

Barnard's Star

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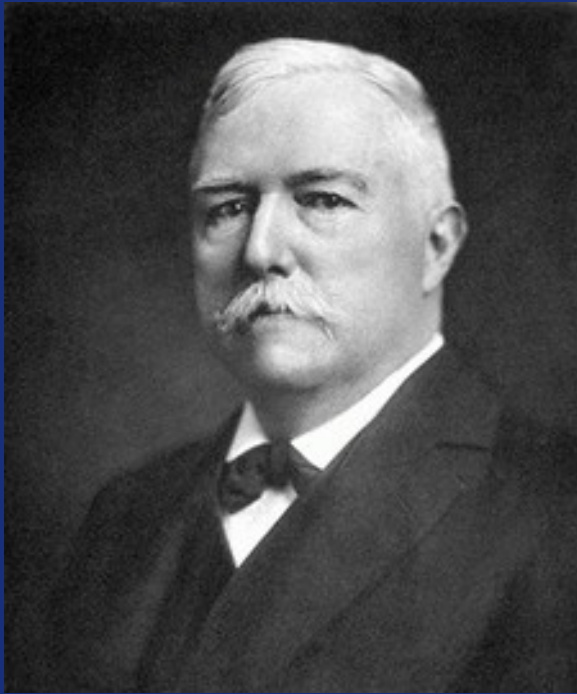
Intinerary

- What is Barnard's star and why is it important?
- The biography of Edward Emerson Barnard who discovered the star.
- Where it can be found in the sky and how to observe it.
- How its most important characteristic, its motion, can be demonstrated.
- And finally, a challenge for amateur astrophotographers.

Basic Facts

- Barnard's star is in the constellation of Ophiuchus.
- It has the highest proper motion of any known star ~10.3 arc-seconds per year.
- It is the closest star to the sun after the three stars of alpha centauri system at 5.9 light years.
- It is a red dwarf of magnitude 9.5 and the second closest after proxima centauri.
- It can be detected with a simple camera & tripod setup or small telescope.
- It is named after Edward Emerson Barnard.

