Astronomy...
Things Both Near and Far

Robert Vanderbei

Carnegie Post Acute Care at Princeton

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https://vanderbei.princeton.edu

Crescent Moon

4:07pm Nov. 5, 2021

Crescent Moon

4:23pm Dec. 18, 2020

First Quarter Moon

10:56pm Feb 11, 2011

Super Full Moon

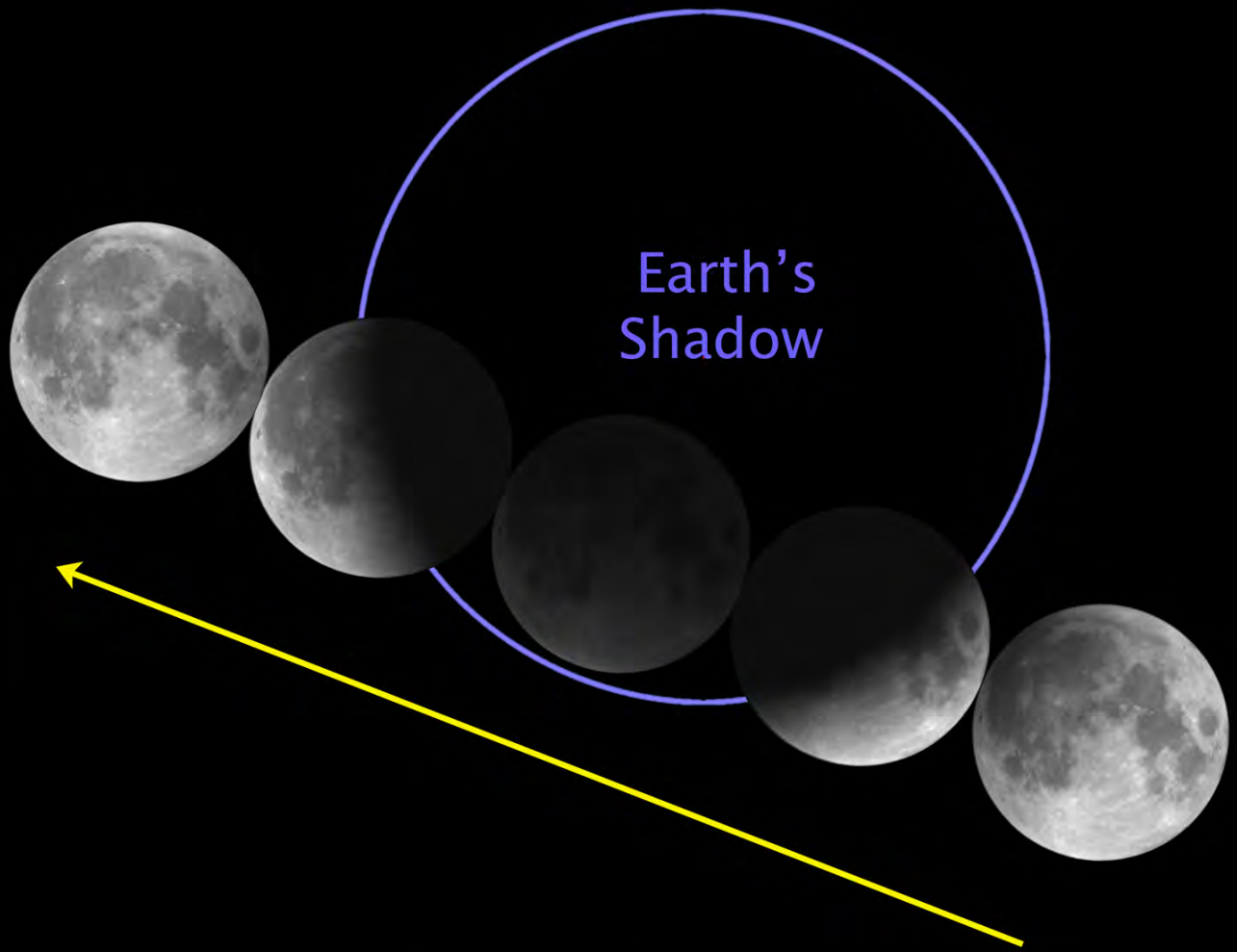
June 14, 2022

Last Quarter Moon

5:41am May 31, 2013

Is The Earth Flat?

A Picture's Worth a Thousand Words...



