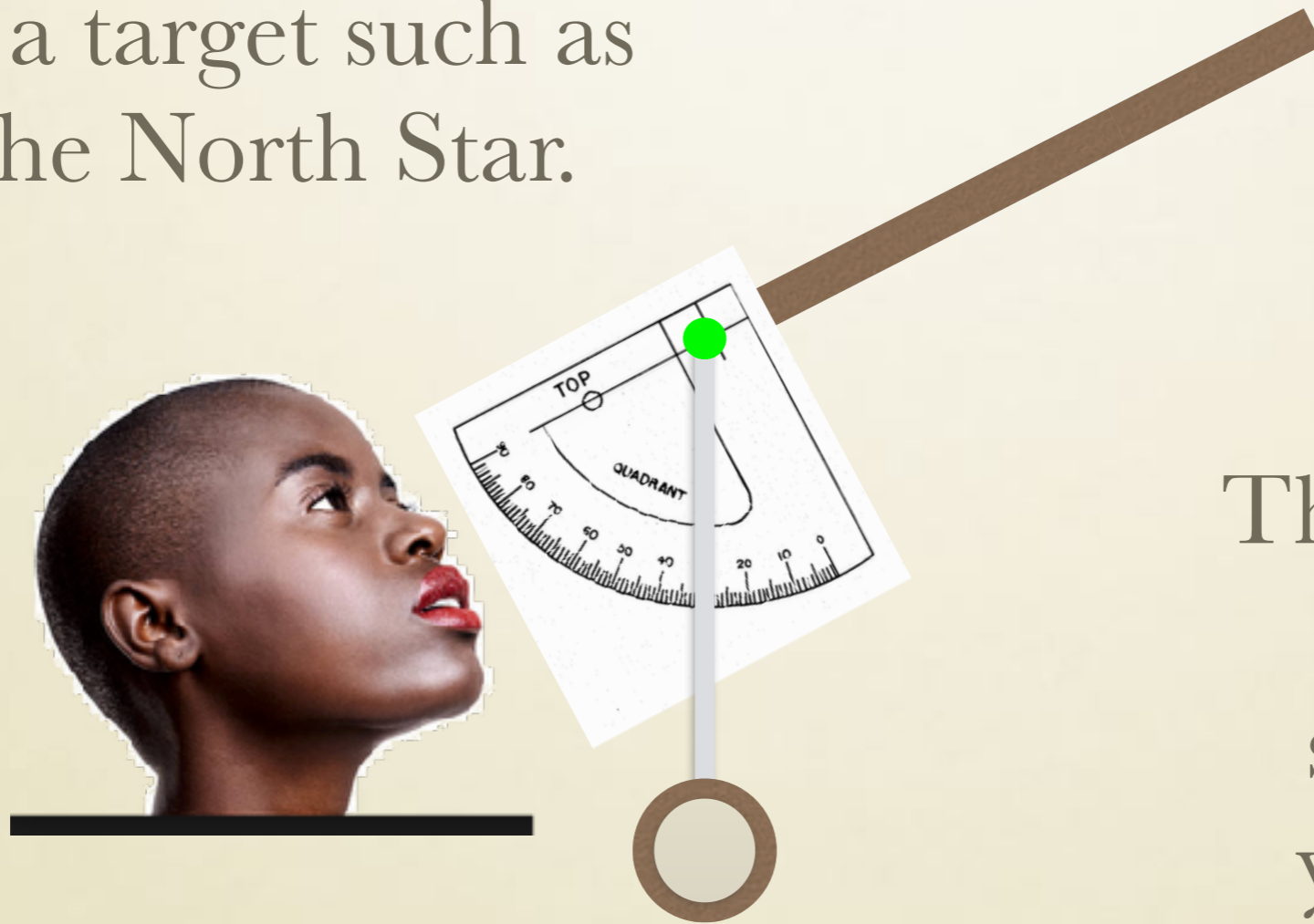


Align the quadrant with the word TOP on the straw and insert a push pin. Secure with tape. Add a washer to the string and tied to push pin.

HOW TO USE



Look through the straw
at a target such as
the North Star.



The angle of the
North Star
should equal
your latitude.
(within 1 degree)

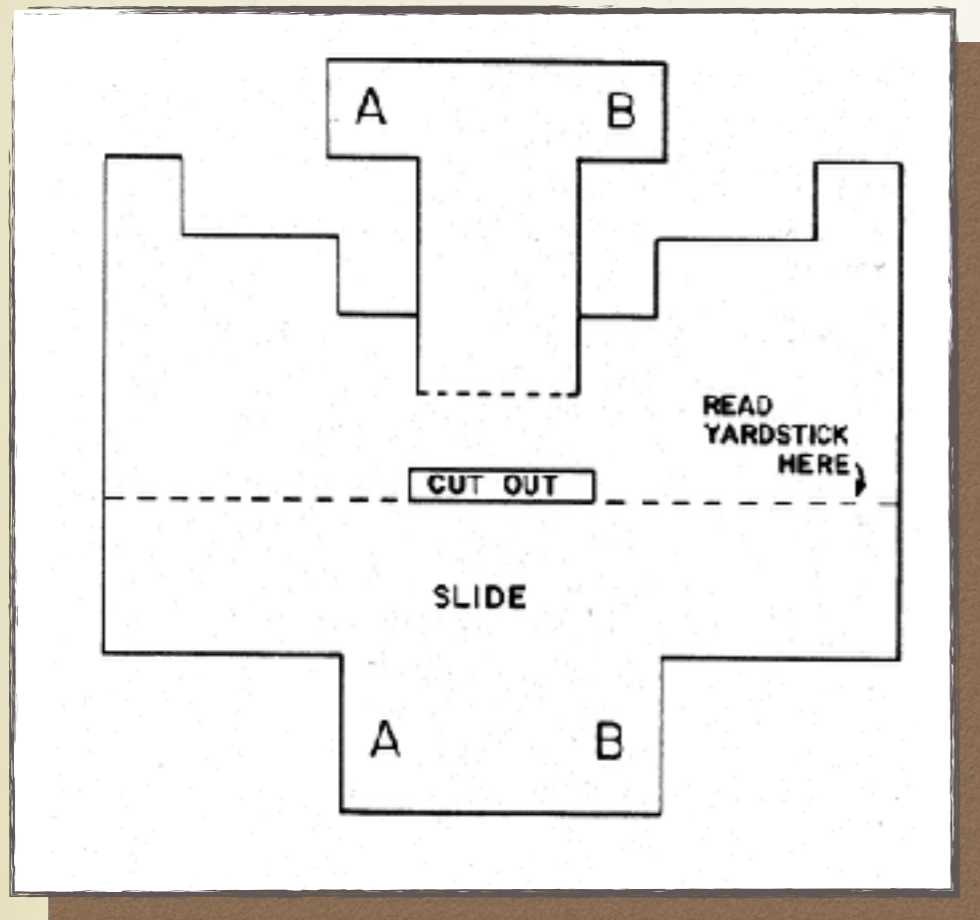


WHY?

