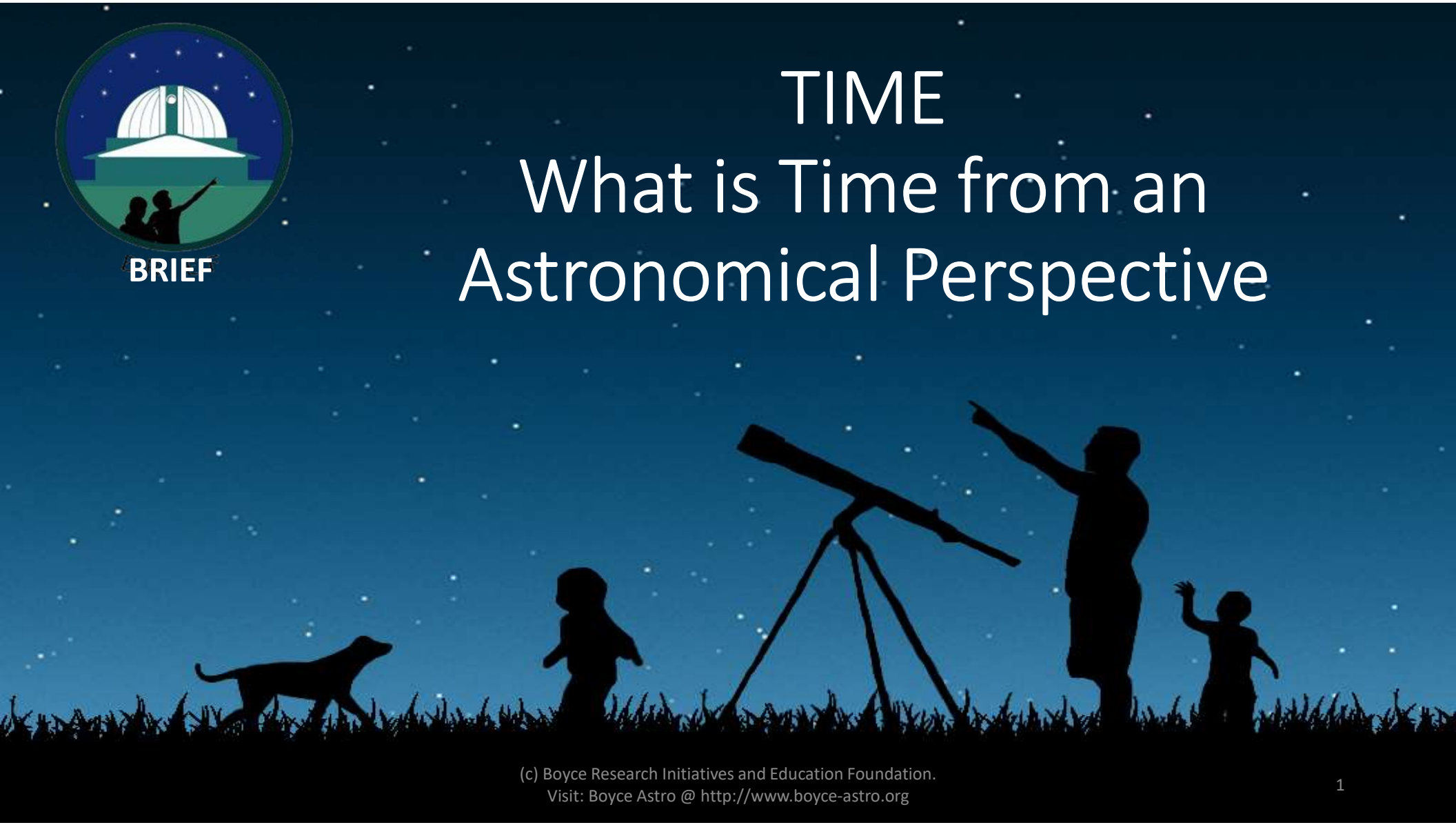
BRIEF

TIME
What is Time from an Astronomical Perspective



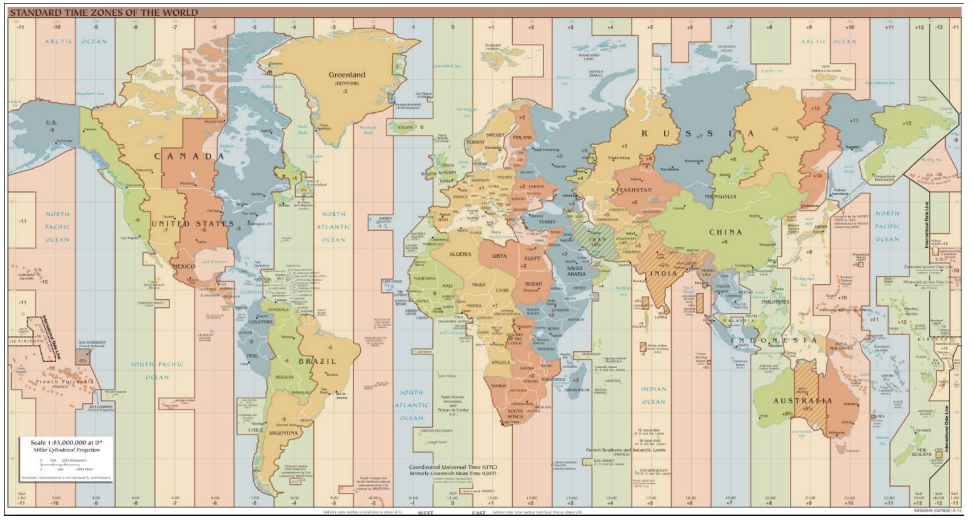
Overview

Here is a loaded question: What time is it?

In Astronomy there are a variety of time scales. You will encounter a fair number of them.

This video will outline some of these most common ones you will experience.

Let's end the confusion!!!!!



What is Time from an Astronomical Perspective

Why is a focus on Time so important?

Key to any astronomical scientific endeavor, even more so in photometry, is providing a coordinated time when an event occurred.