How Aristarchus measured the size of the Moon.

Lunar Eclipse

November 8, 2022

Lunar Eclipse

November 8, 2022

Lunar Eclipse

November 8, 2022

Lunar Eclipse

November 8, 2022

Moon

1.2 sec

Moon and Mars

Moon and Mars

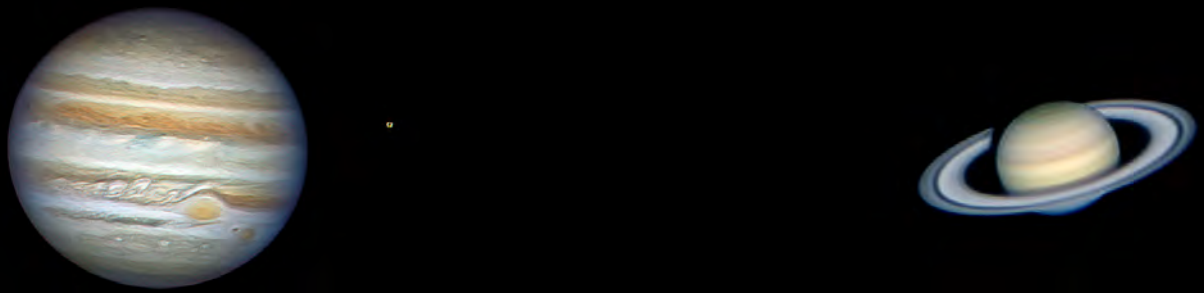
1.2 sec and 3.3 min

Mars

Oct. 6 and 18, 2020

Jupiter and Saturn

32 and 67 min



Comet 103P / Double Cluster

1.2 min / 7,460 and 7,640 yrs

The Green Comet (aka ZTF)