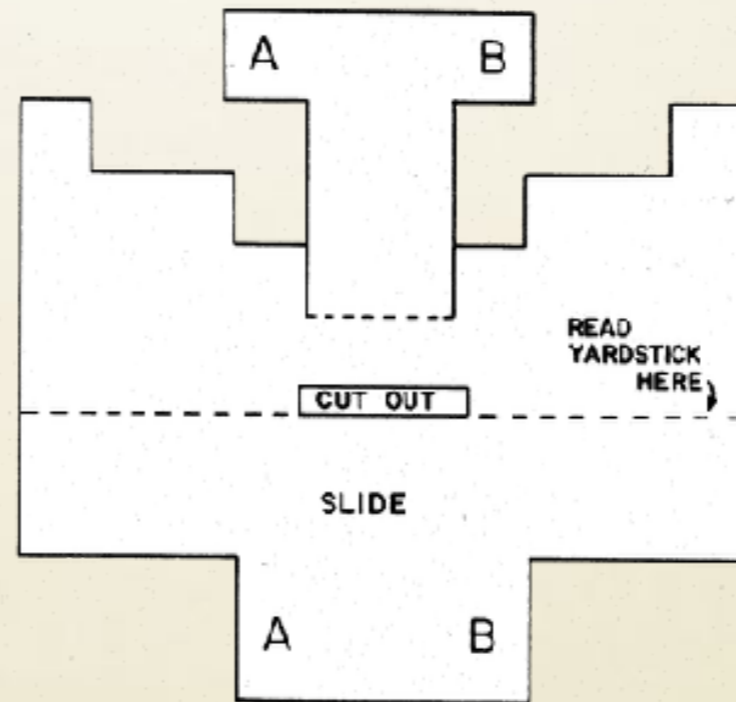
Altitude of
Polaris=
Your latitude*

*once you correct for the fact
that Polaris is about 1 degree off
from the Celestial Pole

THE CROSS STAFF

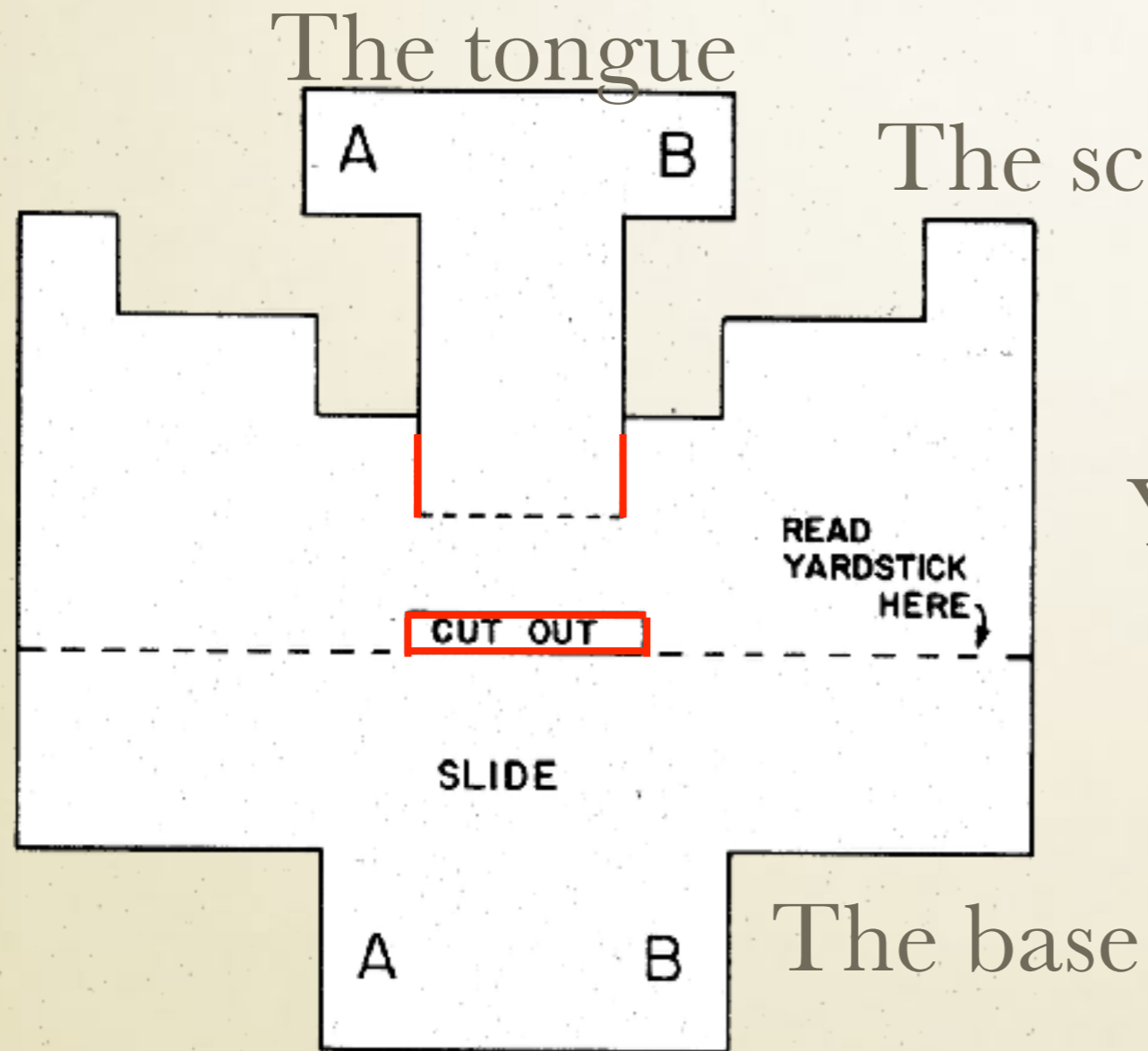


Glue onto construction paper as before.