Edward Emerson Barnard



1857-1923

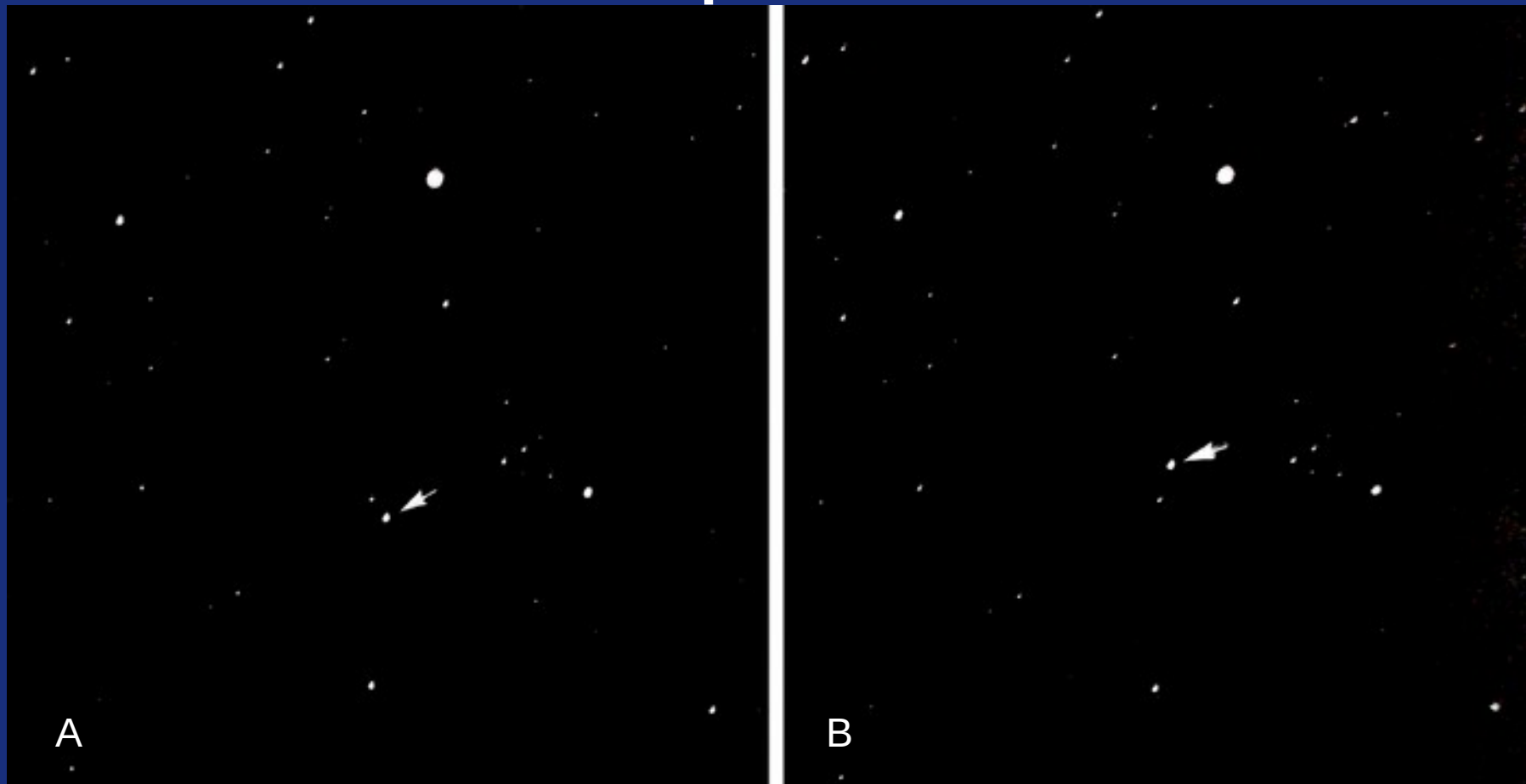
- Outstanding, self taught, American astronomer and astrophotographer (associated with Lick and Yerkes).
- Discovered 17 comets (2 shared).
- Discovered Amalthea, 5th moon of Jupiter (1892).
- ‘Discovered’ spokes on Saturn’s rings (1889).
- ‘Discovered’ craters on Mars (1892-3) and argued against the presence of Martian canals.
- Catalogued 370 dark nebulae (Barnard Objects).
- Discovered proper motion of Barnard’s star (1916).
- His name is honoured in many astronomical objects.



Edward Emerson Barnard

- Edward Barnard's father died when he was very young leaving his mother destitute. So he had to abandon his education at 9 years old to work in a photographer's studio. However, he acquired expertise in photography which served him well in his future. He educated himself in astronomy and astrophotography and showed great skill and dedication as an amateur making a number of significant discoveries. He eventually became a leading astrophotographer at Lick and Yerkes observatories.
- In his career he discovered or co-discovered 17 comets and the fifth moon of Jupiter: Amalthea in 1892. More controversially he reportedly observed 'spokes' on the rings of Saturn in 1889 and craters on Mars between 1892 and 1893. These were all disputed at the time but, somewhat uncannily, we now know he was correct. Interestingly, he also opposed Percival Lowell's claim of Martian canals.
- Apart from discovering the exceptional proper motion of the star originally catalogued as 'Munich 15040', he also pioneered the observation of dark nebulae, now called Barnard's objects, and catalogued 370 of them. Other astronomical objects are named after him – including craters on the moon and Mars and an asteroid.
- Quite a record for a self-taught astronomer.

Lick Telescope Observations



Lick Telescope Observations

- Here are two photographic observations of Barnard's star taken ten years apart by the Lick Observatory Telescope and they serve to show how the star moves noticeably against the background star field.
- Incidentally, these pictures are not likely to be photographs actually taken by Barnard who was himself at Lick. These likely were taken much later, judging by where the star is located.

The Constellation Ophiuchus



The Constellation Ophiuchus

- Barnard's star is in Ophiuchus. This is a photograph of the constellation, taken by me on 20th September 2019.
- The photograph is a 30 second shot taken with a Nikon D40 at ISO 400 using a 50mm lens at F2.0.
- You will hopefully recognise the familiar trapezium of stars that marks out the northern part of Ophiuchus. It is prominent in the southern sky from September to February.
- We shall locate Barnard's star from this picture.

