Chapter 2
What the heavens show us, and why anyone would care

Before we learn anything about astronomy and its history, we have to learn the basics of what the heavens show us. Understanding what a person can see, and in particular, understanding what a person with only an average amount of interest in the heavens can see, is crucial to understanding astronomy's history. Dear Reader, if you spend some time getting to know the sun, moon, and stars you will have a good deal more contact with the sky than many very knowledgeable people who write about astronomy. For most of human history people saw a lot more of the sun, moon, and stars than do any of us who live in the modern world today. Back in the time before electric lights were common, when the sun went down, it got dark, and people saw the stars. Today only those people who live out in the country and farm for a living -- people who see the stars and live their lives by the sun and not the clock -- know the sky as well as people used to know it before modern lights brightened our nights.

So what do the heavens show us? Imagine that we are sitting on a beach, watching the sun set over the ocean.[1] As the sun sets we see it slip below the horizon. The sky begins to grow dark. We see the moon, and then a few bright stars. After a while the moon sets, too. We decide it is time to go to bed, and head for home.

Wait -- we want to learn something about the heavens. Let's go back to our beach, but this time we are going to go with a good watch to keep time, a notebook to record information, and a mind to study nature. We are going to do this four nights in a row, starting on a Thursday evening.

Here is what we see:

THURSDAY EVENING -- We sit on a beach, watching the sun set over the ocean. We see the sun slip below the horizon, and as the sun disappears we look at our watch and

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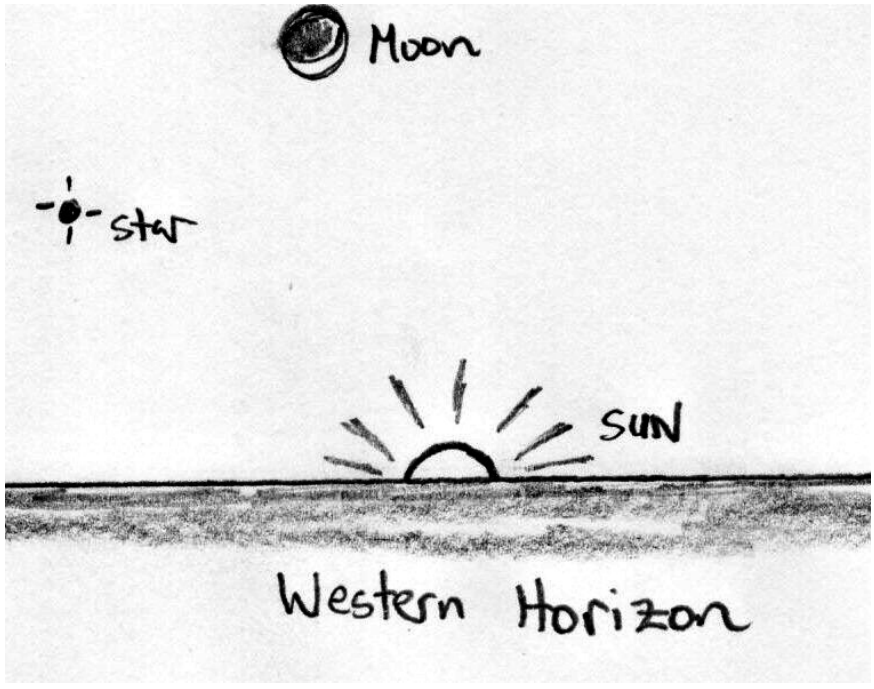
1 You don't have to be on a beach to do this. All you need is a clear, flat horizon. If there are objects on the horizon, or if the horizon is hilly, then the setting of the sun, moon, and stars becomes more complicated, and it is harder to draw pictures. However, the basics of what we are discussing here are still plainly visible.

see that the time is 6:20 PM.[2] The sky begins to grow dark. We see the thin crescent moon, and a few bright stars. The most prominent of the bright stars sets at 7:57 PM. After a while the moon sets, at 8:10 PM. We make a note of all these, decide it is time to go to bed, and head for home.



THURSDAY EVENING

Sun, moon, and star: the sun is setting, and we see a bright star and a crescent moon.

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2 Times given in this discussion were obtained using the computer program *Stellarium* (www.stellarium.org), for the nights of June 21 through June 24, 2012, for Guayaquil, Ecuador. Why some place in Equador? One reason is because it is on the Pacific coast (so if you were there you could see the sun set over the ocean). A more important reason is that it is near the equator. Just as an uneven horizon complicates the setting of the sun, moon, and stars, so does being further from the equator. At moderate latitudes such as in the United States the effect is simply to cause the sun, moon, and stars to approach the horizon at a modest angle, making the pictures a little harder to draw, the times a little harder to calculate, and causing the time of sunset to vary, but all the basics of what we are discussing here are still visible. At extreme latitudes, near the Earth's poles, the effect is such that the sun, moon, and stars do not rise or set at all in a day -- these are the "lands of the midnight sun" and what we are discussing here doesn't really apply very well at all.

FRIDAY EVENING -- It is clear, and again we go to the beach with our watch and notebook. Again we watch the sun set. As the sun slips below the horizon we look at our watch and see that the time is again 6:20 PM. The sky begins to grow dark. We see the moon, and the bright stars, but some things have changed. The most prominent of the bright stars sets a little earlier, at 7:53 PM. The moon, which is not quite as thin of a crescent tonight, sets much later, at 8:58 PM! We make a note of all these, decide it is time to go to bed, and head for home.

SATURDAY EVENING -- We have another clear evening; another beautiful sunset. We make our third journey to the beach. The sun again sets at about 6:20 PM. This time our bright star disappears into the horizon at 7:49 PM. The moon, definitely not a thin crescent any more, doesn't set until 9:46 PM. Now we are really getting home late.