Feb. 1, 2023

Looking Out Beyond Our Solar System


Orion Nebula
Star Forming Region
1,344 yrs


Dumbbell Nebula
Dying Star
1,360 yrs

Horsehead Nebula

1,500 **yrs**

Veil Nebula

Supernova Remnant

2,400 **yrs**

Western Veil

2,400 yrs


Eastern Veil


Ring Nebula
2,567 yrs

Crescent Nebula

5,000 yrs

Jellyfish Nebula

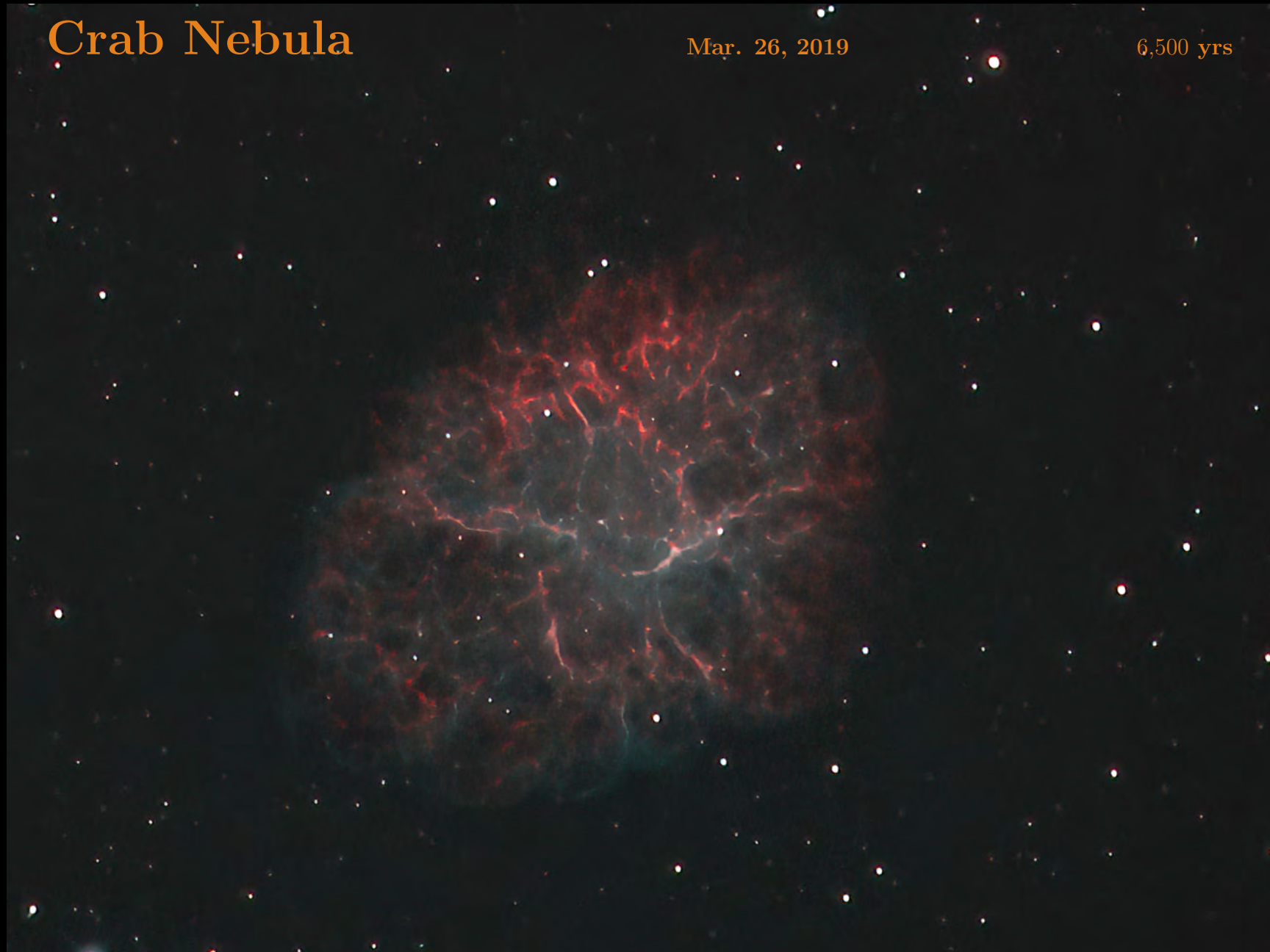
5,000 **yrs**

Rosette Nebula

5,200 **yrs**

Eagle Nebula

5,700 **yrs**


Crab Nebula
Mar. 26, 2019
6,500 yrs


Crab Nebula
Oct. 27, 2006
6,500 yrs


Bubble Nebula
9,100 ± 2,000 yrs


Globular Cluster M13
22,200 yrs

Looking Out Beyond Our Milky Way

The Andromeda Galaxy

2,450,000 **yrs**

M81 and M82

12,000,000 **yrs**

The Whirlpool Galaxy

31,000,000 **yrs**

The Whirlpool Galaxy

31,000,000 **yrs**

The Whirlpool Galaxy

31,000,000 **yrs**

The Leo Trio

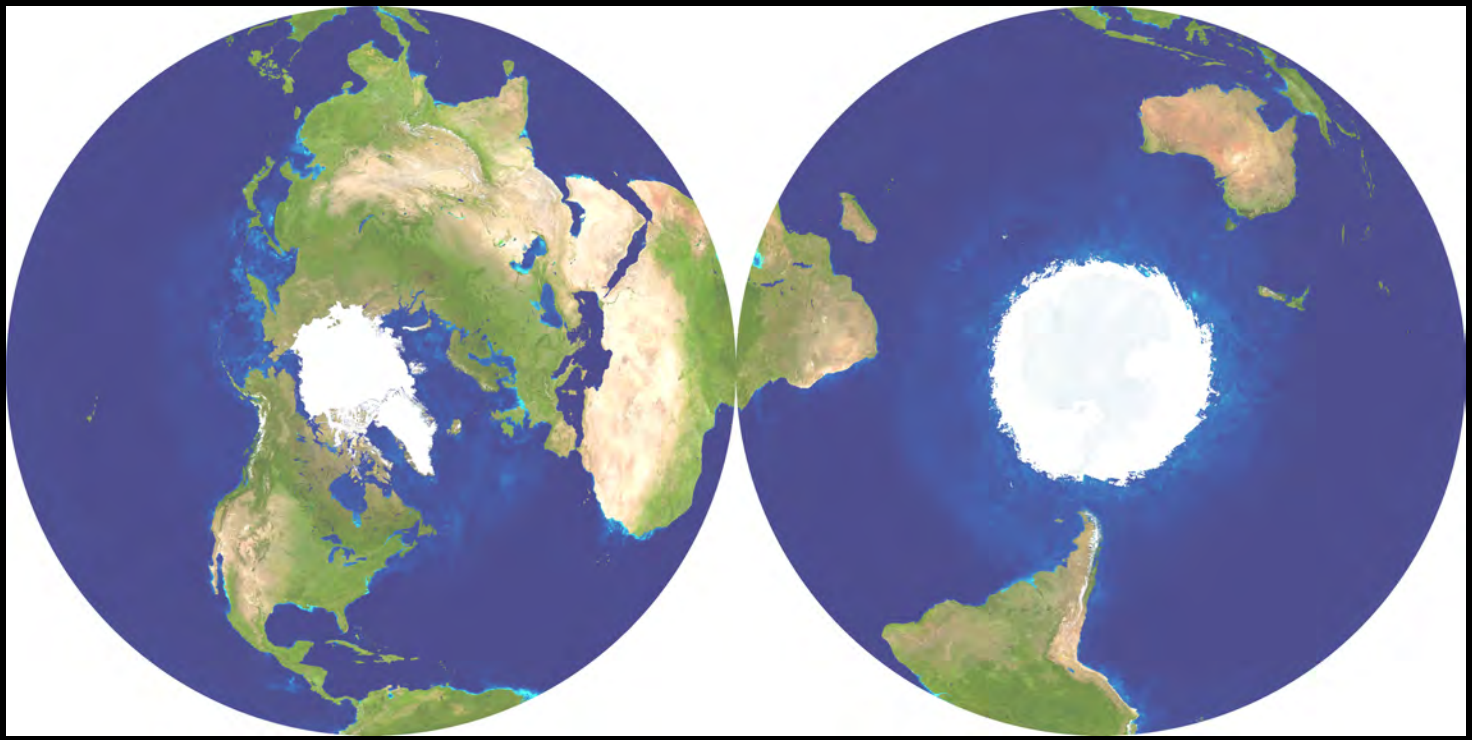
32,000,000 **yrs**

The Needle Galaxy (NGC 4565)

42,700,000 **yrs**

Questions?

Gott-Goldberg-Vanderbei Map



It's a Two-Sided Map

Some Details...

How Far to the Moon?

Angular Size of the Moon.

Using my iPhoneX, I took 16 pics to make a 360° panorama from the middle of the road in front of my house. I used Photoshop to assemble the pics:

Here's a closeup of my neighbor's car as seen at the left edge and the right edge:

The horizontal pixel distance of the car's rear view mirror as seen on the left and on the right is $38108 - 83 = 38025$ pixels.

Using the same camera I took a picture of the crescent Moon:

Here's a closeup showing that the Moon's diameter is 59 pixels:

Using these pixel measurements, we can compute the angular size of the Moon:

$$\text{Moon Size} = \frac{59}{38025} \times 360^\circ = 0.56^\circ$$
$$\approx 1/2 \text{ deg}$$

From a lunar eclipse, we can determine that the Earth is about 4 times larger than the Moon. Earth's diameter is about $8{,}000$ miles. Hence, Moon's diameter is about $2{,}000$ miles.

ANSWER: Distance to the Moon $\approx 240{,}000$ miles

Moon's diameter $= 2{,}000$ miles

Moon's orbital circumference $= 2{,}000$ miles $\times \frac{360 \text{ deg/circumference}}{1/2 \text{ deg/Moon diameter}}$

Moon's distance $= \frac{\text{Moon's orbital circumference}}{2\,\pi} \approx \frac{\text{Moon's orbital circumference}}{6} = \frac{2{,}000 \times 720}{6} = 240{,}000$ mi

