

Spaceship Earth

- Describe the basic motions of “spaceship Earth.”
- How do we know that the Universe is expanding?

Movers... and Shakers...

- “We never get to go anywhere”
- “It costs too much to go anywhere”

·Nothing could be further from the truth...

During the half-minute we've been looking at this slide, we have traveled ~400 miles.

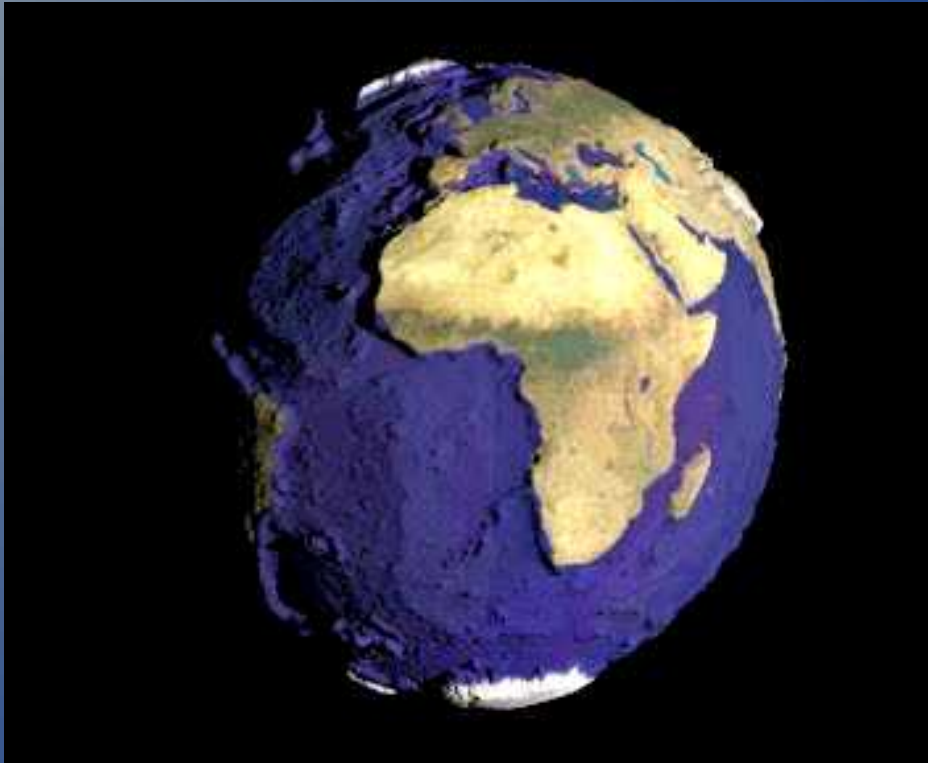
We are whizzing through space in at least four different directions!