SUNDAY EVENING -- Tonight is our last night on the beach and once again we are fortunate enough to have clear skies and a gorgeous sunset. For the fourth time, we see the sun set, and for the fourth time it sets at about 6:20 PM. The bright star sets at 7:45 PM. The moon, now a very fat crescent, goes down at 10:34 PM. And at this point we have had enough sky-watching and are glad our project is over.

So, what did we see, and what conclusions can we draw?

First, we watched the sun set into the western horizon: we saw it *above* the horizon; we saw it sink *into* the horizon; we saw it disappear completely *below* the horizon. The sky then *grew* dark, so apparently the sun didn't just sink below the horizon and stop -- it kept on going. The next morning it rose again on the eastern horizon:

> *The sun also ariseth, and the sun goeth down, and hasteth to his place where he arose.*[3]

We recorded that the sunset occurred at about 6:20 PM all four nights, so it took 24 hours to go from sunset to sunset each time. Since we were sitting motionless on the beach, watching the sun go down, it seems clear that the sun is moving. Therefore we can conclude that the sun circles us once every 24 hours.

Second, we watched the star set into the western horizon. Like the sun, it was above the horizon and sank into it. If we turned around and looked to the east we could see other stars rising out of the eastern horizon. The star set four minutes earlier each

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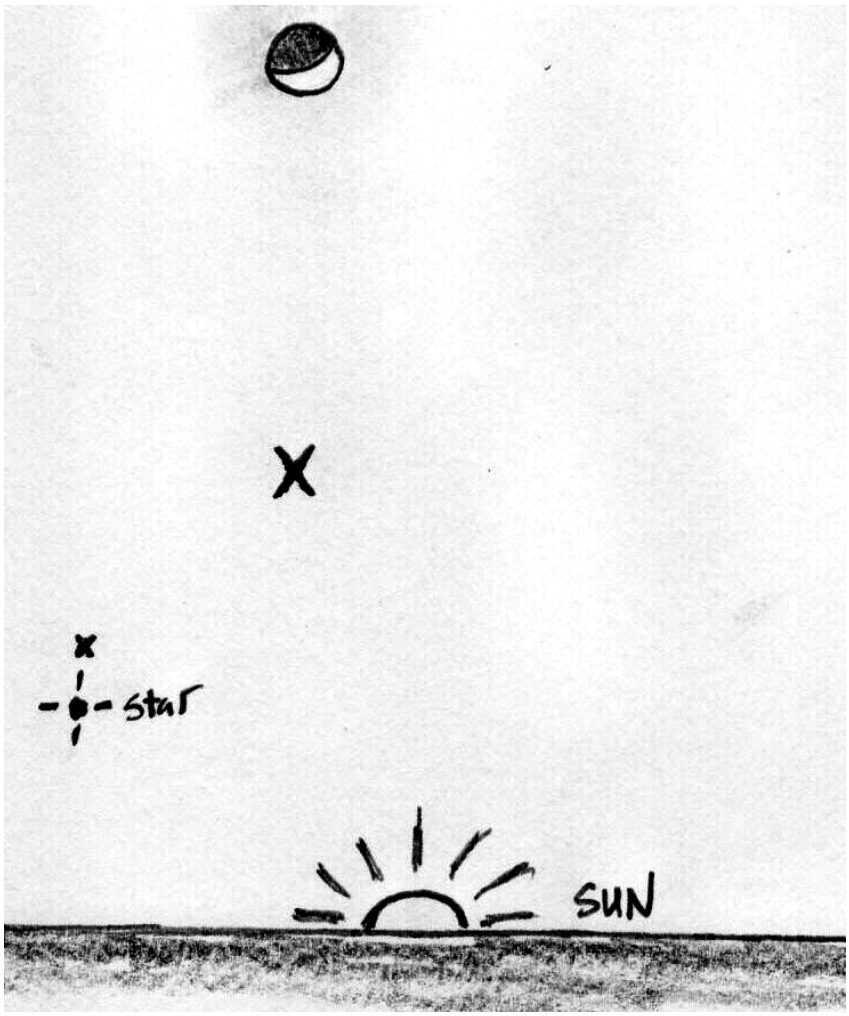
3 Ecclesiastes 1:5 (King James Version)



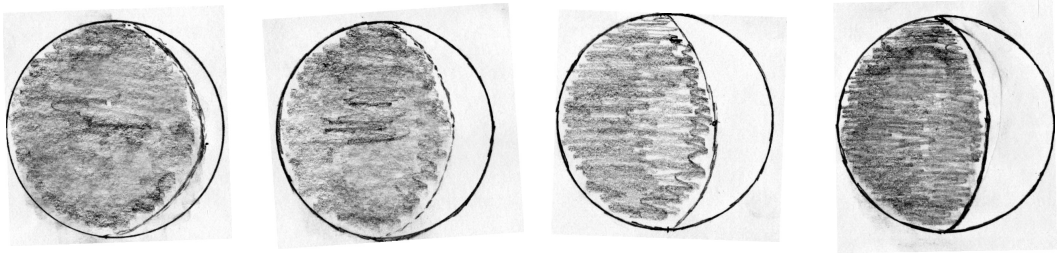
FRIDAY EVENING

Sun, moon, and star: the star sets a little earlier, and so is a little closer to the horizon at sunset, while the moon sets later, and so is further from the horizon at sunset. On Thursday the star was located at the small "x"; the moon was located at the large "X". Note that the moon shows a fatter crescent.

night -- 7:57 PM, 7:53 PM, 7:49 PM, 7:45 PM. We can conclude that the star is also circling us along with the sun, but slightly more rapidly -- once every 23 hours, 56 minutes.

