

Challenger
LEARNING CENTER
of Hardin County



The Otter Creek Astronomical Observatory

The Observer

February 2008 (#12)

Evening Programs:

February 16, beginning at Sunset

March 15, beginning at Sunset

Join the observatory staff for a tour of what is visible in the night sky, including the moon, stars, and planets. *All evening programs are "weather permitting" -- if the sky is not clear enough for celestial objects to be visible the observatory will not be open. Evening programs begin at sunset.*

Daytime (solar) Programs:

January 26, March 1, March 29

Daytime programs are "open house" at the observatory. Come safely observe the Sun, with its prominences and sunspots. Walk the model solar system trail and get a sense of the size of things in space. Check out our telescopes and learn about the observatory -- after all, you can't really see what's in the observatory when it is dark. *Daytime programs are held "rain or shine" -- the observatory is open regardless of weather. Daytime programs begin at 11 AM Eastern Time.*

Visit the Otter Creek Observatory web page at

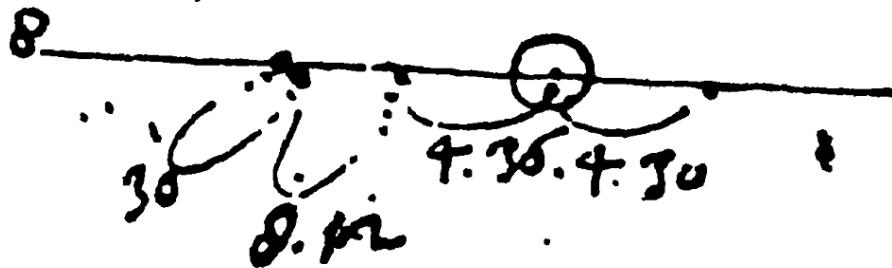
www.ottercreekpark.org

On the Accuracy of Galileo's Observations (Courtesy of Kentucky)*

Galileo Galilei, who lived about 400 years ago in Italy, is among the most famous scientists of all time. He was the first to use a telescope to study the heavens – first turning a telescope to the sky in 1609. His work in astronomy played a significant role in convincing people that the Earth actually circled the Sun, rather than the Sun circling the Earth. Since to the ordinary person it rather looks like the Sun circles us (it rises in the East, travels across the sky to set in the West, and then returns to the East to rise again), that was a tough idea to sell, but Galileo did it.

Since Galileo was the first person to use a telescope to study the heavens, it would seem likely that his work would be pretty crude, right? After all, he was the first person to use a telescope to look at the Moon, or Jupiter. He had to build his own telescopes – even find glass and make his lenses “from scratch”. Henry Ford's first cars couldn't go 150 mph – we wouldn't expect great stuff from the first telescopes.

But Galileo's work wasn't crude at all. In fact, it seems that Galileo was an incredibly talented man who not only was good with his head but also was good with his hands. He made excellent telescopes – and he figured out how to make them perform. For example, take a look at this picture Galileo drew of Jupiter and its moons on January 6, 1613:



* By C. Graney. At Otter Creek Observatory most of our time is spent on activities related to education -- our public programs, the model solar system, and so forth. However, we also do a little scholarly work here as well. This newsletter will discuss work done by Otter Creek Observatory staff member Chris Graney that has just recently appeared in *Baltic Astronomy*, a scientific journal published out of Vilnius, Lithuania: Graney, Christopher M., "On the Accuracy of Galileo's Observations", *Baltic Astronomy*, Vol. 16, pp. 443-449.

It doesn't look like much, does it? Maybe it seems like something a kid might draw? We can't know exactly what Jupiter and its moons looked like that night, but we can get some idea by using a computer program called "Stellarium", which can reproduce views of the night sky going back centuries. At right is what Galileo might have recorded if he had a 21st-century state-of-the art telescope in 1613 (produced via Stellarium).

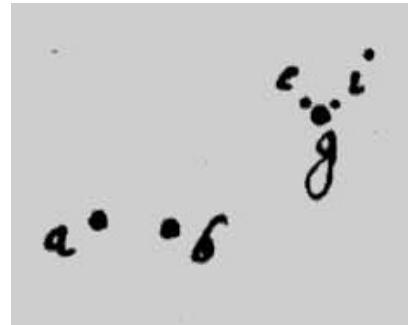


Did you notice the little blue "moon" at the upper right? It's not a moon at all. It's the planet Neptune, which just happened to be in Galileo's field of view when he was studying Jupiter that night. Galileo did not know what it was – it would be another two hundred years before Neptune was actually "discovered" – but if you look at his drawing, you can see that he drew it anyway. Look what happens when we overlay Galileo's sketch on the Stellarium output:

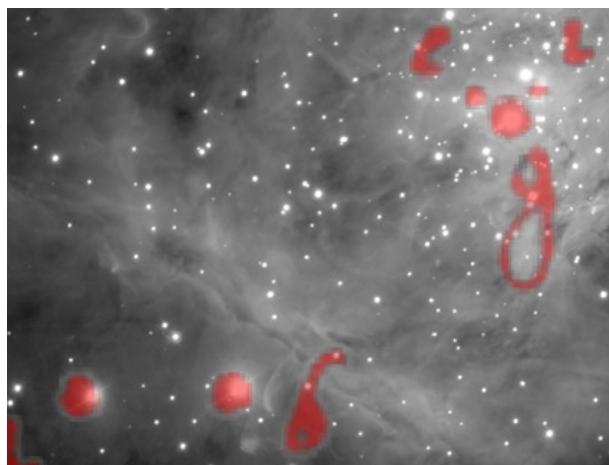


Not so kid-like after all maybe? Note that Galileo has the distances of the moons to the right and left of Jupiter basically accurate to within the size of the dots he uses to mark them. And he even gets Neptune right – even though Neptune is very faint. Not bad for the first person to use a telescope to look at Jupiter, using his own home-built telescope! What's more, let's not forget that the software may not be able to perfectly represent what Jupiter looked like 400 years ago. In other words, if Galileo's drawing differs from Stellarium, it might be because Stellarium is wrong, not Galileo.

For another example, take a look at this drawing Galileo made of stars in Orion (at right). Like the other drawing, it doesn't look like much. Now let's look at a modern photograph of the same region of Orion – which turns out to be the “Trapezium” region in the heart of the great Orion Nebula (below – see the last page of the newsletter for a large color image of the nebula that highlights the region Galileo drew).



Now let's overlay the two:



That's a really good match! Galileo is pretty impressive. He has drawn these stars, which are all quite close together, with an amazing degree of accuracy. It's almost like he took a picture.

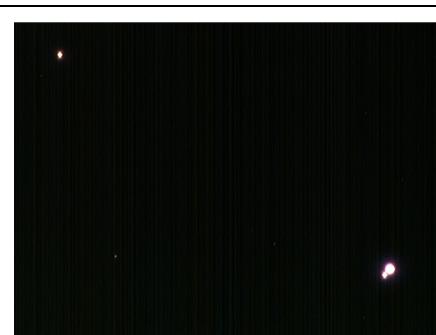
Galileo did other amazing things. He measured the distance between the two component stars of the double star Mizar in the Big Dipper and his value almost perfectly matched the value we measure today with modern equipment (less than 5% difference). It seems that Galileo could make accurate measurements at the “2 arc-second” level. Two arc-seconds is $2/3600$ of a degree, or 0.1% the apparent size of the full Moon. Two arc-seconds is also the size a quarter looks if you are more than a mile and a half away from it! Once again, not too bad for the first person to use a telescope to look at the sky.

He came up with sensible ideas about the sizes of stars, which he was also able to measure. His ideas and measurements were sensible but they turned out to be wrong. In the 1600's scientists did not know about how light is a kind of wave and how that can distort the appearance of tiny points of light like stars.

And then there is the matter of his telescopes. After all, he couldn't have made these great measurements without a great telescope. But he couldn't just go buy a telescope in 1613 – he had to make his own from scratch. So not only was he great at doing science, he was also great at making things!

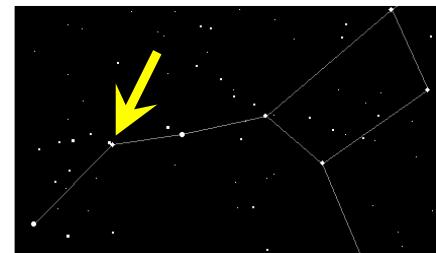
Another interesting thing about Galileo is that he had what today might be called an “attitude”. He knew what he could do and that he was the best by far – probably no one in his time could touch him. And he was not quiet about it! If you read his writings, especially his letters to people who argued with him, you quickly realize that Galileo could be a real jerk. Of course when you are Galileo and can do what he could do it is probably difficult to put up with criticism from people who hardly know which end of a telescope to look through.

Galileo was a man of amazing talents. Next year is the International Year of Astronomy (www.astronomy2009.org), in celebration of the 400th anniversary of Galileo's telescope. You will probably hear a lot about Galileo in the coming year. But now you know something about Galileo that is new – that he could observe, draw, and measure objects in the sky with incredible accuracy. And what's more, this new information about Galileo comes from Otter Creek Observatory right here in Kentucky!