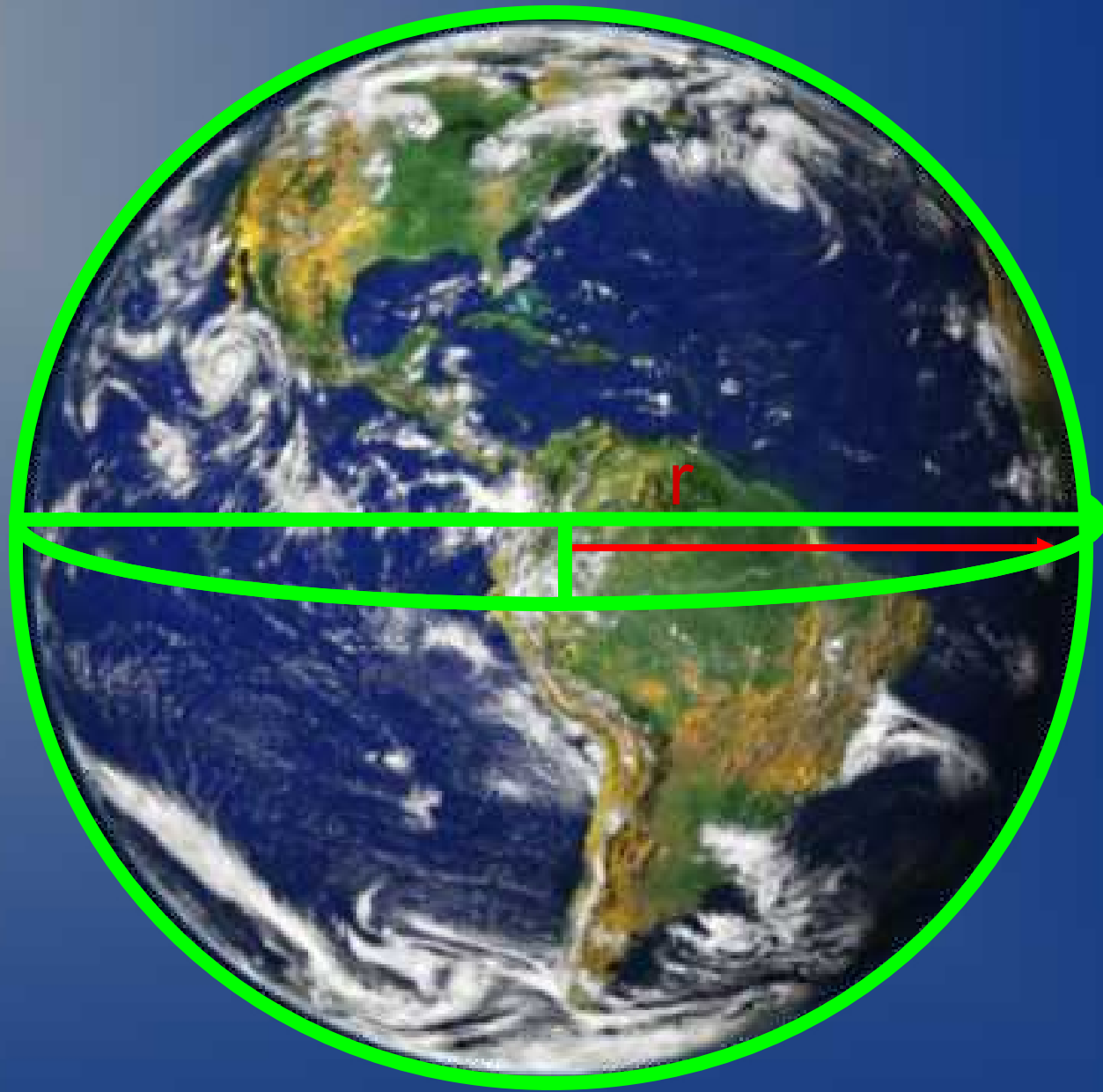
Why don't we feel the motion?

Motion I

Face the rising sun in the morning. That's our first direction of celestial movement.