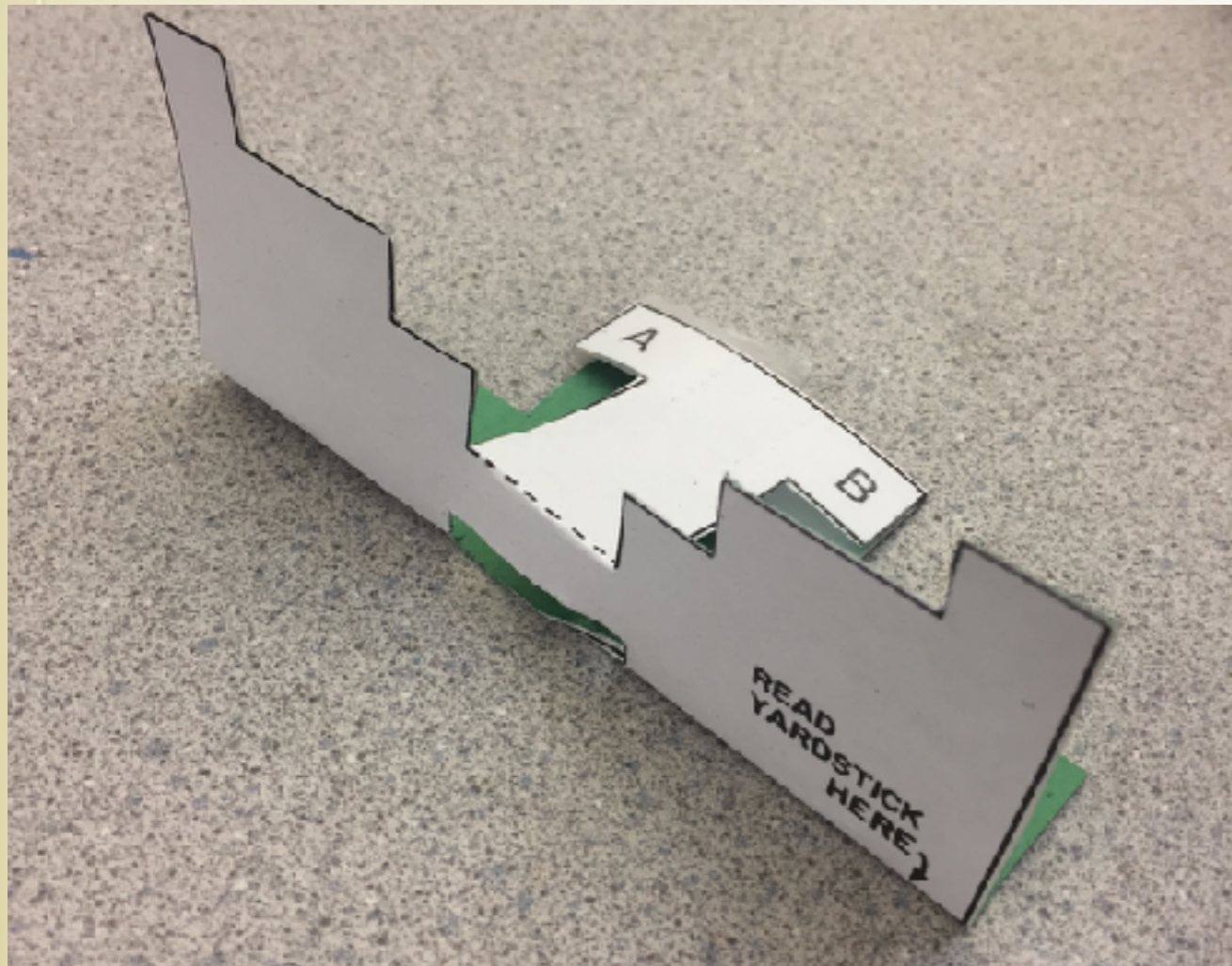
Cut around the outside edges.

CROSS STAFF CONT.



Cut out the red lines.
You might need an Xacto.

FOLD AND TAPE

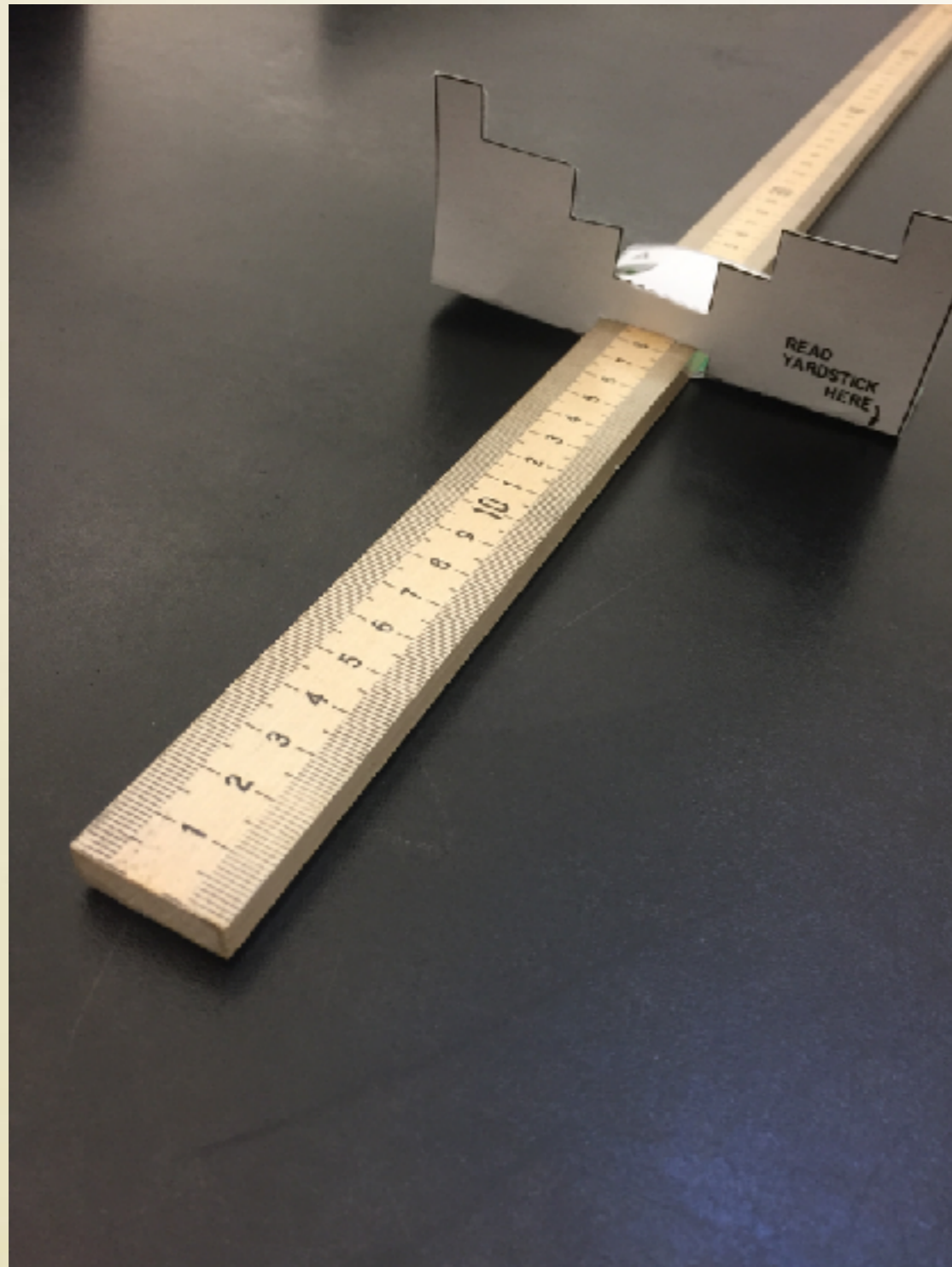


Fold the “tongue” back and match A to A and B to B and tape.

The dotted lines are the folds.