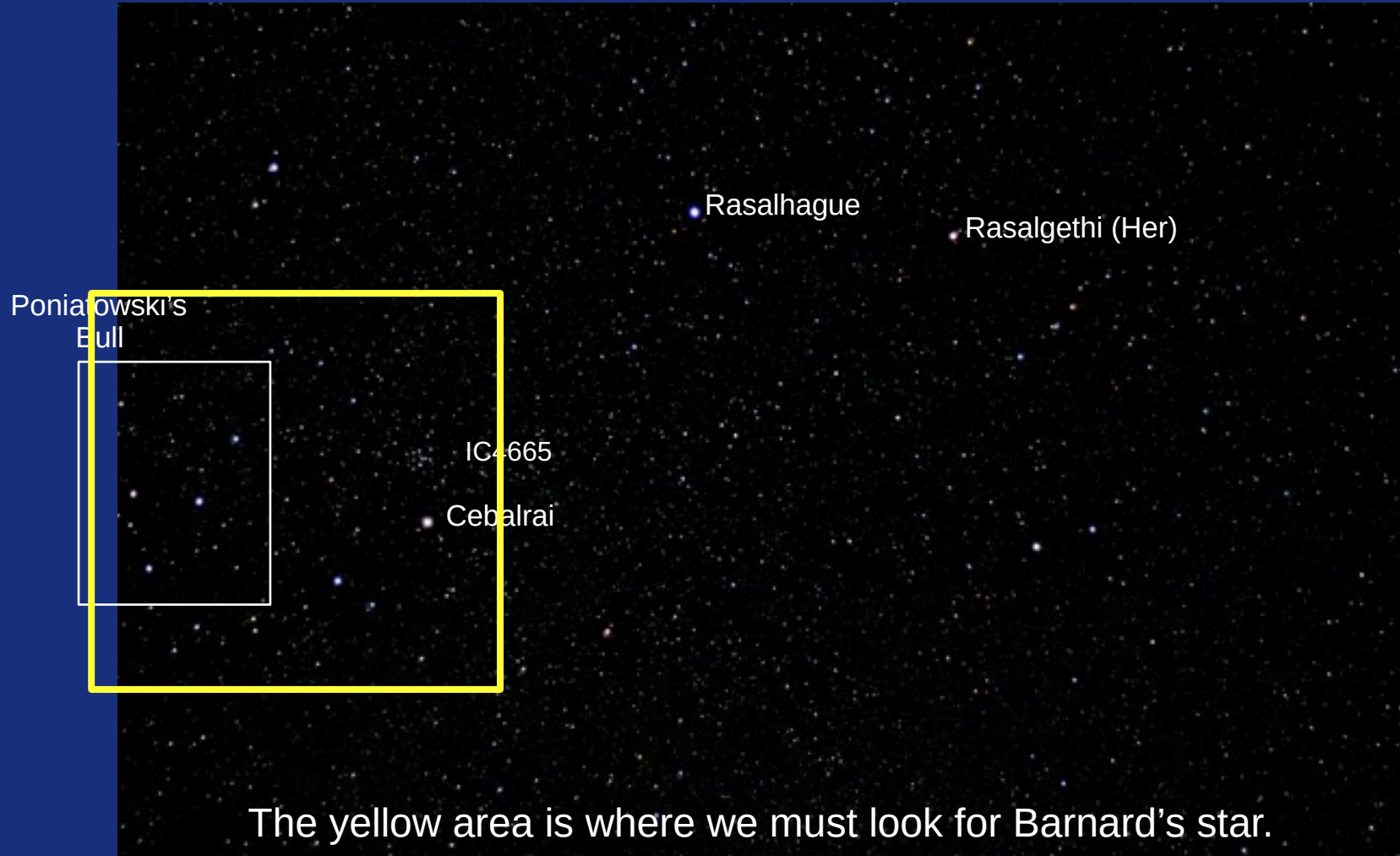
Ophiuchus Details



Ophiuchus Details

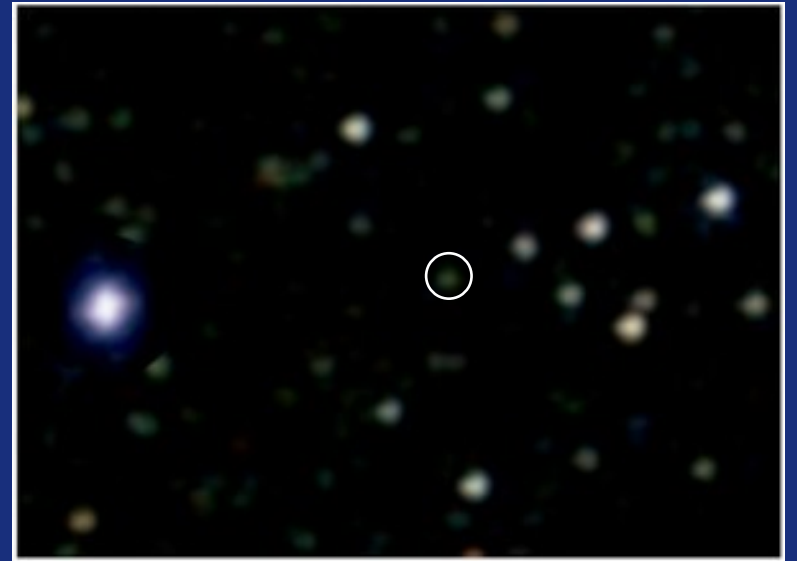
- Top left of the Ophiuchus trapezium is the star Rasalhague.
- The top right star is Rasalgethi (which is actually in the constellation of Hercules).
- Bottom left of the trapezium is the star Cebalrai, which is an important signpost in our search for Barnards's star.
- Above Cebalrai is the handsome star cluster IC4665, which resembles the Beehive cluster in Cancer.
- Lastly, over on the far left is a V shaped asterism which is known as Poniatowski's Bull, probably so named because the V shape resembles the constellation Taurus - particularly given the close proximity of IC4665 which reminds us of the Pleiades.

Ophiuchus Area of Interest



The yellow area is where we must look for Barnard's star.

Finding Barnard's Star



Finding Barnard's Star

- On the left of the slide is a blow-up of the yellow highlighted area of the previous slide. You can see Poniatowski's Bull left and on the right the star Cebalrai, below the star cluster IC4665.
- Moving up the right hand (or western) horn of the bull to the topmost star, we see to its right an asterism resembling an arrowhead.
- If we blow up the rectangular area indicated, we get the picture on the right of the slide. The arrowhead and the topmost star of the right hand horn are prominent.
- And right of centre (circled), is Barnard's star, which should of course be red, but processing the picture has made it look green!
- How can we be sure this is Barnard's star – we use Stellarium!