Third, we watched the moon set into the western horizon. Like the sun and star, it started above the horizon and sank into it. It set 48 minutes later every night -- 8:10 PM, 8:58 PM, 9:46 PM, 10:34 PM. What's more, the later the moon set, the fatter its crescent

was. We can conclude that the moon circles us more slowly than the sun -- roughly once every 24 hours, 48 minutes -- and the moon's crescent shape varies depending on when it sets.



THURSDAY	FRIDAY	SATURDAY	SUNDAY
8:10 PM	8:58 PM	9:46 PM	10:34 PM

So, to summarize our conclusions from four nights of observing the the world with our eyes, a notebook, and a watch:

- ✔ The sun circles our world once every 24 hours.
- ✔ The stars circle our world once every 23 hours, 56 minutes.
- ✔ The moon circles our world once every 24 hours, 48 minutes.

What's that, dear Reader? You are telling me something about how the sun doesn't circle our Earth? You say Earth circles the sun and turns on its own axis? Really! We sit there on the beach and clearly see, *with our own two eyes,* the sun descending from above the horizon to below the horizon -- and you tell me that actually the sun is *not* going down but the horizon is coming *up*? Are you saying it isn't a "sunset" but a "horizon rise"?

Who told you this thing that is so contrary to what you can see with your own two eyes? Your teacher in grade school, you say? Oh, did she also tell you that when you trip and fall it isn't your face that hits the ground, but it is the ground that jumps up and smacks your face? And you believed that?

You see, one of the problems in science education is that we are taught certain factoids, such as *Earth circles the sun*, but we are not taught how we know these factoids. In my college astronomy class I regularly ask students "why does the sun rise and set?", and they regularly say "because the Earth is moving", and then I reply "how do you know

this?" -- and they say "we were taught it in school". You can be taught any factoid in school. There are lots of scientific factoids sitting in history's garbage can that were once taught in schools; once they were cool science factoids, and now they are known to be wrong factoids. So in this story of astronomy we are not going to believe anything unless we know where it came from. If we cannot explain it, it does not exist until we can. That is why at the end of Chapter 1 we said we would forget everything we knew about science.

So for now, based on our trip to the beach, we experienced the sun setting into a stationary horizon. We did not experience the horizon rising up to cover a stationary sun. That's what we observed, so that's what we are going to talk about.[4]

Let's now look at what else our observations at the beach can tell us. Let's think about that star and the sun. The time of sunset hung around 6:20 PM all four nights, but the star was setting four minutes earlier each night.

	Sun	**Star**
THURSDAY	6:20 PM	7:57 PM
FRIDAY	6:20 PM	7:53 PM
SATURDAY	6:20 PM	7:49 PM
SUNDAY	6:20 PM	7:45 PM

Since the star's set time is changing by four minutes a night, by next Sunday it should be setting 28 minutes[5] earlier, at 7:17 PM. The Sunday after that it will be setting another 28 minutes earlier, at 6:49 PM. The Sunday after that, at 6:21 PM. If the sun stays steady in its set time, that would imply that in a few weeks the sun and the star will be setting together. But the sun is so bright that it lights up the sky -- you can't see any stars until well after sunset. So in a few weeks our star will have disappeared into the sunset.

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4 Your teacher was right, of course -- we'll get to that eventually.

5 4 minutes/night x 7 nights = 28 minutes

	Sun	Star
THURSDAY	6:20 PM	7:57 PM
FRIDAY	6:20 PM	7:53 PM
SATURDAY	6:20 PM	7:49 PM
SUNDAY	6:20 PM	7:45 PM
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SUNDAY	6:20 PM?	7:17 PM
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SUNDAY	6:20 PM?	6:49 PM
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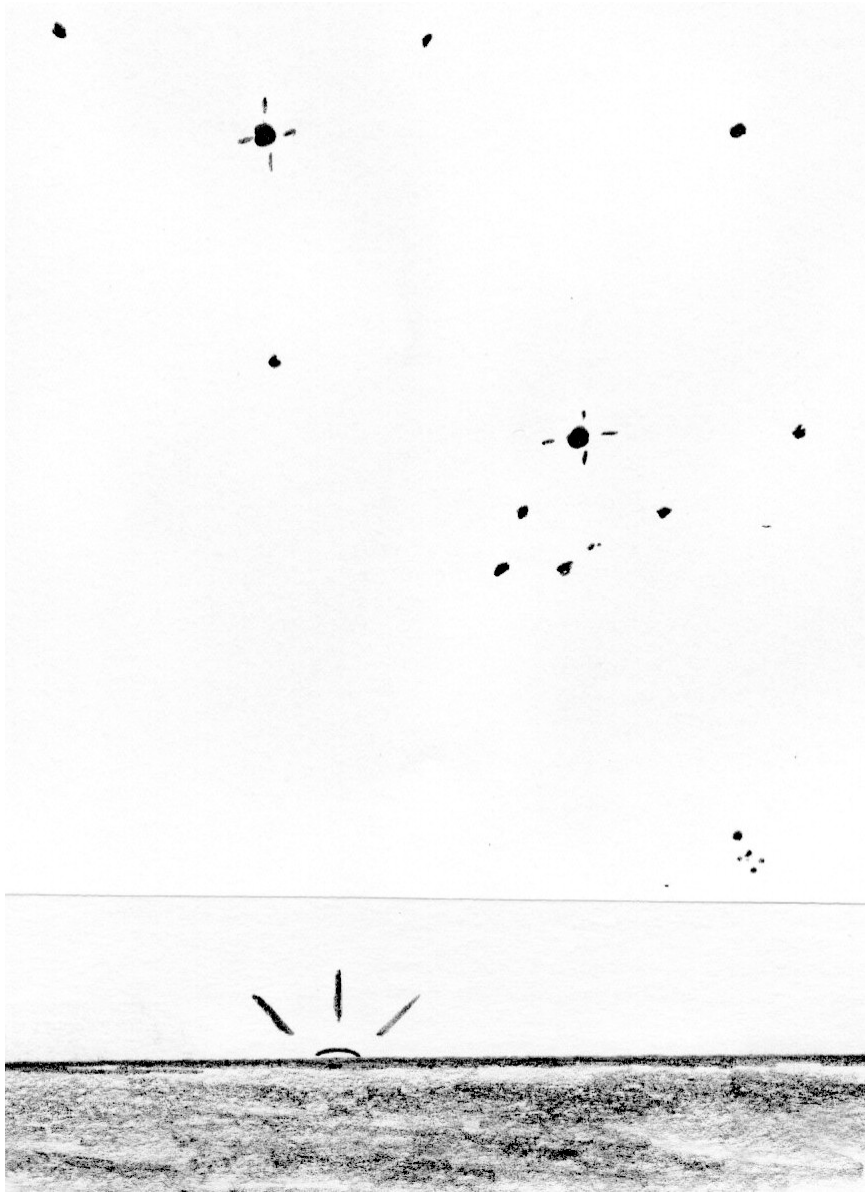
SUNDAY	6:20 PM?	6:21 PM