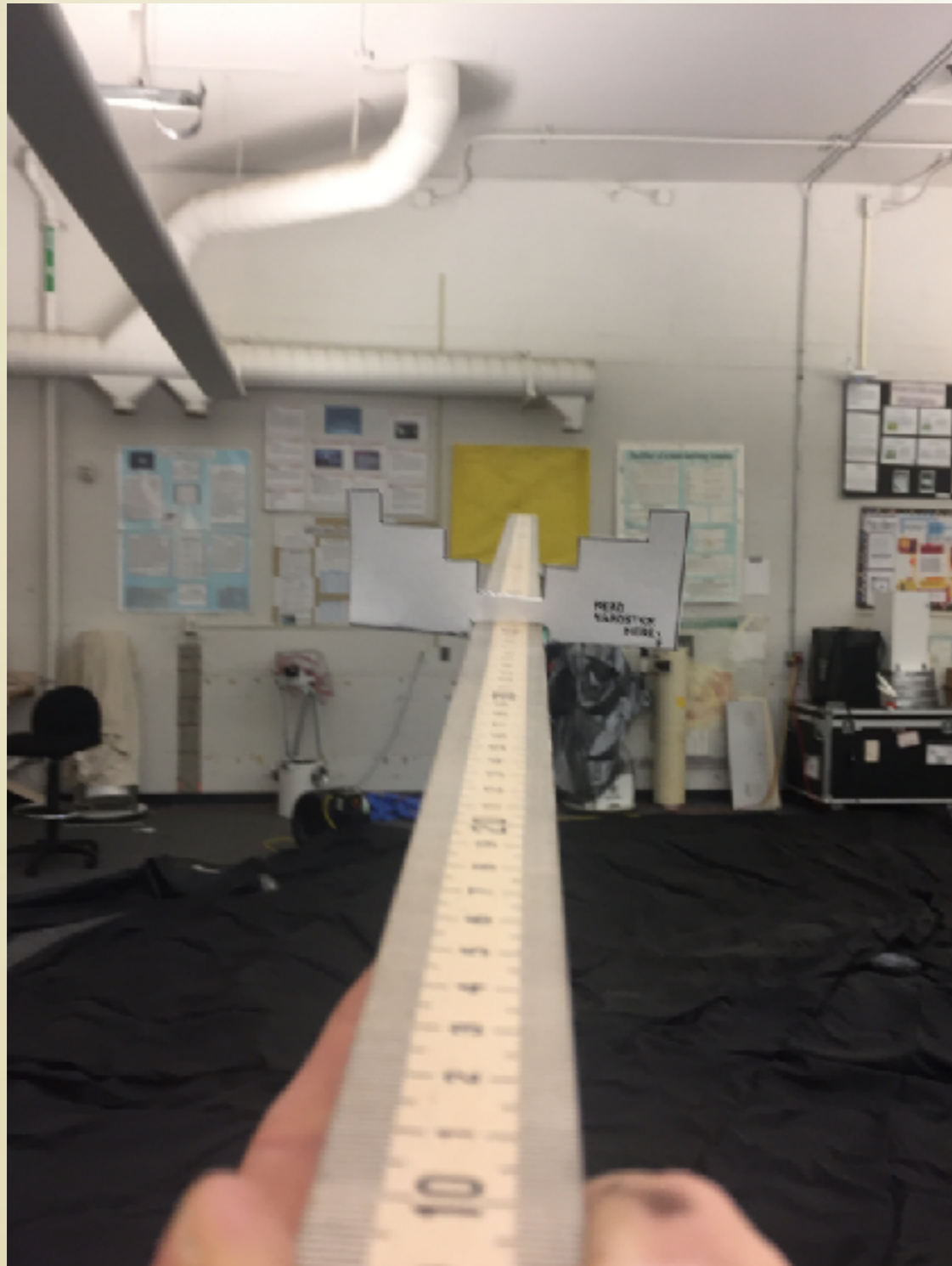
The scales should be perpendicular to the base.

FINAL ASSEMBLY



Slide the cross-staff onto the meterstick so the “Read meterstick here” part is towards the zero end of the meterstick.