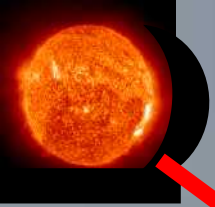
Circumference = $2\pi r$

Motion I

Circumference = $2\pi r \sim 25000$ miles

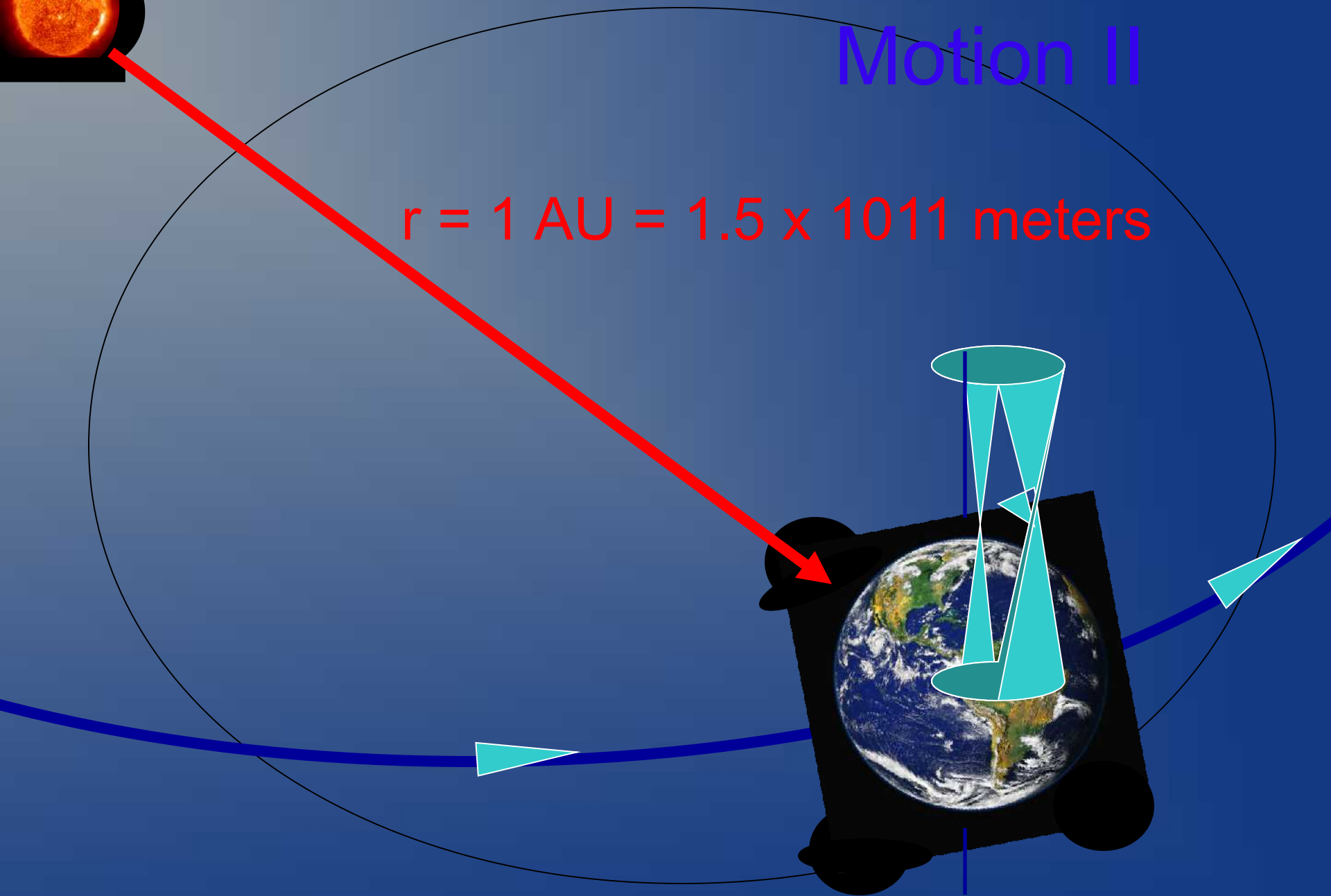
Time = 24 hours

$$V = D/T \quad \text{so} \quad 25000/24 = 1042$$



Motion II

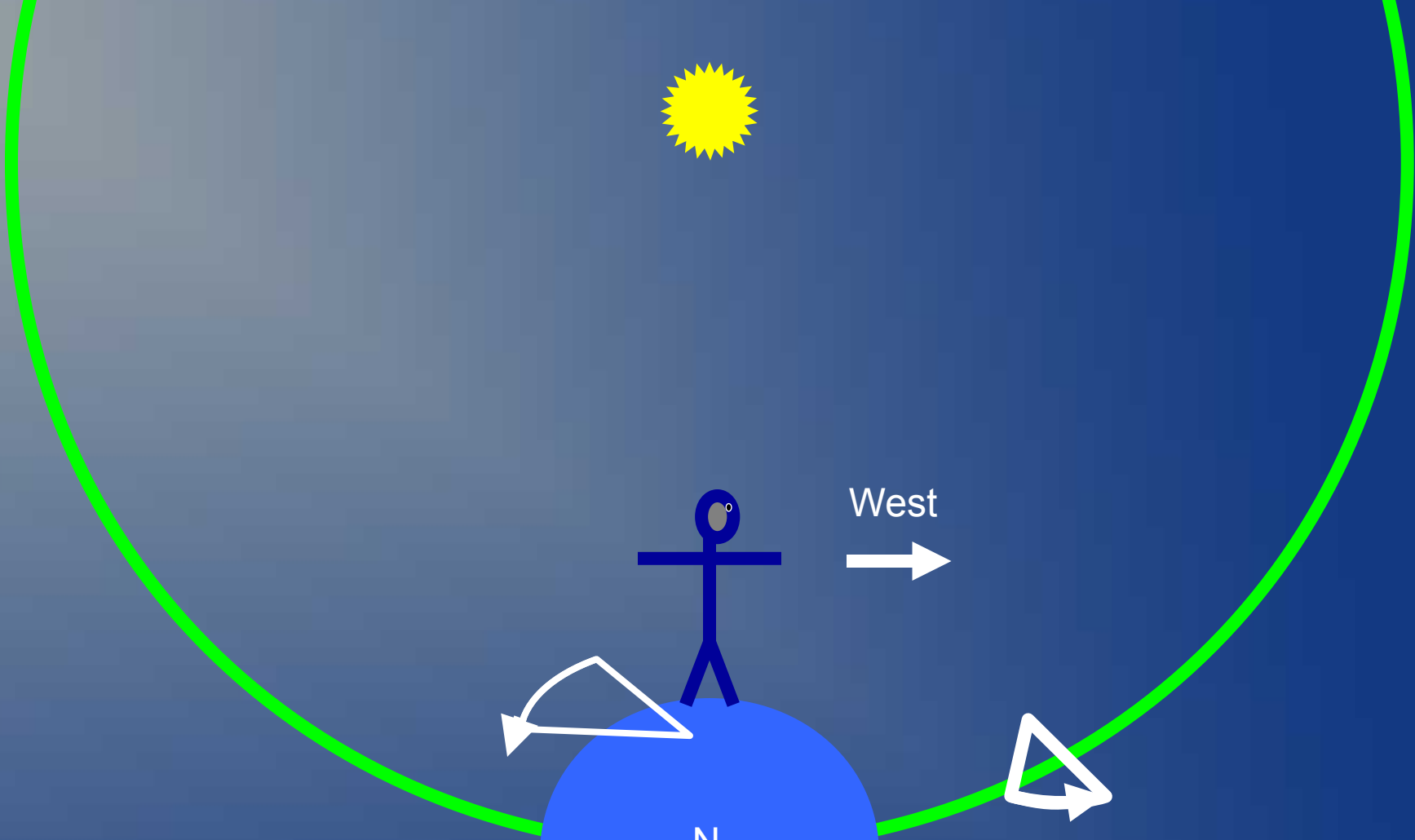
$r = 1 \text{ AU} = 1.5 \times 10^{11} \text{ meters}$