This means that the stars that are visible after sunset might change with the passing of days. We can see this easily for ourselves -- we just have to go watch sunsets periodically. If we do we will see that, as the weeks pass, the stars that are visible over the western horizon after sunset gradually change, as they all in turn disappear into the sunset



Stars visible over the western horizon after sunset change with the passing of weeks. Note how, on this page and the next, the stars visible at the beginning of a month disappear into the horizon. By the end of the month the stars visible after sunset are significantly different.

Here we see how stars appear after sunset at the beginning of a certain month.

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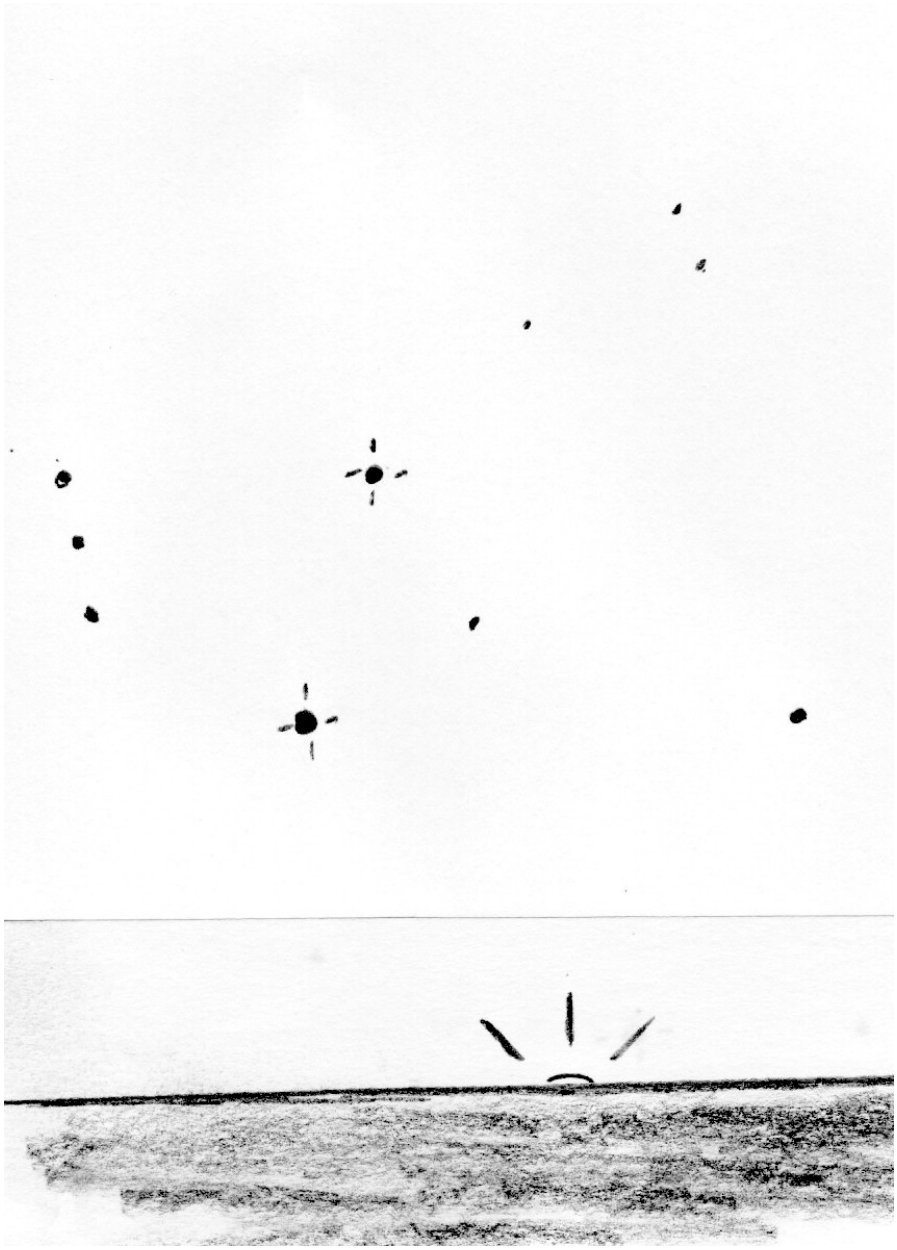
Here we see how the stars appear after sunset at the mid-point of that month.