Thus syncing your observations to a known time source is ***fundamental***.

To begin an activity, it is important to sync your computer with a known source. The USNO provides a time source if needed: http://tycho.usno. navy.mil/simpletime.html

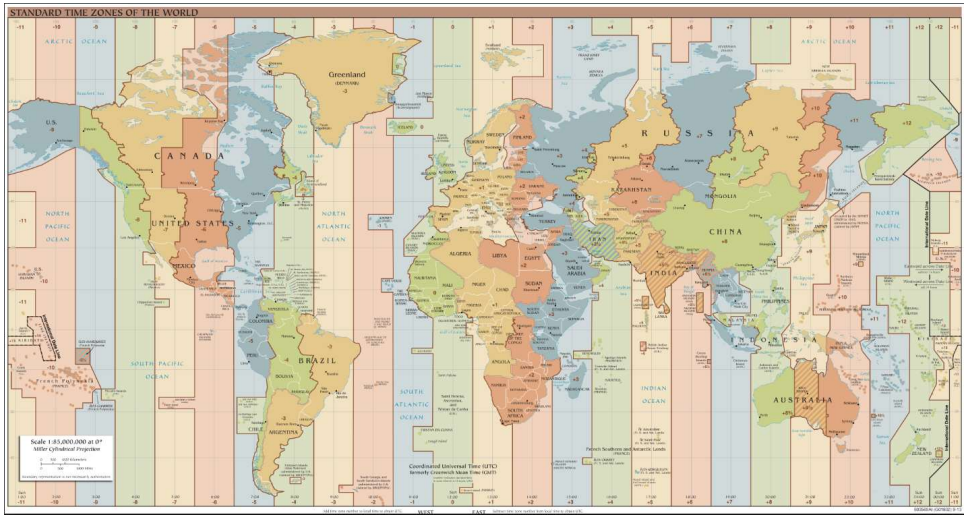
It is paramount that the computer's clock is accurate as the time of each image will be embedded into each FITS header of each image.

IMPORTANT: Computer clocks are not perfect and should frequently be sync'd with the above source.