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Distance Measurements

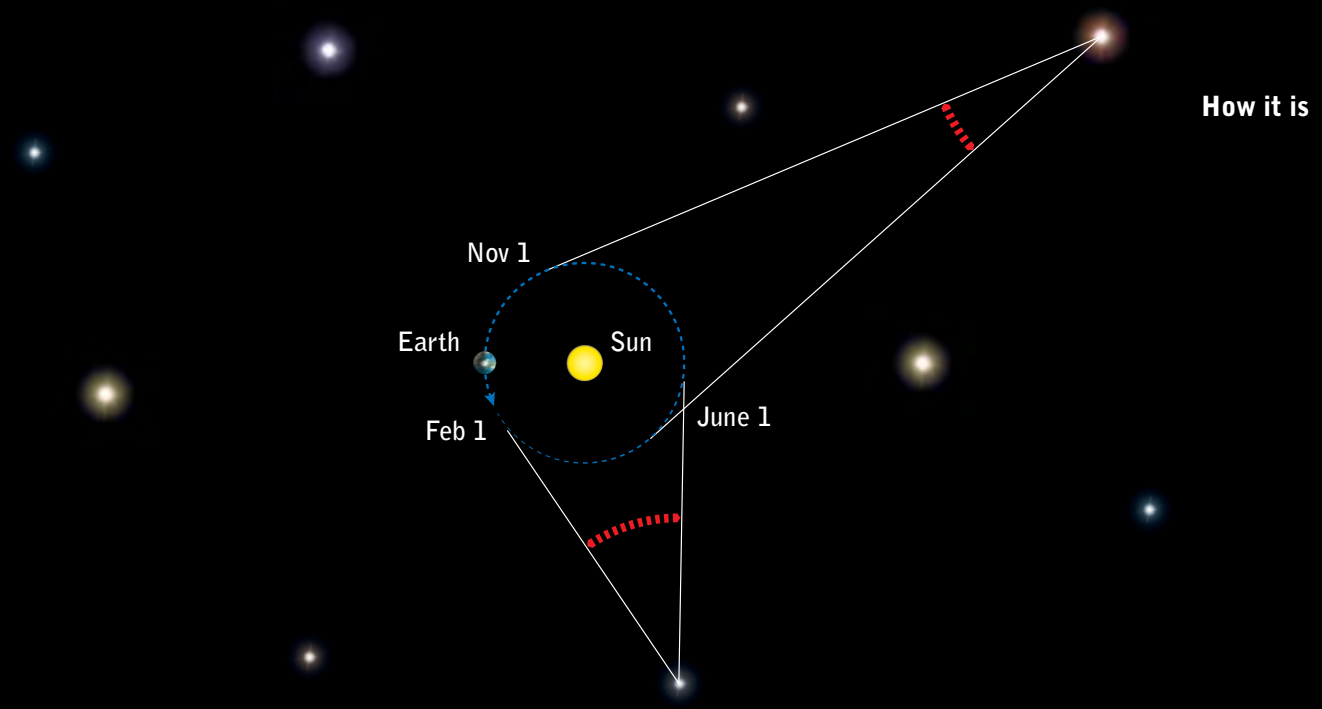
There are various ideas/methods for measuring distances.

The simplest is called *parallax*.

Using parallax, we can measure the distance to nearby stars.

For things further away, we need more clever/subtle methods.