Motion II

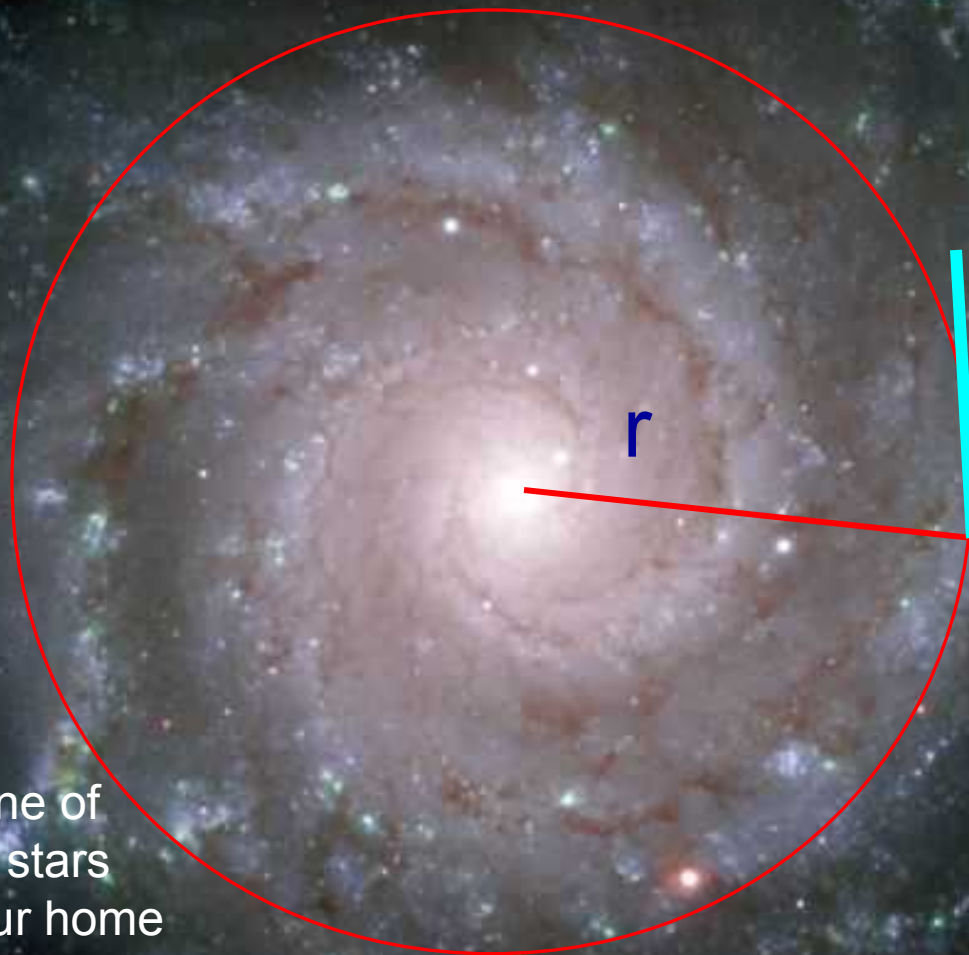
We are zooming around the sun at

64,800 mph!!!