US Naval Observatory Master Clock Time:
Wed, 11 Jul 2018 19:36:44 UTC

Time Zones:
Wed, 11 Jul 2018 15:36:44 EDT
Wed, 11 Jul 2018 14:36:44 CDT
Wed, 11 Jul 2018 13:36:44 MDT
Wed, 11 Jul 2018 12:36:44 PDT
Wed, 11 Jul 2018 11:36:44 AKDT
Wed, 11 Jul 2018 09:36:44 HST

NOTE: Individual users will not perform time sync'ing of BRIEF telescopes. This will be performed for you.



Earth Based Time

Time Zones:

There are many time zones, but only one matters: Coordinated Universal Time (UTC)

UTC is NOT GMT – Greenwich Mean Time. GMT can be displayed in 12 or 24 hour format. UTC is only displayed in 24-hour format and is the same time across the world.

UTC is the standard we want to embrace for Earth based time.

Earth Based Time

There are two types of Days: Solar and Sidereal

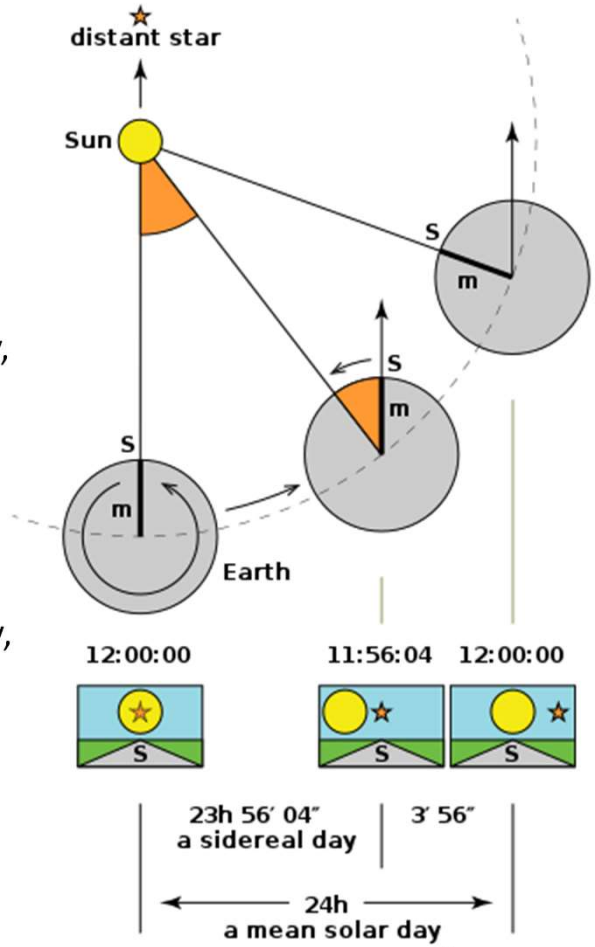
Solar:

- Time based on the Earth rotation relative to the Sun.
- The time it takes for the Sun to move from directly overhead on one day, to directly overhead the next day.
- Our clocks use Solar Time. There are 24-hours in a Solar Day

Sidereal:

- Based on the rotation of the Earth with respect to the stars. The time that it takes for a particular star to move from directly overhead one day, to directly overhead the next day.
- Astronomers use Sidereal Time. This is 4-mins shorter than an Solar Day.

Moon: The moon also is impacted by this: Synodic Month (29.5 days) and Sidereal Month (27.3 days). However, we will not use this in our studies.



Beyond Earth Based Time

In Astronomy, there are a variety of time clocks:

- Julian
- Besselian
- Barycentric
- Barycentric Dynamical Time (BJD_{TBD}) – Important for Exoplanets
- J2000 – Used for standardizing RA/Dec coordinates
- Sidereal, and others

The more commonly used time systems, from above, are:

a) Julian Date/Universal Coordinated Time (JD_{UTC}),
b) Heliocentric Julian Date/Universal Coordinated Time (HJD_{UTC}),
c) Barycentric Julian Date/Barycentric Dynamical Time (BJD_{TDB}).