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Here we see how the stars appear after sunset at the end of that month.

and are replaced by other stars which come behind them. This is illustrated in the sketches you just saw on the previous three pages.

Now let's think in terms of longer times. Going back to our time on the beach, we saw the most prominent bright star set at 7:57 PM on Thursday evening. We have figured out that the stars set four minutes earlier each day. If we think in terms of months, that would mean that each month our star sets 120 minutes earlier.[6] 120 minutes is two hours. We can now predict when our star will set on a month-by-month basis just by moving the time two hours earlier:

	Star		Star
THURSDAY at the beach	7:57 PM	**8 Months later**	3:57 AM
1 Month later	5:57 PM	**9 Months later**	1:57 AM
2 Months later	3:57 PM	**10 Months later**	11:57 PM
3 Months later	1:57 PM	**11 Months later**	9:57 PM
4 Months later	11:57 AM	***12 Months later***	*7:57 PM*
5 Months later	9:57 AM	**13 Months later**	5:57 PM
6 Months later	7:57 AM	**14 Months later**	3:57 PM
7 Months later	5:57 AM	**15 Months later**	1:57 PM

Notice that at the 12 month mark the star is setting at 7:57 PM again, and everything starts repeating itself. We have reached another conclusion -- that the stars that we can see in the evening sky change as the weeks pass, in a cycle that repeats itself every year. This means that the stars that are visible after sunset not only change with the passing of days, they are also linked to the passing of the year. The same stars are always visible after sunset at Christmas time, year in and year out. The same stars are always visible after sunset on the 4th of July, year in and year out. And, the stars you see after sunset at Christmas are not the same stars that you see after sunset on the 4th of July. We

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6 4 minutes/night x 30 nights = 120 minutes. This is approximate, since not all months are 30 days.

can see this easily for ourselves -- we just have to go watch sunsets periodically throughout the year, for several years. To start to see all this requires some serious dedication to sky-watching!

So, here is an updated summary of the conclusions we have reached from four nights of observing the the world with our eyes, a notebook, and a watch:

- ✔ The sun circles our world once every 24 hours.
- ✔ The stars circle our world once every 23 hours, 56 minutes.
- ✔ The moon circles our world once every 24 hours, 48 minutes.
- ✔ The stars visible after sunset change in a yearly cycle.

What else can we find out from our observations at the beach? Now we'll turn our attention to the moon. The moon sets 48 minutes later every night:

	Sun	Star	Moon
THURSDAY	6:20 PM	7:57 PM	8:10 PM
FRIDAY	6:20 PM	7:53 PM	8:58 PM
SATURDAY	6:20 PM	7:49 PM	9:46 PM
SUNDAY	6:20 PM	7:45 PM	10:34 PM

That means that after a month it will set 1440 minutes[7] (or 24 hours[8]) later. In other words, after a month it will be setting at the same time as it did when we first observed it.

	Star	Moon
THURSDAY at the beach	7:57 PM	8:10 PM
1 month later	5:57 PM	8:10 PM

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7 48 minutes/night x 30 nights/month = 1440 minutes

8 1440 minutes ÷ 60 min/hr = 24 hrs

Based on our four nights at the beach, we can project that the setting of the moon changes in a cycle that repeats itself once per month. Since we have already figured out that the moon's crescent shape is linked to the time the moon sets, we can guess that the moon's appearance also changes in a cycle that repeats itself once per month.

THURSDAY at the beach

1 month later

Well, it seems the cycle of the moon is *monthly*, and the cycle of the stars is *yearly*. It goes without saying that the sun rises and sets *daily*. And this brings us to the first and most immediate answer to the question, asked in the title of this chapter, of why anyone would ever care about what the heavens show us: the heavens provide us with a great method for keeping time. Today we keep time with watches and clocks and cell phones; but for most of human history time-keeping devices either did not exist at all, or were not very accurate. The heavens provide a great time-keeping service. Our basic units of time -- the *day*, the *month*, and the *year* -- are based on the cycles of the heavens[9], because the cycles of the heavens were humanity's first clock and calendar.

Time is money, as they say, and because time is money people will care about what the heavens show us. Imagine if there were no way to keep time. Imagine a school or business trying to run without a clock. Time is money, and if you don't have a good clock or watch then you will turn to nature's clock -- the heavens. If you can't keep time you can't have a functioning economy.

To envision what life is like if you can't keep close track of time, consider the following piece from an article in *National Geographic* by Michael Finkel, describing how

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9 Dear Reader, if you tend to think of the year based on the seasons -- from one winter to the next -- that's because of where you live. In Kentucky we have four seasons. But in tropical latitudes, for example, there is no "winter", and the four seasons with which Kentuckians are familiar do not exist. However, people in the tropics, and in Kentucky, and in fact anywhere in the world, can measure years by the cycle of the stars.

he sets out to meet and spend time with the Hazda people in Tanzania in Africa. The Hazda are true hunter-gatherers -- they live off the land and have little need for keeping a schedule. Finkel describes arranging to meet a member of the Hazda so that he can be taken into Hazda territory:

> *...I had contacted the owner of a tourist camp not far outside the Hazda territory to see if he could arrange for me to spend time with a remote Hazda group. While on a camping trip in the bush, the owner came across Onwas [a Hazda elder] and asked him, in Swahili, if I might visit. The Hazda tend to be gregarious people, and Onwas readily agreed. He said I'd be the first foreigner ever to live in his camp. He promised to send his son to a particular tree at the edge of the bush to meet me when I was scheduled to arrive, in three weeks.*
>
> *Sure enough, three weeks later, when my interpreter and I arrived by Land Rover in the bush, there was Onwas's son Ngaola waiting for us. Apparently, Onwas had noted the stages of the moon, and when he felt enough time had passed, he sent his son to the tree. I asked Ngaola if he'd waited a long time for me. "No," he said. "Only a few days."*[10]

For a people with no method for keeping close track of time (and note that what time-keeping the Hazda have involves the heavens), waiting three days by a tree at the edge of wilderness to keep an appointment is no big deal. But for people who are not hunter-gatherers, waiting three days just to meet someone is not acceptable; it is worthwhile to closely study the heavens in order to keep better track of time and avoid three-day waits!