HOW TO MEASURE

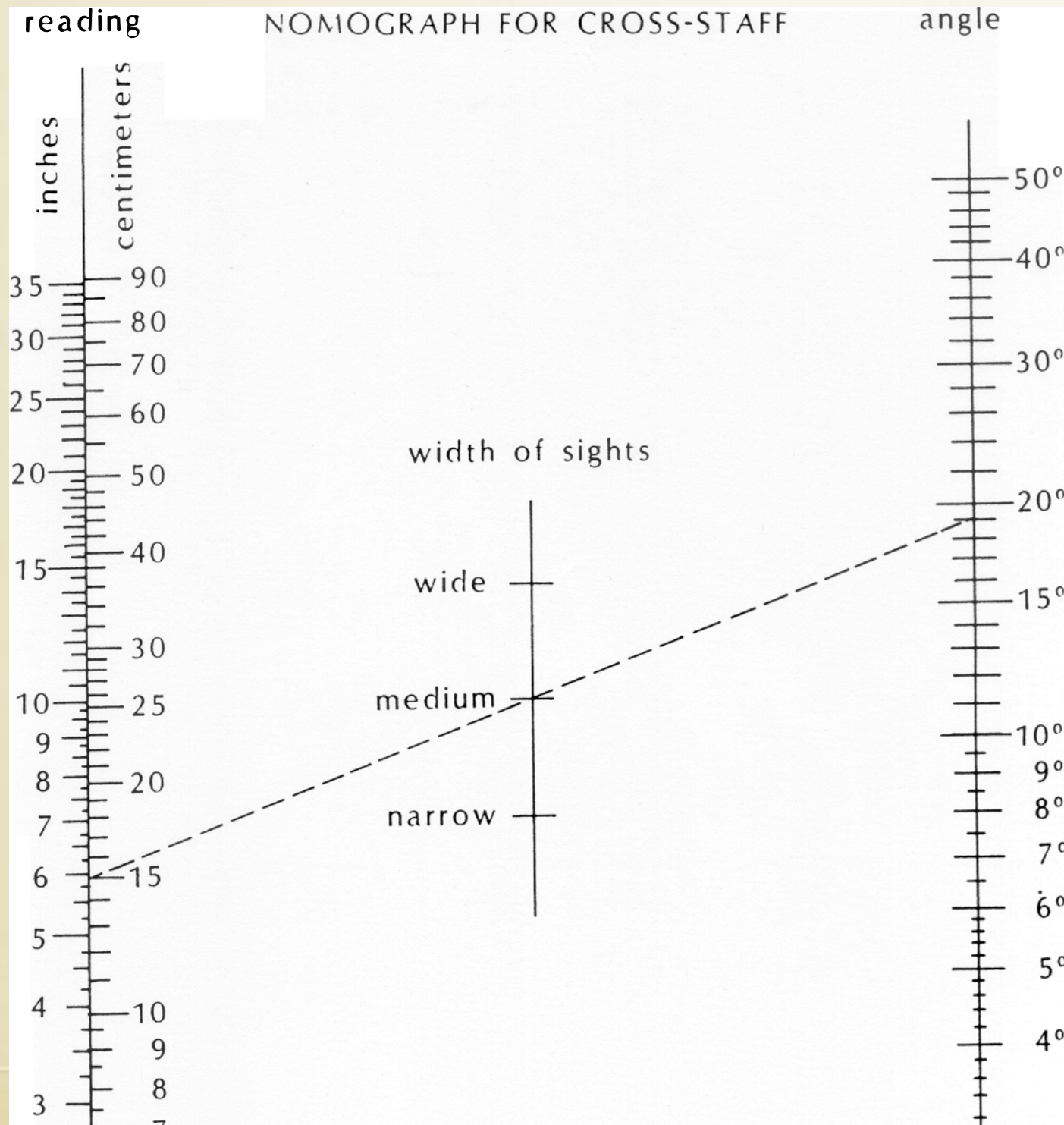


To measure an angle, slide the cross-staff until one of the scales is the same width as the object. In this case, the yellow poster and the medium scale.

Read the ruler where the slide is.

TO GET THE ANGLE

*WITHOUT TRIG

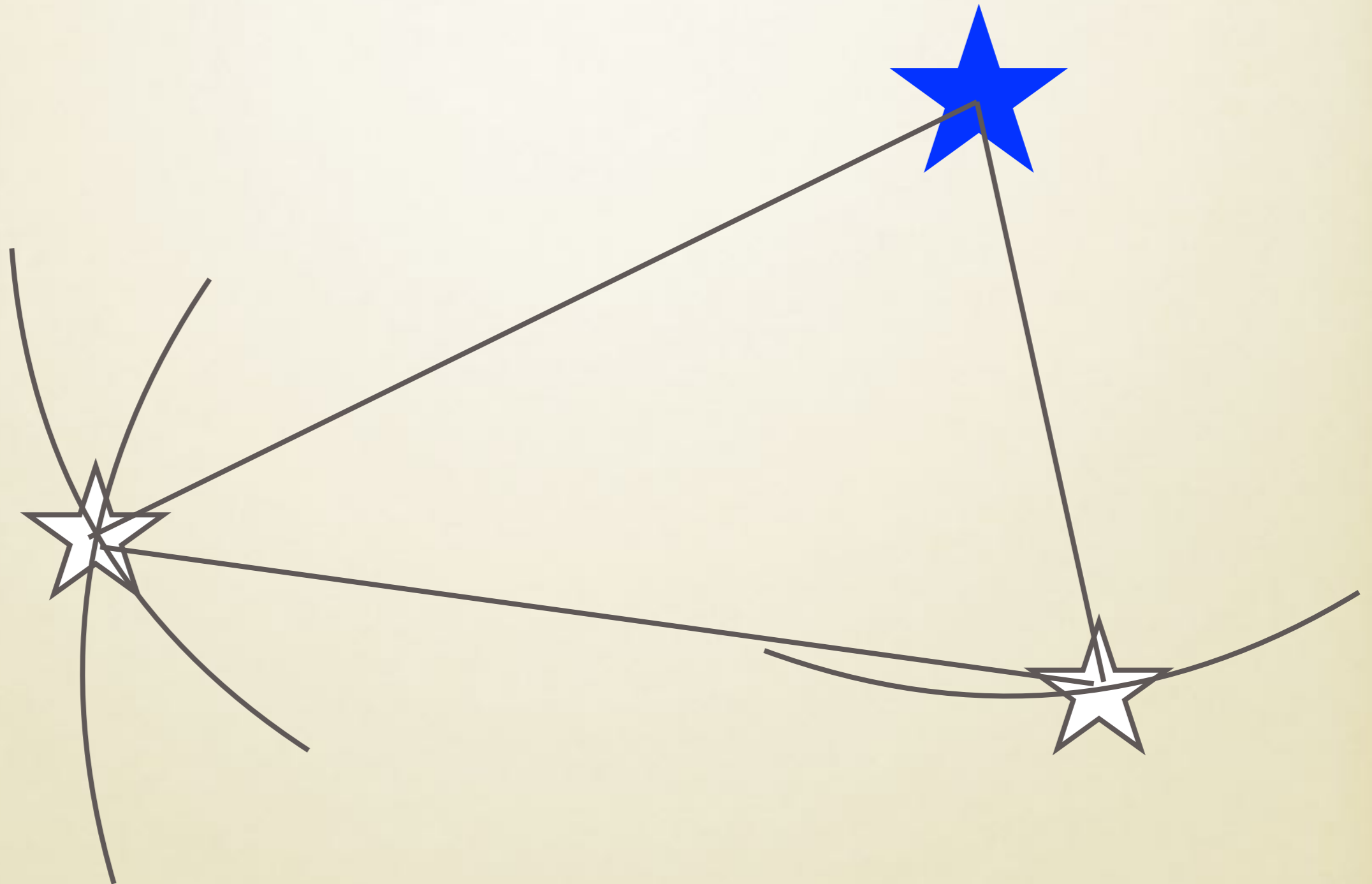


Using an ordinary ruler, find the reading on the left side, then aim through the scale width in the center. The line will point to the angle on the right.

WHAT YOU CAN DO WITH IT

- Map constellations
- Measure altitude angles
- Map planet motions over time
- Measure maximum elongation angle of inferior planets

CONSTELLATION MAPS



THE ASTROLABE



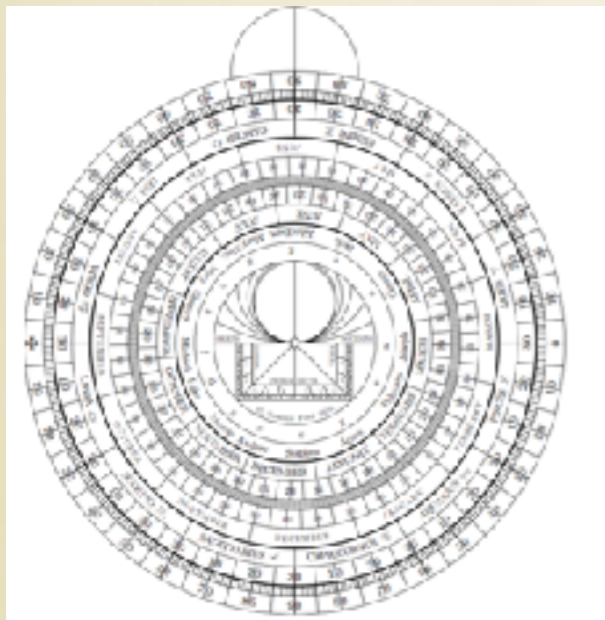
“A Treatise on the Astrolabe”
Geoffrey Chaucer
(1391)

Wikipedia: “The *Treatise* is considered the "oldest work in [English](#) written upon an elaborate scientific instrument". It is admired for its clarity in explaining difficult concepts—although modern readers lacking an actual astrolabe may find the details of the astrolabe difficult to understand. Robinson believes that it indicates that had Chaucer written more freely composed prose it would have been superior to his translations of [Boece](#) and [Melibee](#).