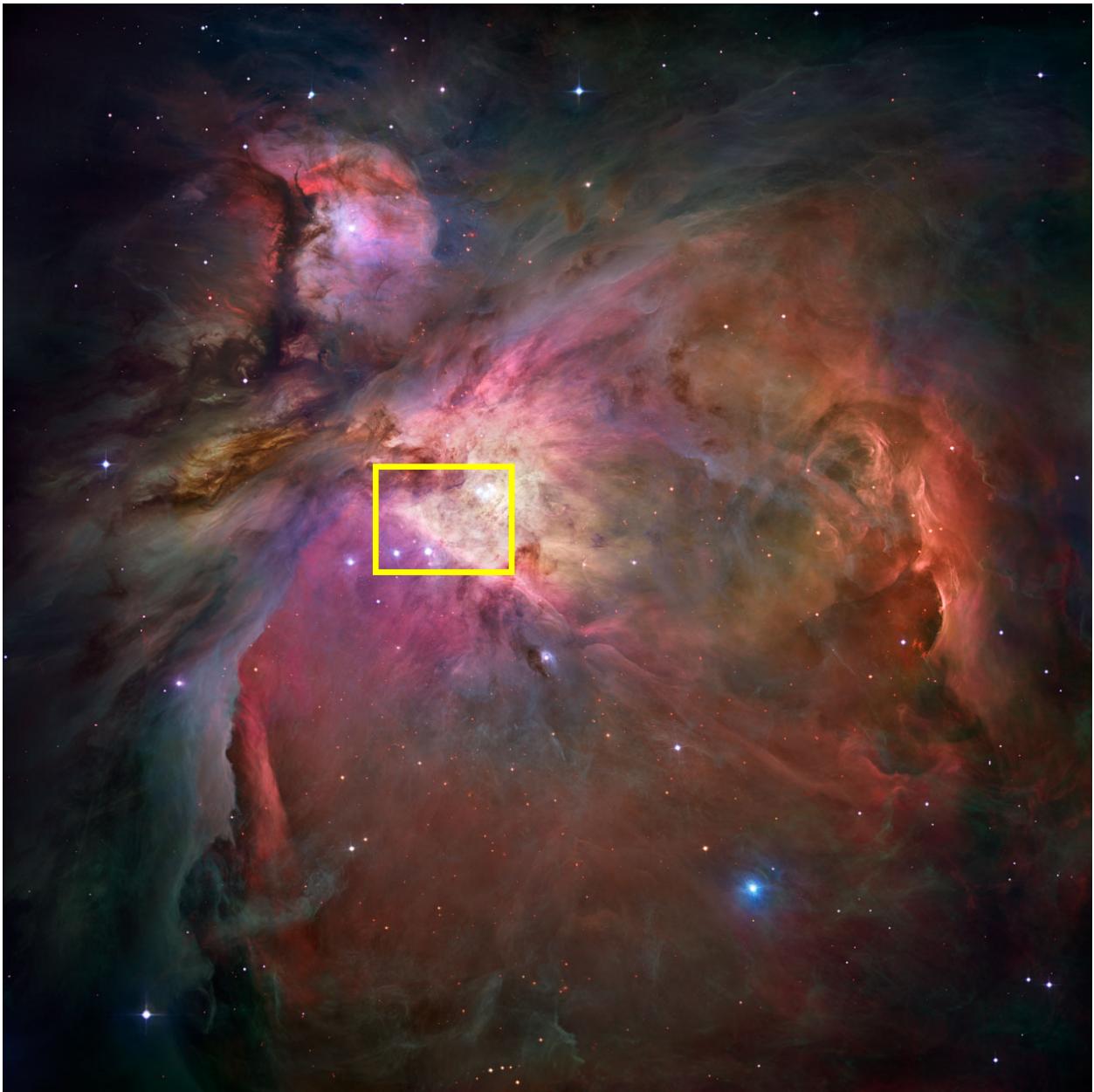


Mizar (lower right, showing the two components that Galileo measured), and the star Alcor.

<http://zimmer.csufresno.edu/~fringwal/bright-gallery.html>



Mizar and Alcor in the Big Dipper (arrow).



Hubble Space Telescope photo of the Orion Nebula. The region shown in Galileo's drawing is highlighted by the yellow box. Galileo's telescope only revealed stars – he apparently could not see the nebulosity.