The heavens actually make a pretty good clock, and a calendar as well. The sun marks days, and how far the sun has traveled through the heavens can be easily used to divide up a day. The cycle of the moon marks 30-day periods which we call months (there's a reason "moon" and "month" are similar-sounding). The stars mark years, and

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10 Michael Finkel, "The Hazda," *National Geographic* (December 2009) pg. 102. A general note about references: If the information presented here is generally available, meaning that you can verify the information by quick check of Wikipedia or by checking the first couple of returns from a Google search, then I will not provide a reference. Much of the information presented in this history is readily available, but not all. Information not readily available will be referenced with a footnote. Direct quotes, such as this about the Hazda, will also be referenced with a footnote.

since the stars visible after sunset change, they can be used to keep track of the entire year to a fair degree of precision. The idea that the heavens are valuable for time-keeping is even endorsed in the Hebrew Tanakh:

> *And God said: 'Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days and years; and let them be for lights in the firmament of the heaven to give light upon the earth.' And it was so. And God made the two great lights: the greater light to rule the day, and the lesser light to rule the night; and the stars.*[11]

A second answer to the question of why anyone would ever care about what the heavens show us has to do with watching the sun set. The sun sets in the west.[12] As we sit on that beach, watching the sun set, west is in front of us, east is behind us, north is to our right, south is to our left. The heavens *define* direction, and those who have no sense of direction get lost. Again, time is money, and getting lost costs you time, or worse. Before GPS units and modern mapping technology, people still had to navigate and find their way from place to place, and the heavens provided the means for keeping track of direction.

In short, the reason people have cared to study the heavens, the reason that astronomy is the oldest of sciences, is the very practical reason that time is money. Keeping track of time and not getting lost are good for business. Better time-keeping and better navigation is good for the economy, and the best way to keep time and go places is to carefully study the heavens -- until you develop accurate clocks, compasses, GPS systems, and so forth.[13]

However, there is a third answer to the question of why anyone would ever care about what the heavens show us, an answer that is an embarrassment to astronomers today because it involves something that was of no practical good at all. That answer is

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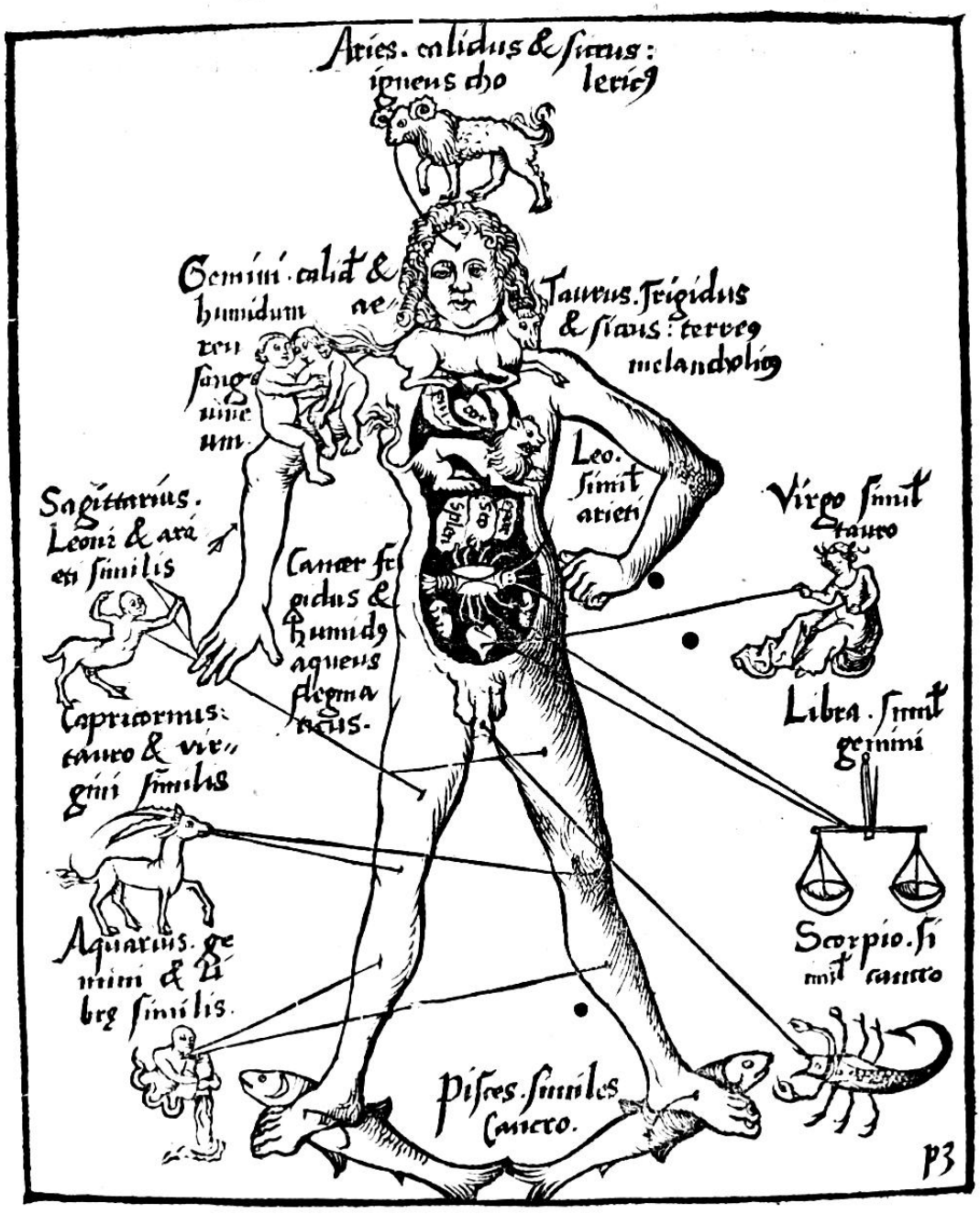
11 בְּרֵאשִׁית (Bərêšîth -- more commonly known in Kentucky as Genesis) 1:14 - 16, Jewish Publication Society's 1917 edition of the Hebrew Bible in English.