West

N



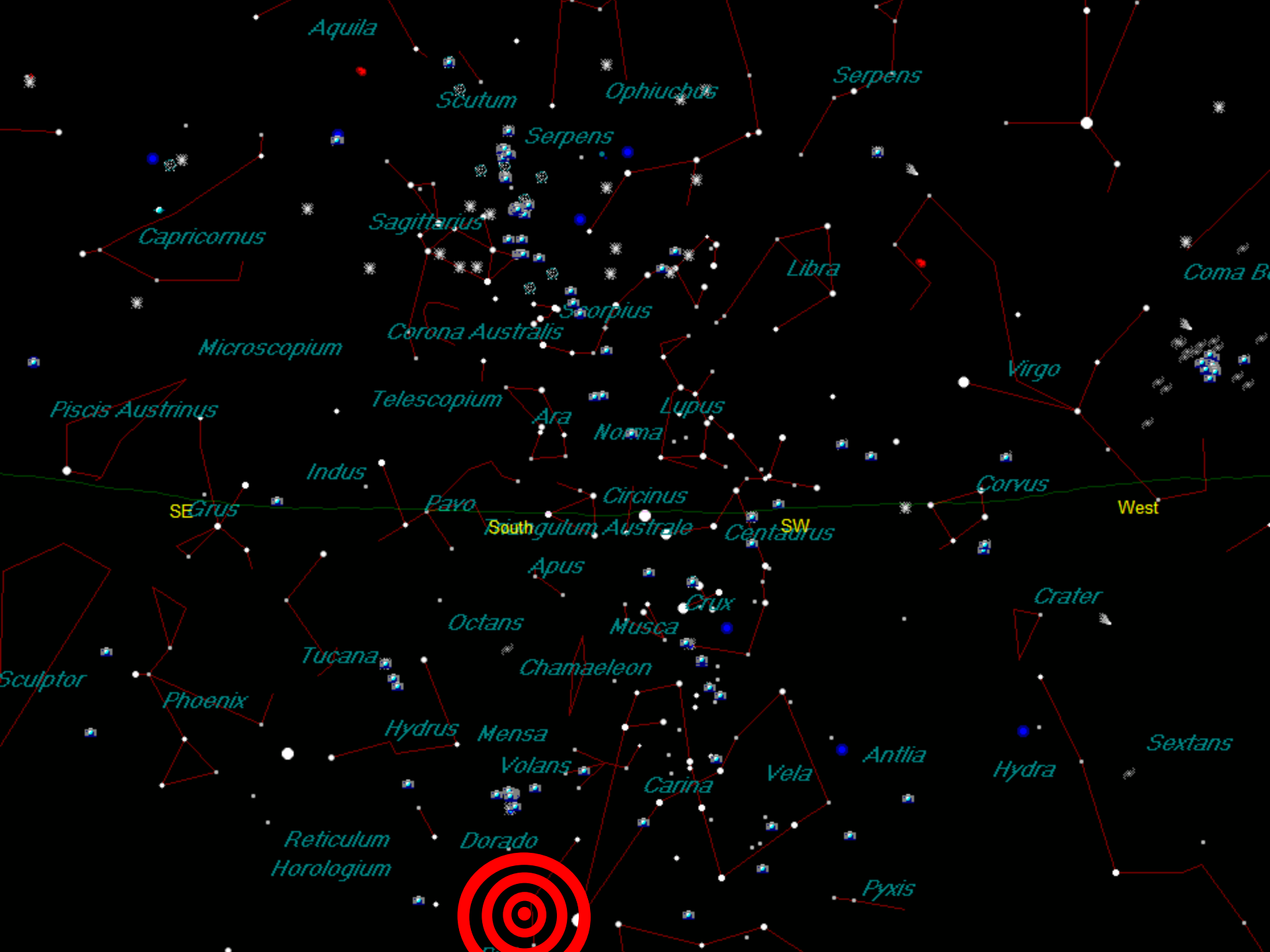
Our Sun is but one of some 100 billion stars that makes up our home galaxy, the Milky Way. It takes our sun about 226 million years to circle the Milky Way.

