Sidereal And Synodic Time - Activities (Ages 16-18)

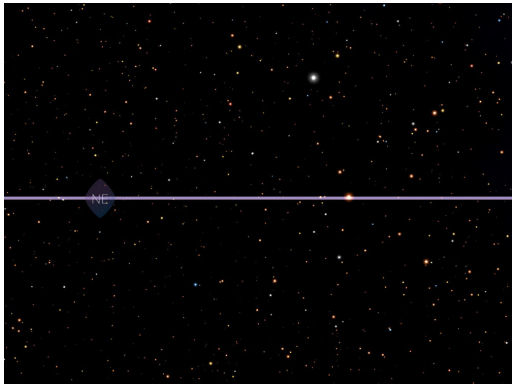
Today we are going to investigate:

- How stars rise above the horizon
- How to determine the rising time of a star
- How the rising time of a star changes each day
- The difference between a synodic day and a sidereal day

1

Activities

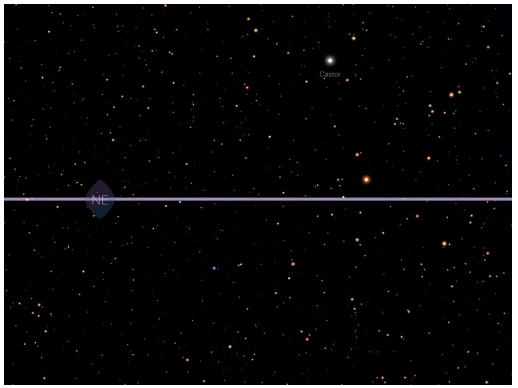
Night Sky accurately simulates the movements of objects in the sky caused by the Earth rotating on its axis and revolving around the Sun. As the Earth rotates every day stars rise above the horizon, move across the sky and set under the horizon. Start up Night Sky and check the Preferences to ensure that Environment Based Horizons is turned off. Move the sky to find a bright star just about to rise above the horizon. (Tip: you should try to find a star with a name that is continuously labelled).



Question: Do you think this star will rise at exactly the same time every day?

2

Use the Space Travel tab, and tap on the minutes value of the displayed time to select it. Slide the minutes value to advance time minute by minute and watch the star move up towards the horizon. You will see that you need to do this very slowly. Also, you will find it helpful to zoom in on the star to enlarge it. Find the time when the horizon is passing exactly through the center of the star. This is the star's rising time. When you are happy that the star is exactly on the horizon, save this time by tapping on the blue Time Stamp button .



Question: On the following day what time do you expect the same star to rise?

3

Use the Space Travel tab, and tap on the day value of the displayed time to select it. Advance time by exactly one day and find your chosen star again.

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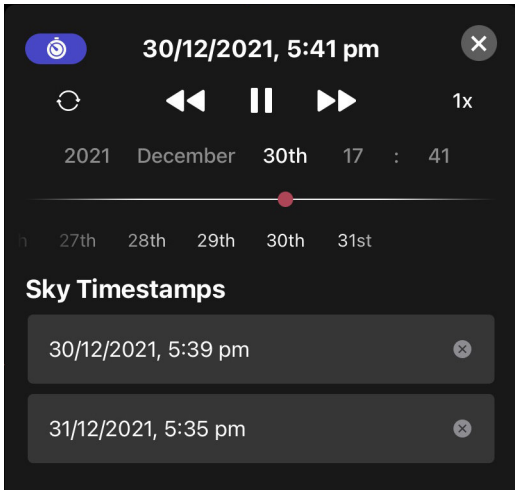
Question: Is the star still on the horizon?

4 Use the Space Travel tab, and reselect minutes. Move time back until the star is exactly on the horizon again. Save this time by tapping on the blue Time Stamp button. You should have two saved timestamps recording the rising time of your chosen star on two consecutive days.



Questions: On the second day did the star rise earlier or later than the first day?

By how many minutes was the rising time different each day?

5 A day can be defined to in two ways. A day can be based on its rotation with respect to the Sun (called a **synodic day**) or its rotation with respect to distant stars (called a **sidereal day**). The two types of day are slightly different as over a year the Earth moves in its orbit with respect to the stars.

Question: If a synodic day is exactly 24 hours long, based on your observations how long do you think a sidereal day lasts in hours and minutes?

What we have discovered:

- The Earth's rotation causes stars to rise over the horizon
- A day based on Earth's rotation with respect to the Sun is called a synodic day
- A day based on Earth's rotation with respect to the stars is called a sidereal day
- A sidereal day is slightly shorter than a synodic day

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