12 The moon and stars also set in the west and rise in the east.

13 A nice discussion of the role of the heavens in time-keeping and navigation can be found in *The Wonderful World of Mathematics*, by Lancelot Hogben (Doubleday: New York, 1955). Anyone, even children, will find Hogben's book very easy to read and enjoyable. It can be found used.



An astrological illustration from the 1503 book *Margarita Philosophica* by Gregor Reisch. The various symbols of the fish, the scorpion, the ram, etc. all refer to certain groupings of stars.

astrology. It seems that people have a strong tendency to believe that since (1) the heavens can be used to keep track of time and the calendar, and thus can be used to plan events in the future; and since (2) the heavens can be used to navigate, and thus can be used to plan journeys from place to place; then it follows that (3) the heavens can be used to plan the "events and journeys of life", too. In other words, people have a strong tendency to believe that the heavens can tell them something about themselves and their future, such as what days are best to conduct business or pursue love, or what is the best course of treatment of an illness. For example, the historian David Wootton has noted that "in seventeenth-century England, there were plenty of medical practitioners who were happy to diagnose on the basis of a urine sample and an astrological chart."[14]

Astrology has always been controversial, however.[15] In Christian cultures, for example, theologians have viewed it as contrary to Christian teaching that all people have a free will -- an idea reflected in Shakespeare's *Julius Caesar*, where Cassius muses to Brutus that "Men at some times are masters of their fates. The fault, dear Brutus, is not in our stars, but in ourselves...." In Muslim cultures, many scholars, seeing astrology as fortune-telling, have viewed as *haram* (forbidden) not only the practice of astrology, but even the listening to or reading of astrological predictions such as horoscopes. Then there is the matter that, whereas in the cases of time-keeping and navigation the heavens clearly "work as advertised" (in that different people, each of whom devotes a limited amount of time to studying the heavens, each will be able to keep time or navigate in a manner that is in agreement with one another, and that is repeatable, explainable, and reliable), in the case of astrology they do not. Across history some astronomers, including very prominent ones like the sixteenth-century Danish astronomer Tycho Brahe, have argued that astrology could be improved by means of better observations, better instruments, and generally just giving astronomers more resources to do their work. Some of those astronomers probably

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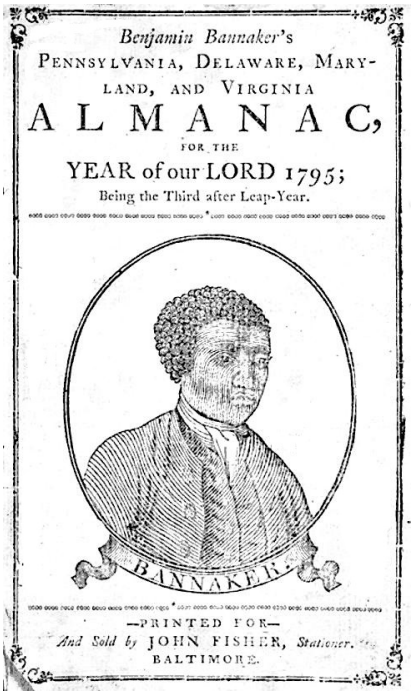
14 David Wootton, *Bad Medicine: Doctors Doing Harm Since Hippocrates* (Oxford University Press, 2007), page 64.

15 Information on astrology is adapted from display panels at the Tycho Brahe museum (September 2014) on the island of Hven, near Denmark; and from "The Islamic Ruling on Horoscopes," Sunnahonline.com (January 28, 2017), sunnahonline.com/library/beliefs-and-methodology/70-the-islamic-ruling-on-horoscopes, checked against other sources on Islam and astrology.



Benjamin Bannaker's
PENNSYLVANIA, DELAWARE, MARYLAND, AND VIRGINIA
ALMANAC,
FOR THE
YEAR of our LORD 1795;
Being the Third after Leap-Year.

—PRINTED FOR—
And Sold by JOHN FISHER, *Stationer.*
BALTIMORE.

Common Notes and Moveable Feasts, for 1792.

Dominical Letter,	AG	Easter Sunday,	April 8
Cycle of the Sun,	9	Ascension day,	May 17
Golden Number,	7	Whitsunday,	May 27
Epact,	6	Trinity Sunday,	June 3
Number of Direction,	18	Advent Sunday,	Dec. 2

ECLIPSES for the YEAR 1792.