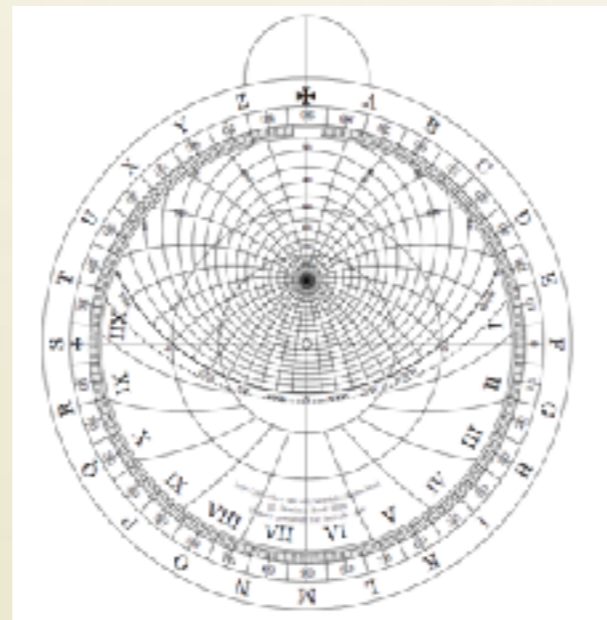
PARTS OF AN ASTROLABE

designed by
Dominic Ford

MOTHER



BACK



FRONT

RETE



TRANSPARENT

RULE

ADELAIDE

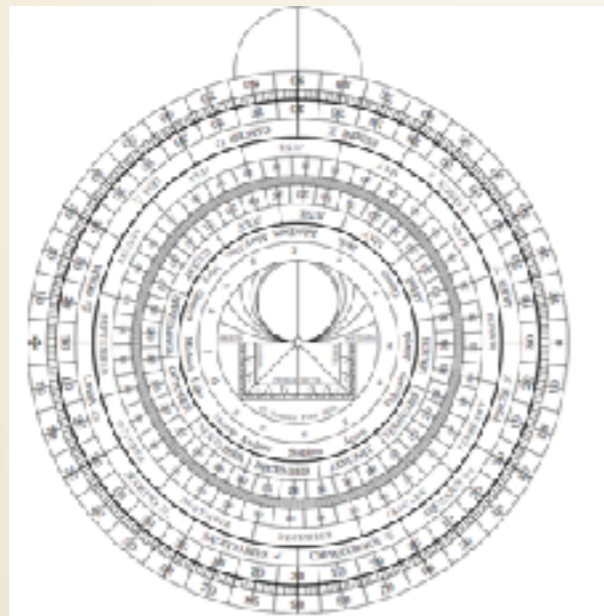


ASSEMBLY

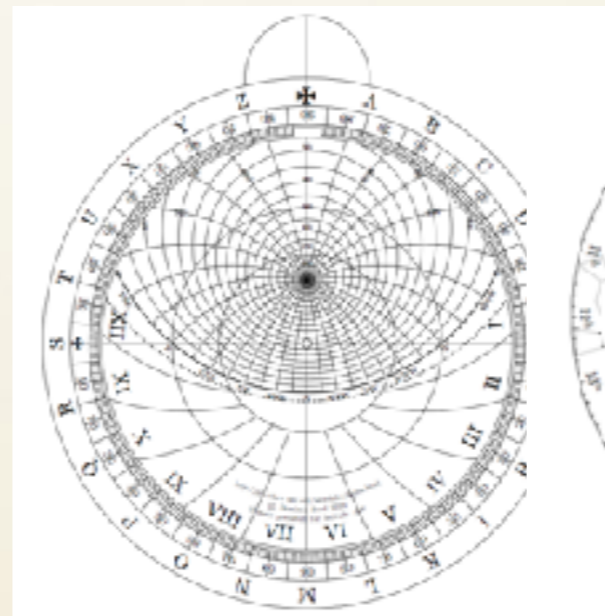
ADELAIDE



MOTHER



BACK



FRONT

RETE



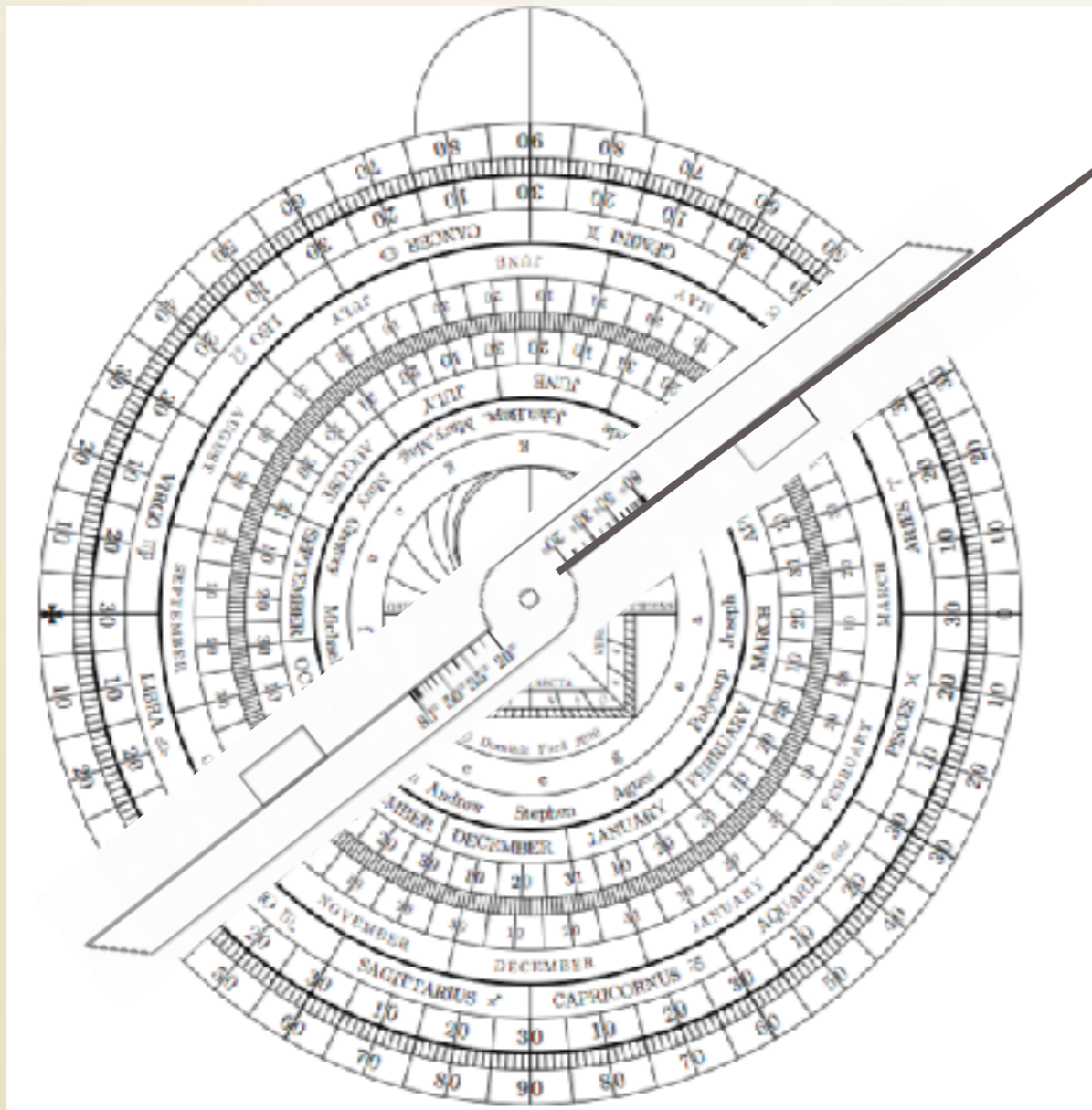
RULE



Cut out the pieces
Glue to card stock