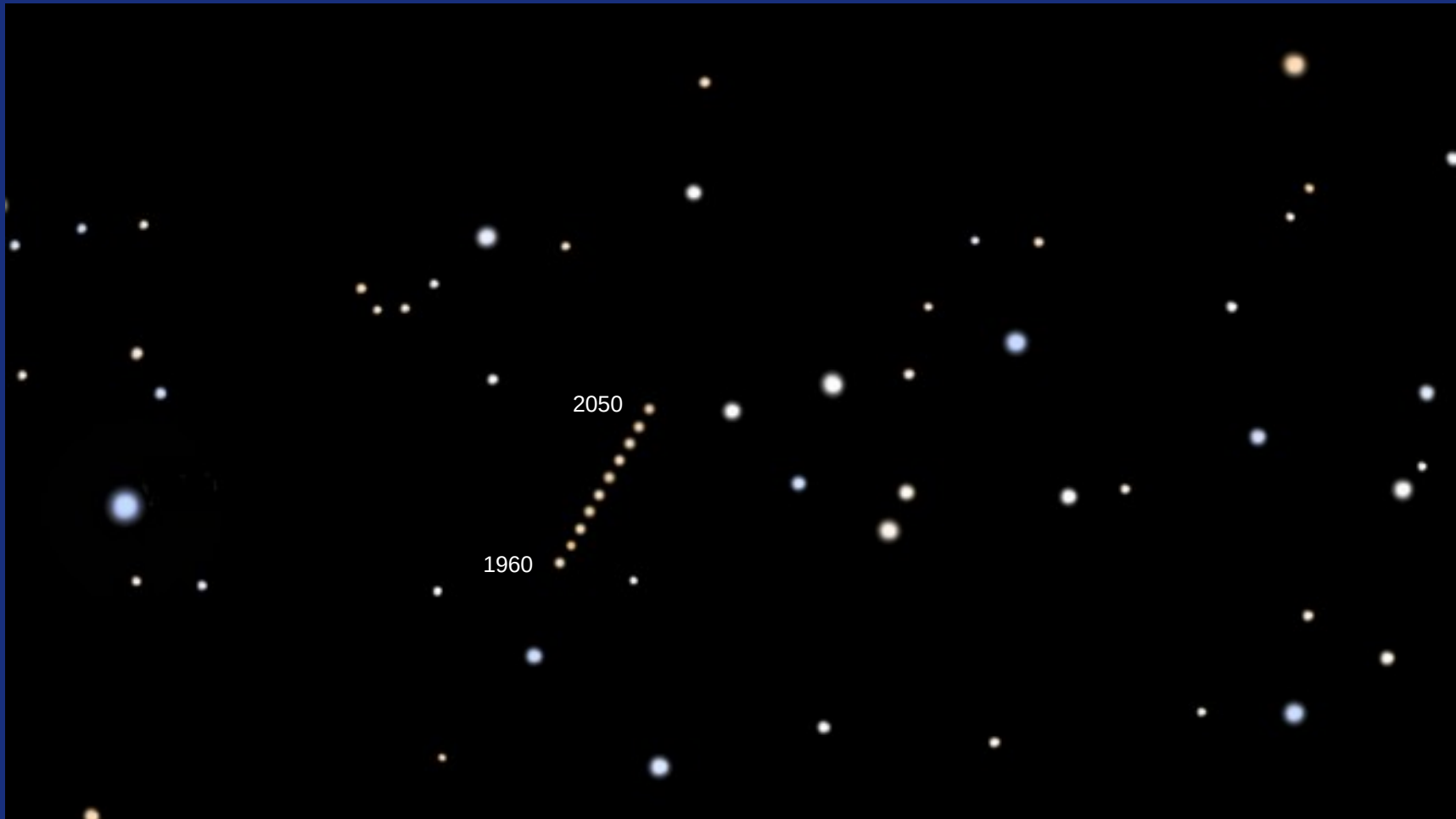
Stellarium Confirmation



Stellarium Confirmation

- Stellarium is of course the well-known planetarium program.
- This is a Stellarium picture of our target area of sky for the date of my photograph.
- Barnard's star is circled, just where it is in my photograph (Slide 13).
- But Stellarium can do much more than just reveal where the star is. It also allows us to see what the region is like in different eras. So