Parallax: Distance to the Stars



Barnard's Star

Barnard's Star

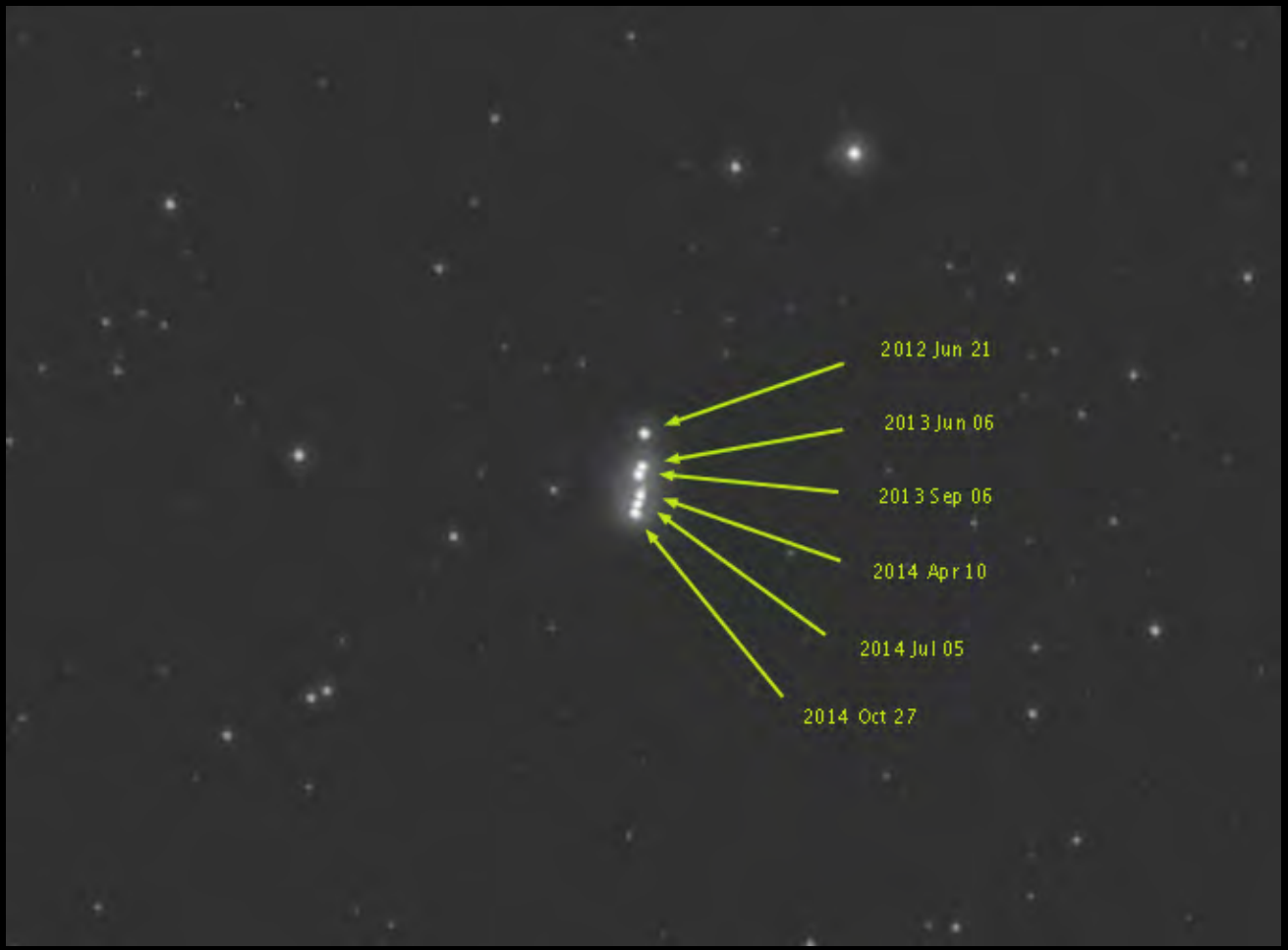
Barnard's Star

Barnard's Star

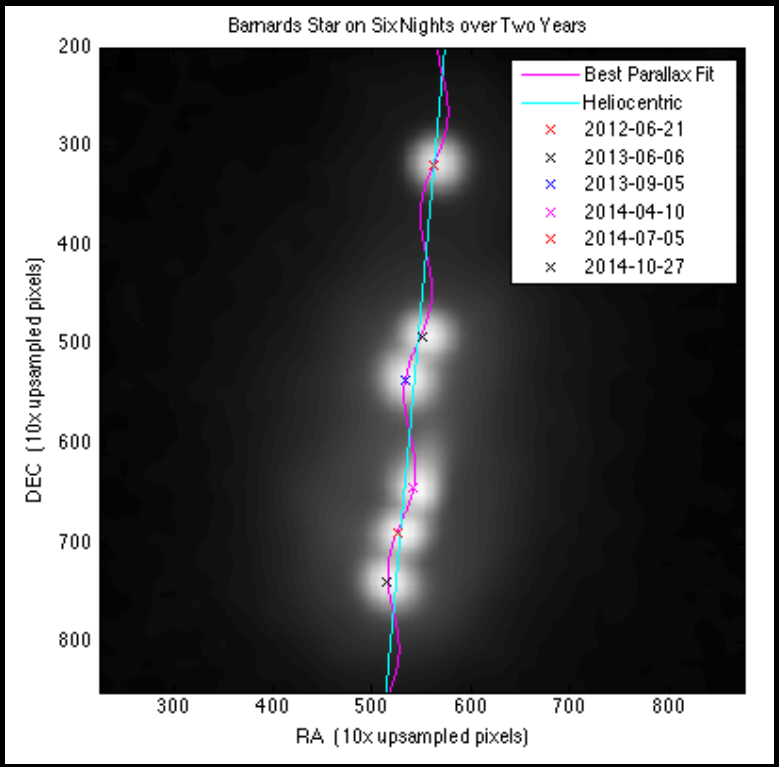
Barnard's Star

Barnard's Star

Barnard's Star Overlay



Barnard's Star Closeup



The measured parallax is 0.5478 arcsecs. Corresponds to a distance of 5.97 lightyears.