Use a brad to hold it together
Leftmost 2 pieces get flipped over
Glue front and back of Mother together

IN PRACTICE

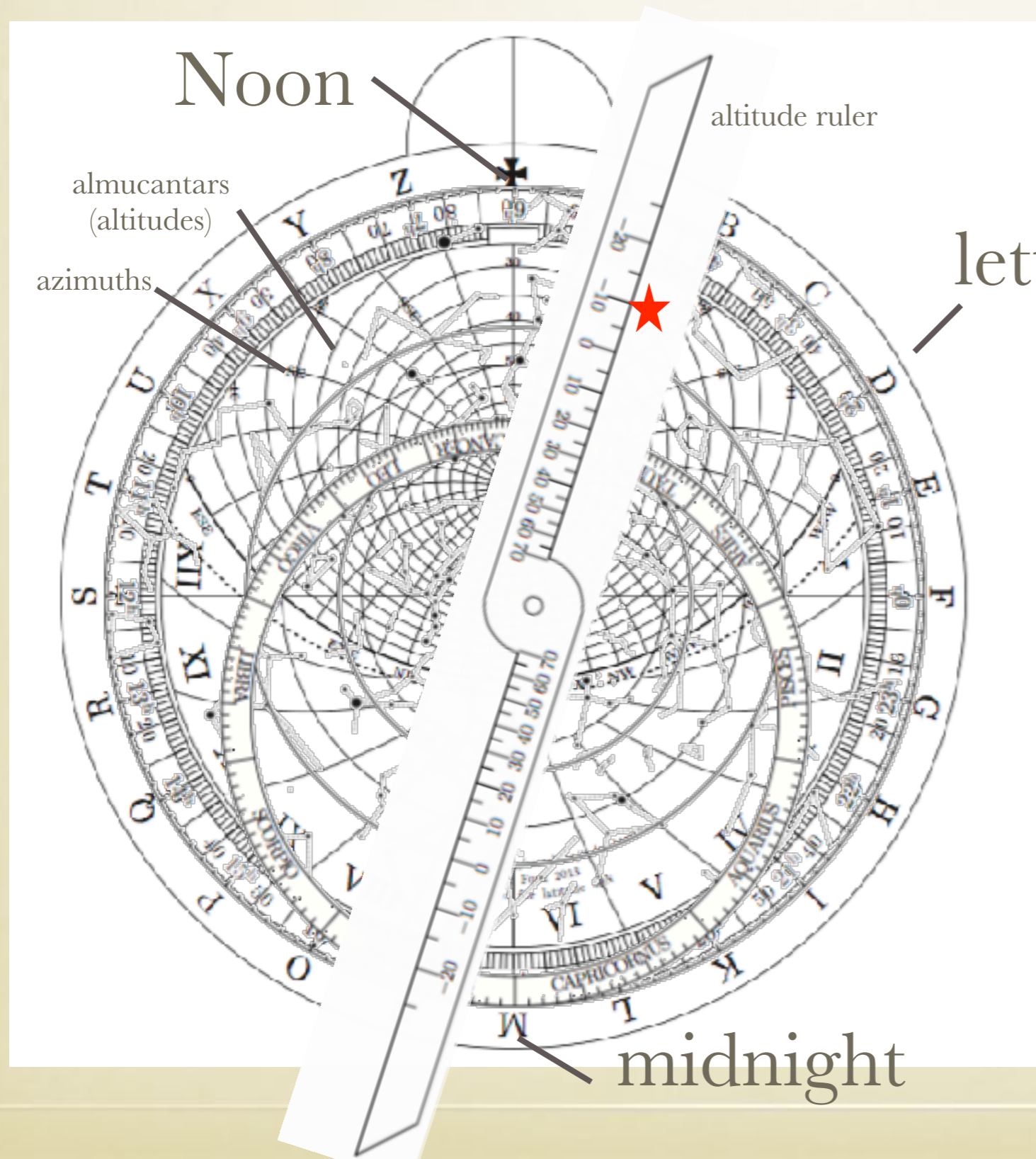
Hold here
let hang vertically



Use the back
of the Mother
and the
adelaide
to measure the
altitude of a known
star

THEN...

Rotate the rete
until that star's altitude
matches the
altitude on the front scale.
Use the rule to
be precise.