Stellarium Extrapolation



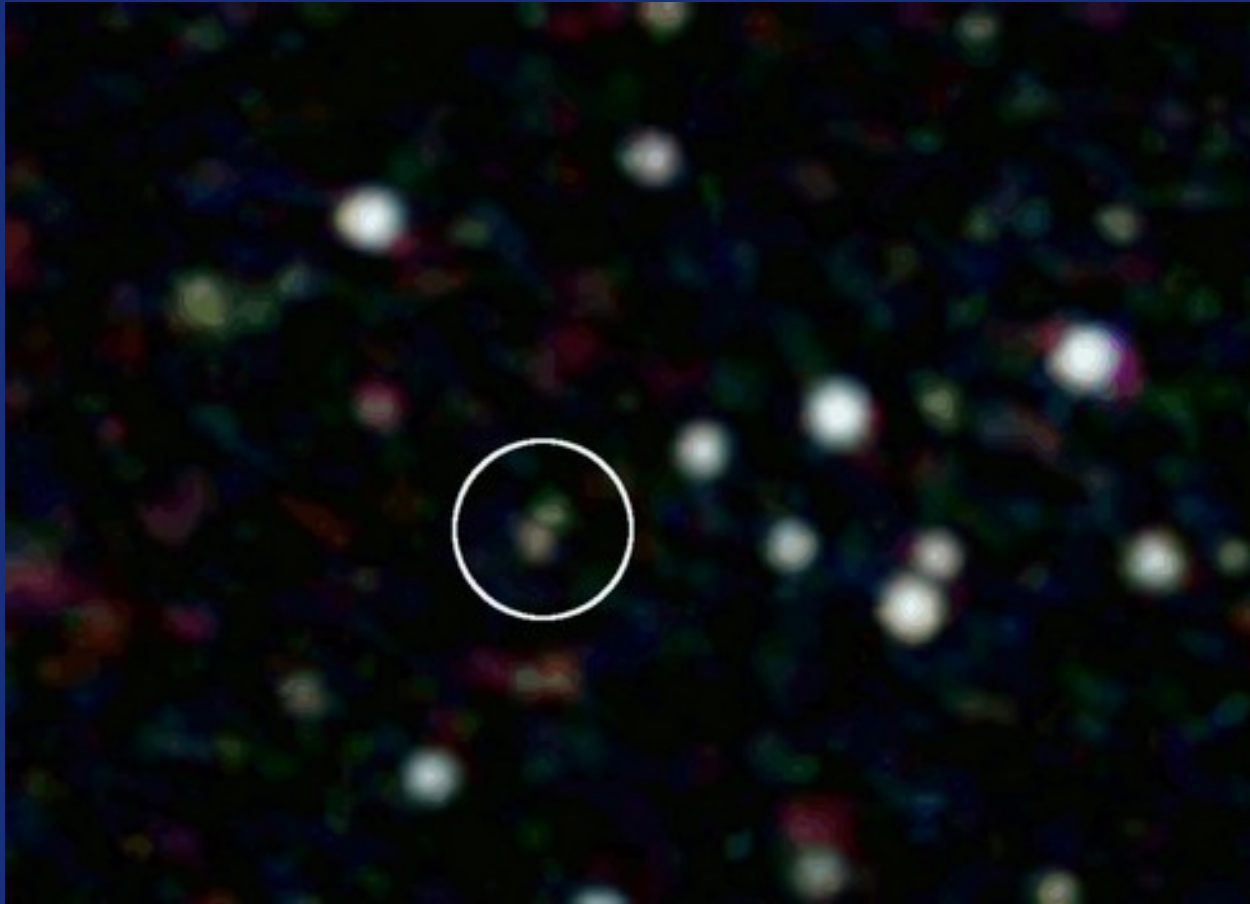
Stellarium Extrapolation

- In this slide I have combined Stellarium pictures of the target area at 10-year intervals for 50 years before and after the date of my photograph.
- It is evident from this slide just how much Barnard's star has moved in our century. Note that no motion is apparent in any other star in this field.
- For those interested, the combined picture was put together using the free image processing program called GIMP, making use of the Layers option and the appropriate blending mode (called 'lighten only').
- GIMP can do other things. For example, the same series of pictures, can be animated in a GIF image. Just save the stacked layers as a GIF file and tick the 'animation' box. The result is very pleasing.

Challenge!

- If you are young enough (!), take a photograph of Barnard's star this year and every 5 years thereafter and construct your own history of the star's movement. See how far it moves in your lifetime!
- The following slide shows two of my photographs of Barnard's star taken 2010 and 2019. Despite the noisy images, The movement of the star over this period is easily seen.
- See if you can do better!

My Observations 2010 & 2019



Other Facts about Barnard's Star

- In the 1960s, Dutch astronomer Peter van de Kamp reported that Barnard's star had a measurable 'wobble' of 0.04 arc-seconds. This he put down to unseen planets in orbit about the star. Unfortunately nobody else detected a wobble of this magnitude and the idea of planets was dismissed. However, in 2018 astronomers reported a planet of at least 3 Earth masses in orbit around the star.
- In 3,600 years Barnard's star will have moved 10 degrees to the constellation Hercules.
- In the year 11,800 it will be a mere 3.75 light years from our sun and at its closest approach.
- So, two interesting astronomical events to look forward to!

The End