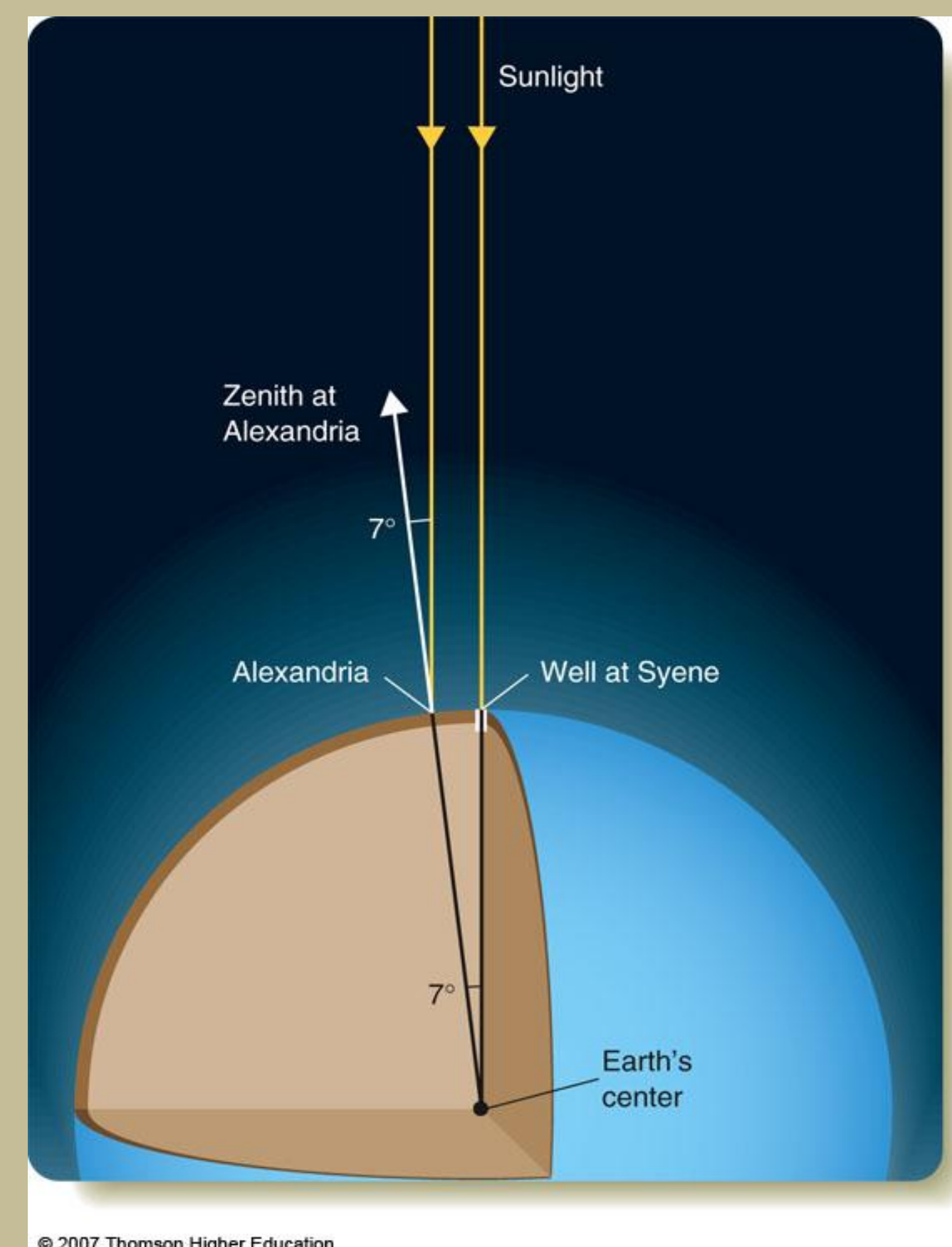


# MEASURING THE EARTH'S SIZE

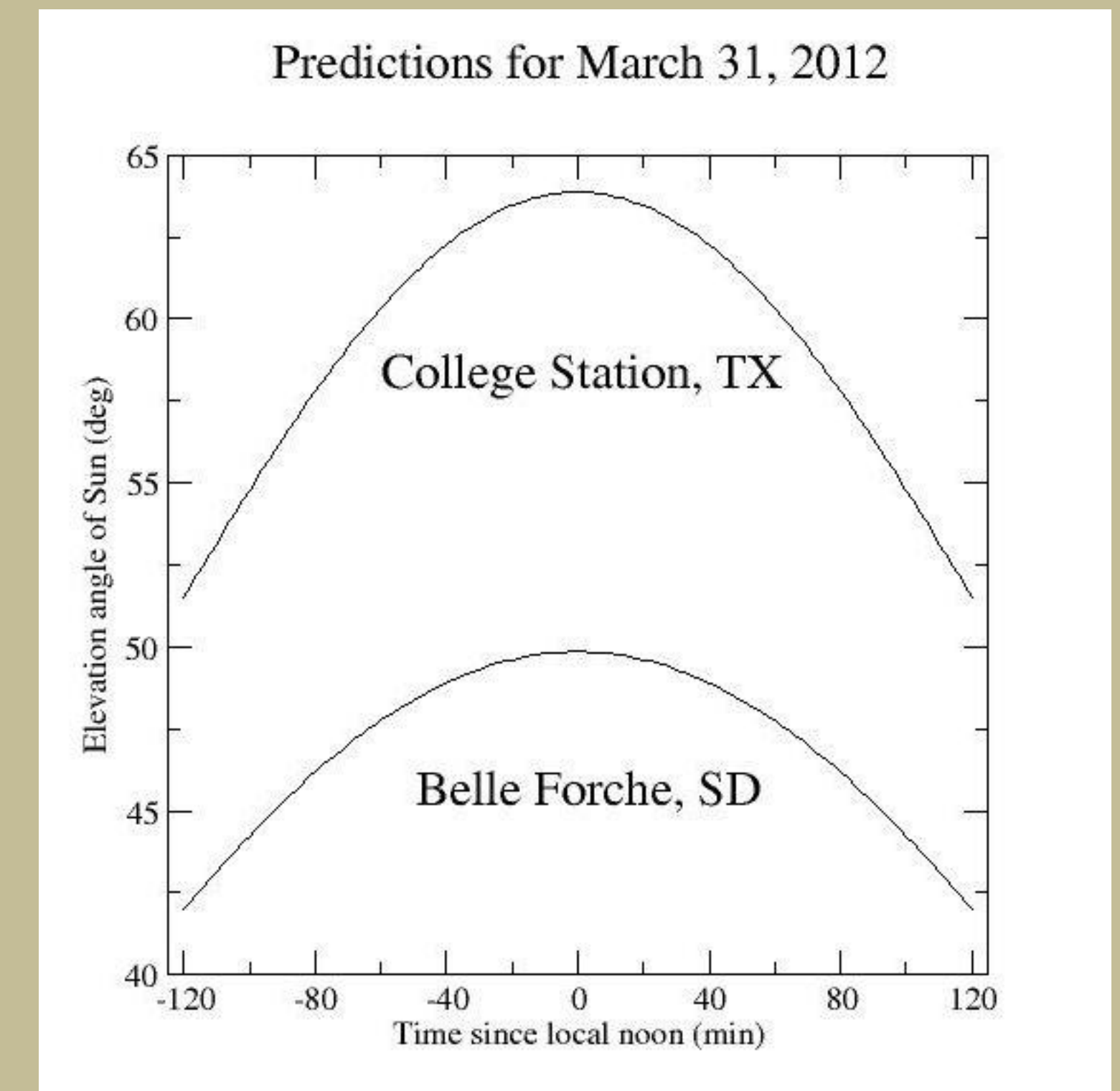
## Eratosthenes' experiment

The Greek astronomer Eratosthenes (ca. 276-195 BC) worked in Alexandria, Egypt. He noted that in a town named Syene to the south of Alexandria the Sun was straight up at local noontime on the first day of summer, while in Alexandria the Sun was 7 degrees from the zenith on that day. He reasoned correctly that the circumference of the Earth would therefore be  $360/7$  times the distance between Alexandria and Syene.



## Elevation of the Sun on March 31, 2012

We will attempt to measure the circumference of the Earth from observations made on the same day from College Station, Texas, and Belle Fourche, South Dakota. This involves measuring the length of the shadow of a vertical stick for a couple hours either side of local noontime. To do this we will use a *gnomon* at each location such as the one pictured here. The shadow lengths can be converted into values of the elevation angle of the Sun for the two locations.



We have already determined that the distance between the two locations is 1310 statute miles by car. We estimate that this would be 1054 miles along a great circle arc. Belle Fourche is about 972 statute miles further north than College Station. Local noontime (when the Sun is highest in the sky) will occur at about 1:27 PM CDT in College Station, and will occur at about 1:57 CDT in Belle Fourche, as it is further west in the Central time zone.

Because the observations are to be carried out on the same day, the difference in the maximum elevation angles of the Sun will be equal to the difference of the latitudes. We do not need to know the declination of the Sun. The circumference of the Earth will then be equal to  $360/(\text{latitude difference})$  times 972 miles.

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