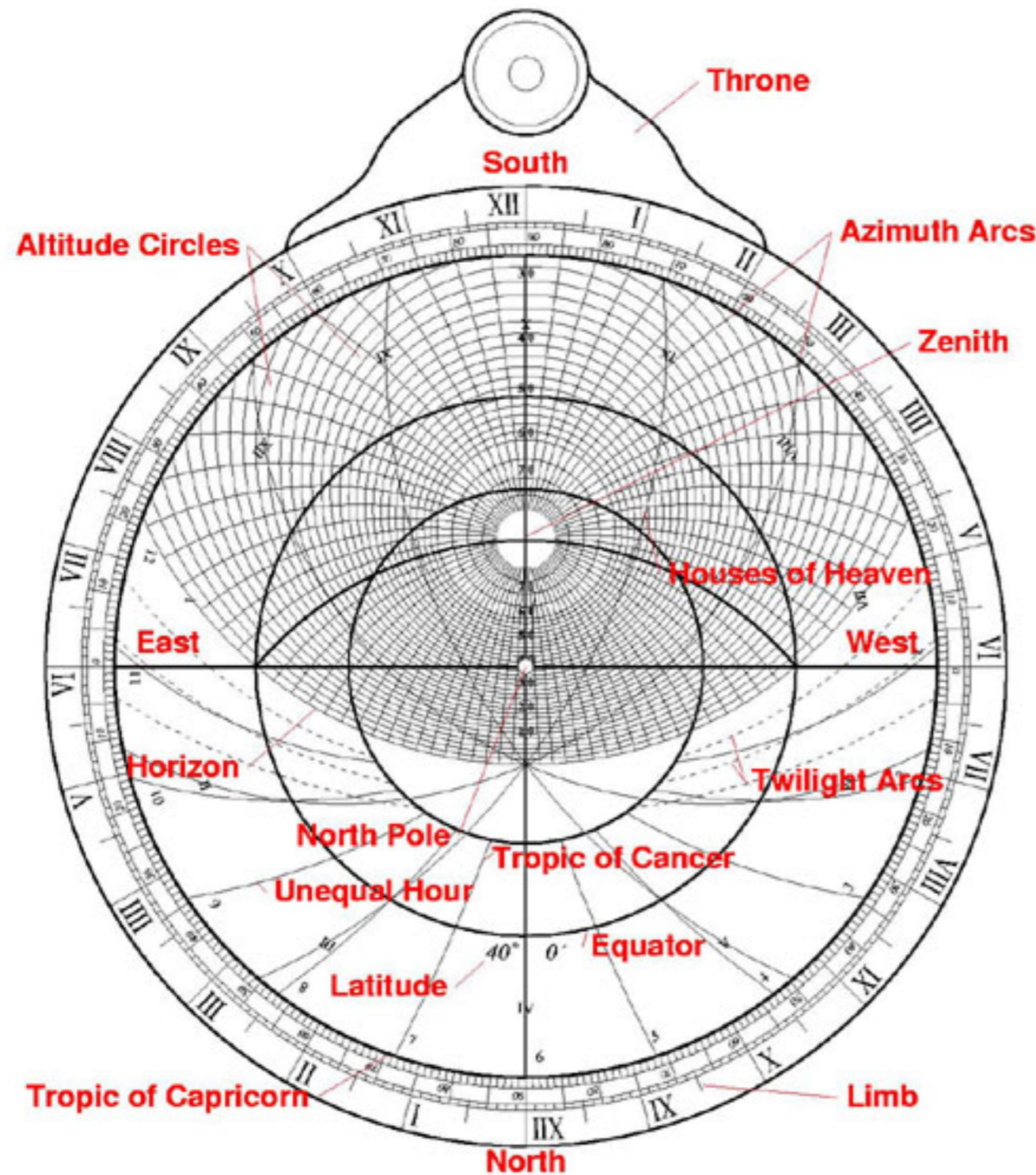
letters are hours

Interchangeable front plate
= “the climate”
different latitudes

Retes used to be open
lattices with branches
pointing to a few stars.

w,v,j missing

PIECES PARTS



[https://
www.astrolabes.org/
pages/plate.htm](https://www.astrolabes.org/pages/plate.htm)

OTHER FEATURES

“Equal hour”
diagram

Zodiac

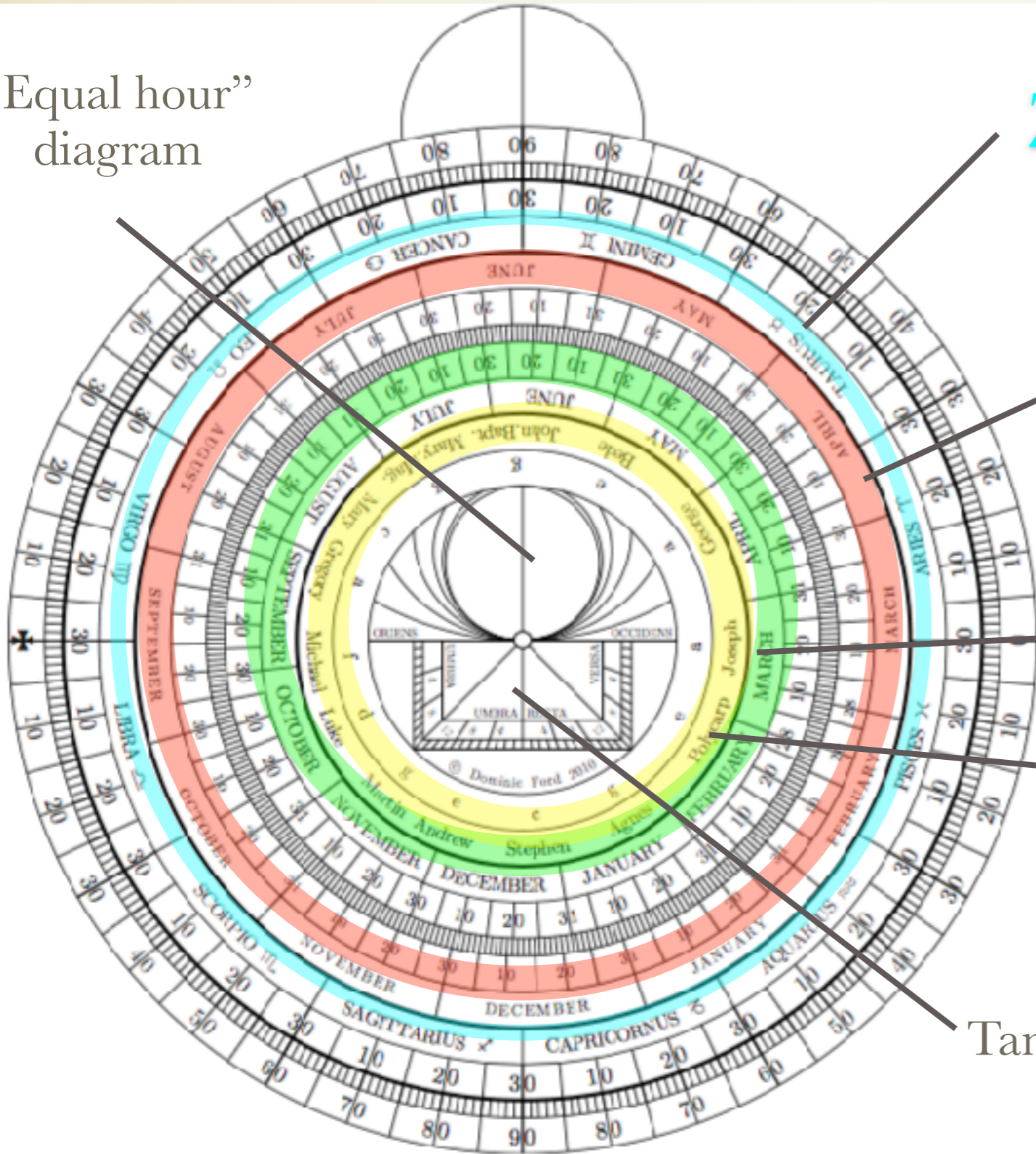
1394 Calendar

“Treatise on the Astrolabe”
Geoffrey Chaucer

1974 Calendar

Saints

Tangent fraction calculator



REFERENCES

- <https://www.astrolabes.org>
- <http://in-the-sky.org/astrolabe/>
 - Building directions
- http://in-the-sky.org/astrolabe/astrolabe_jbaa.pdf
 - How to use
- Hemenway, M. K., & Robbins, R. R. (1991). Modern astronomy: an activities approach. Austin: University of Texas Press. (quadrant and cross staff)