Beyond Earth Based Time

Julian (Video available: What is Time – JD)

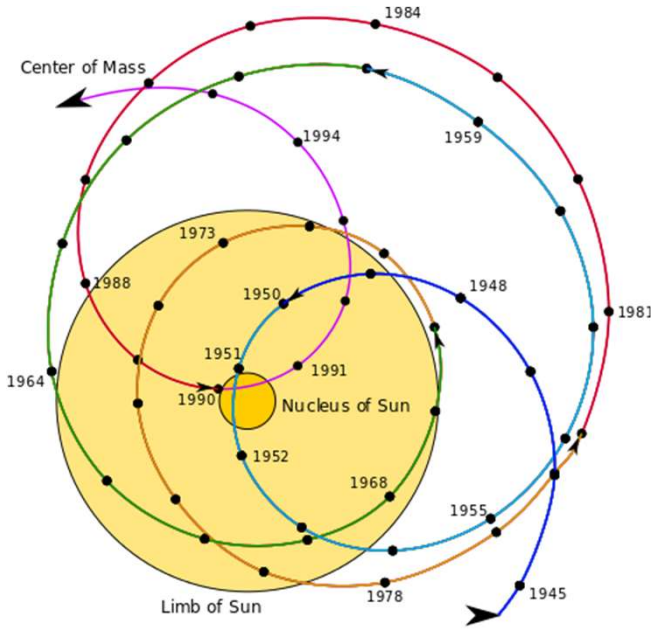
Continuous count of days since 01 January, 4713 BC at Noon

Heliocentric Julian Day (Video available: What is Time – HJD)

Is JD corrected for differences in the Earth's position relative to the Sun.
Accounts for the finite speed of light and the time it takes to travel.
Allows for a common reference system as it is fixed.
Is dependent on the direction of the object observed.

Barycentric Julian Date (Video available: What is Time – BJD)

Julian Date corrected for differences in the Earth's position with respect to the barycenter of the Solar System.



Beyond Earth Based Time

Barycentric Dynamical Time

This is a relativistic (no, there isn't a video on Relativity) where BJD is corrected for the Time Dilation between the Sun and Earth.

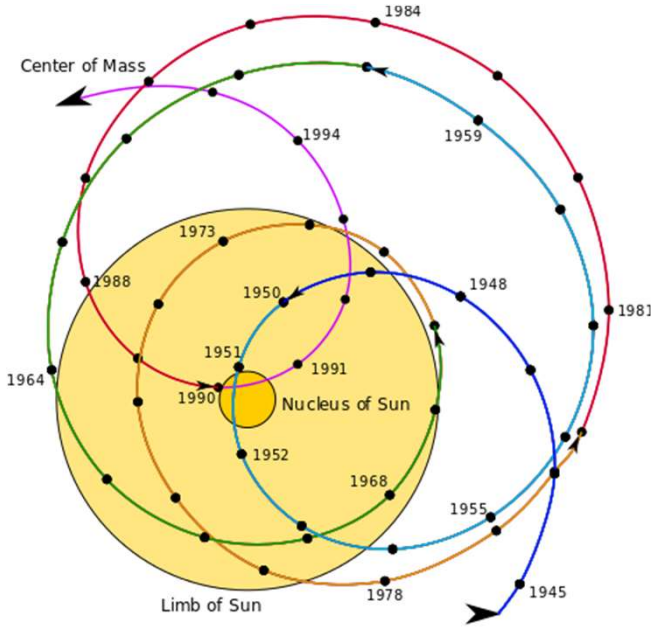
Time Dilation – the difference in the elapsed time measured by two observers in different places either due to velocity differences or gravitational fields.

J2000

Stellar positions based on the Gregorian date of 01January, 2000 at 12:00 GMT

This is the typical way Right Ascension and Declination are reported: J2000

This is an Epoch (Video available: What is an Epoch)



Online Resource for Converting Time

BREIF has provided a resource (covered in another video: Besselian Epoch and the Calculator) for these conversions.

For time conversion, the University of Ohio has a “Time Utilities” web site that allows for various conversions: http://astroutils.astronomy.ohio-state.edu/time/

The USNO provides a time source if needed: http://tycho.usno. navy.mil/simpletime.html

Summary

There are a wide variety of ways to express the same moment in time.

So, the simple question of “What time is it?” really depends.

This video was meant to provide an overview of the most relevant times. Please consult other videos if greater detail on each is needed.

Questions?