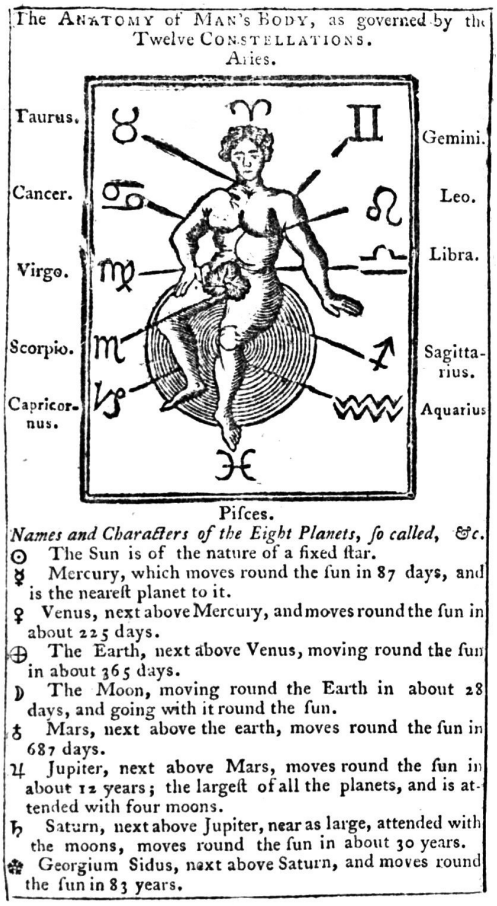
THERE will be TWO ECLIPSES this Year, and both of the SUN; the first will be visible on the 22d day of *March*, in the afternoon.

Beginning of the eclipse,	1 22	P. M.	Digits eclipsed 2½, on the sun's southern limb.
Greatest obscuration,	2 15		
End of the eclipse,	3 15		
Total Duration,	1 53		

[This will be a central Eclipse on the meridian at sea, between the island Cocos and the Galapagos, in the Pacific Ocean, in Long. 87d. 52½m. W. and Lat. 4d. 45m. N. at 0h. 51m. P. M.]

The Second will be on the 16th day of *September*, at 12 minutes past 4 o'clock in the morning; invisible.

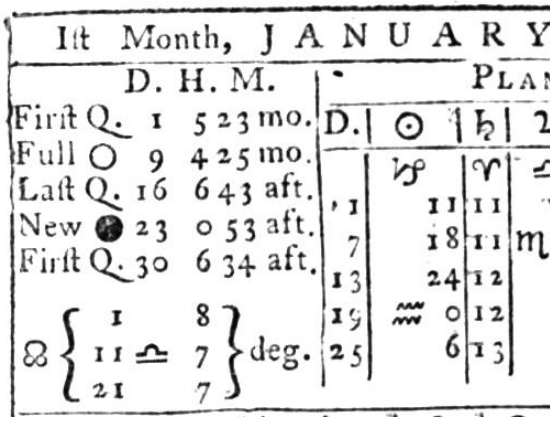
The work of Benjamin Bannaker, one of America's early astronomers, reflects an interest in matters of time-keeping and calendars, and an interest in astrology. Bannaker helped to survey the boundaries of Washington, DC, using astronomy for matters of direction. Shown here are pages from different editions of his *Almanac*.



The ANATOMY of MAN's BODY, as governed by the Twelve CONSTELLATIONS.

Names and Characters of the Eight Planets, so called, &c.

☉ The Sun is of the nature of a fixed star.
☿ Mercury, which moves round the sun in 87 days, and is the nearest planet to it.
♀ Venus, next above Mercury, and moves round the sun in about 225 days.
⊕ The Earth, next above Venus, moving round the sun in about 365 days.
☽ The Moon, moving round the Earth in about 28 days, and going with it round the sun.
♂ Mars, next above the earth, moves round the sun in 687 days.
♃ Jupiter, next above Mars, moves round the sun in about 12 years; the largest of all the planets, and is attended with four moons.
♄ Saturn, next above Jupiter, near as large, attended with the moons, moves round the sun in about 30 years.
♅ Georgium Sidus, next above Saturn, and moves round the sun in 83 years.



It Month, JANUARY

	D.	H.	M.	
First Q.	1	5	23	mo.
Full ○	9	4	25	mo.
Last Q.	16	6	43	aft.
New ●	23	0	53	aft.
First Q.	30	6	34	aft.

☊ { 1 / 11 ♎ / 21 } 8 7 7 deg.

PLA

D.	☉	♄	♀	
	♒		♈	♐
1	11	11		
7	18	11		♏
13	24	12		
19	♓ 0	12		
25	6	13		

believed this to be true; others probably just realized that astrology was a good source of income. Modern astronomers view astrology as being entirely bogus, and of no value at all, and just an embarrassing part of astronomy's history. But the fact remains that astrology has been a reason that people have cared about what the heavens show us.

We have now come to the end of what our beach chair observations of the heavens have to tell us. A final summary of the conclusions we have reached from four nights of observing the world with our eyes, a notebook, and a watch:

- ✔ The sun circles our world once every 24 hours.
- ✔ The stars circle our world once every 23 hours, 56 minutes.
- ✔ The moon circles our world once every 24 hours, 48 minutes.
- ✔ The stars visible after sunset change in a yearly cycle.
- ✔ The moon changes in a monthly cycle.

Let me emphasize that you can see this stuff for yourself -- you can *do* this science, not just read about it, and not just take my word for it. You don't have to be on a tropical beach -- it's just easier for me to illustrate the sun setting over a tropical ocean and to calculate times for the sun setting over a tropical ocean than it is for me to illustrate and calculate for some complicated urban skyline in the USA! Four clear nights of careful observation will show you all of this stuff for yourself. And just casually watching the sky will show you the cycles of the sun, moon, and stars, too. Having a more cluttered horizon and being further from the equator does not complicate things so much that you won't see the patterns for yourself!