Motion III

Motion III

With the measured distance to the Galactic Center we calculate a speed of about 486,000 mph.

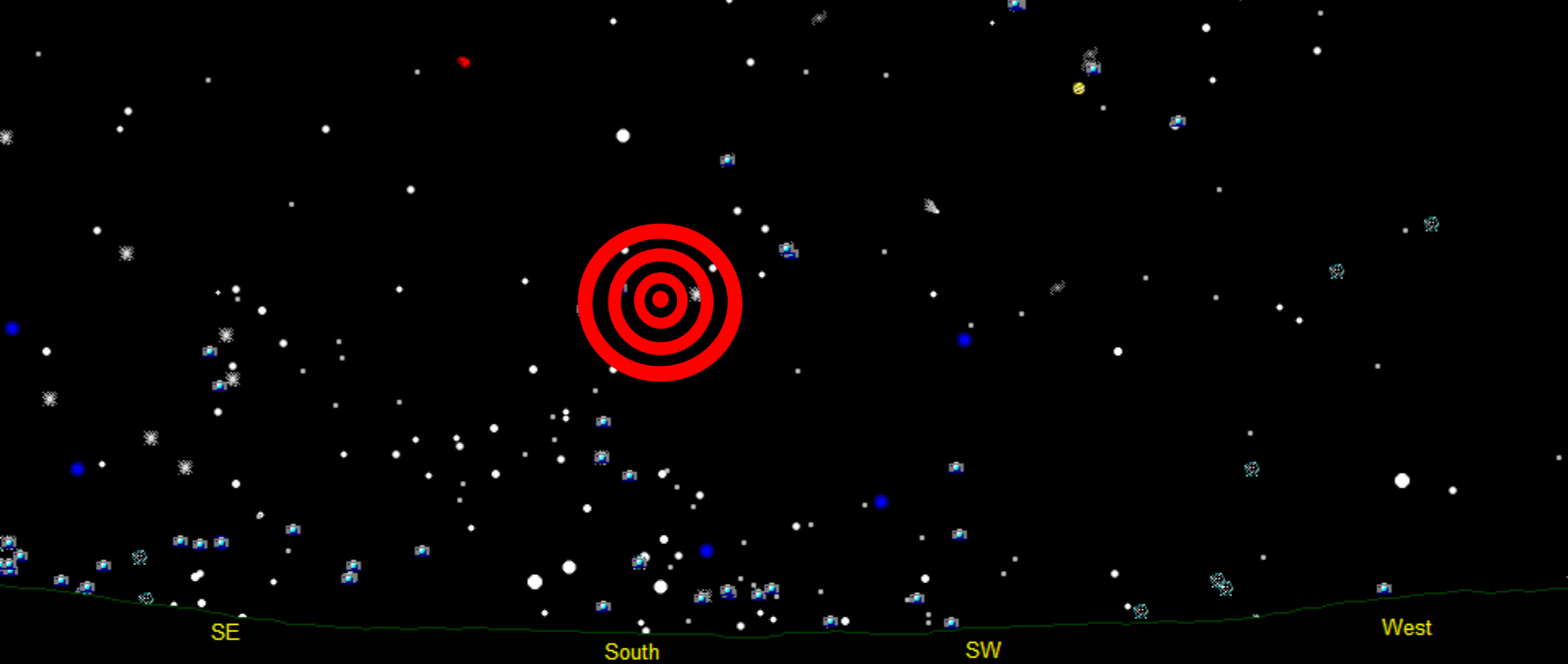
Look a little above the horizon about 20 degrees west of directly south – you are traveling in that direction! The center of the Galaxy is located between the two constellations Scorpius and Sagittarius. 90 degrees away from this direction (toward Dorado) is the direction we are going as we orbit the galaxy at 135 miles per second.



Motion IV

Look South around midnight in June, you'll see the beautiful Southern Cross low on the horizon. Right above it is the constellation Centaurus.

That's the direction our solar system and galaxy is headed at more than a million miles per hour!



Take your pick:

1. Earth's rotational speed = 1042 mph
2. Earth's orbital speed = 64,800 mph
3. Sun's orbital speed = 486,000 mph
4. Milky Way's speed = 1,000,000 mph

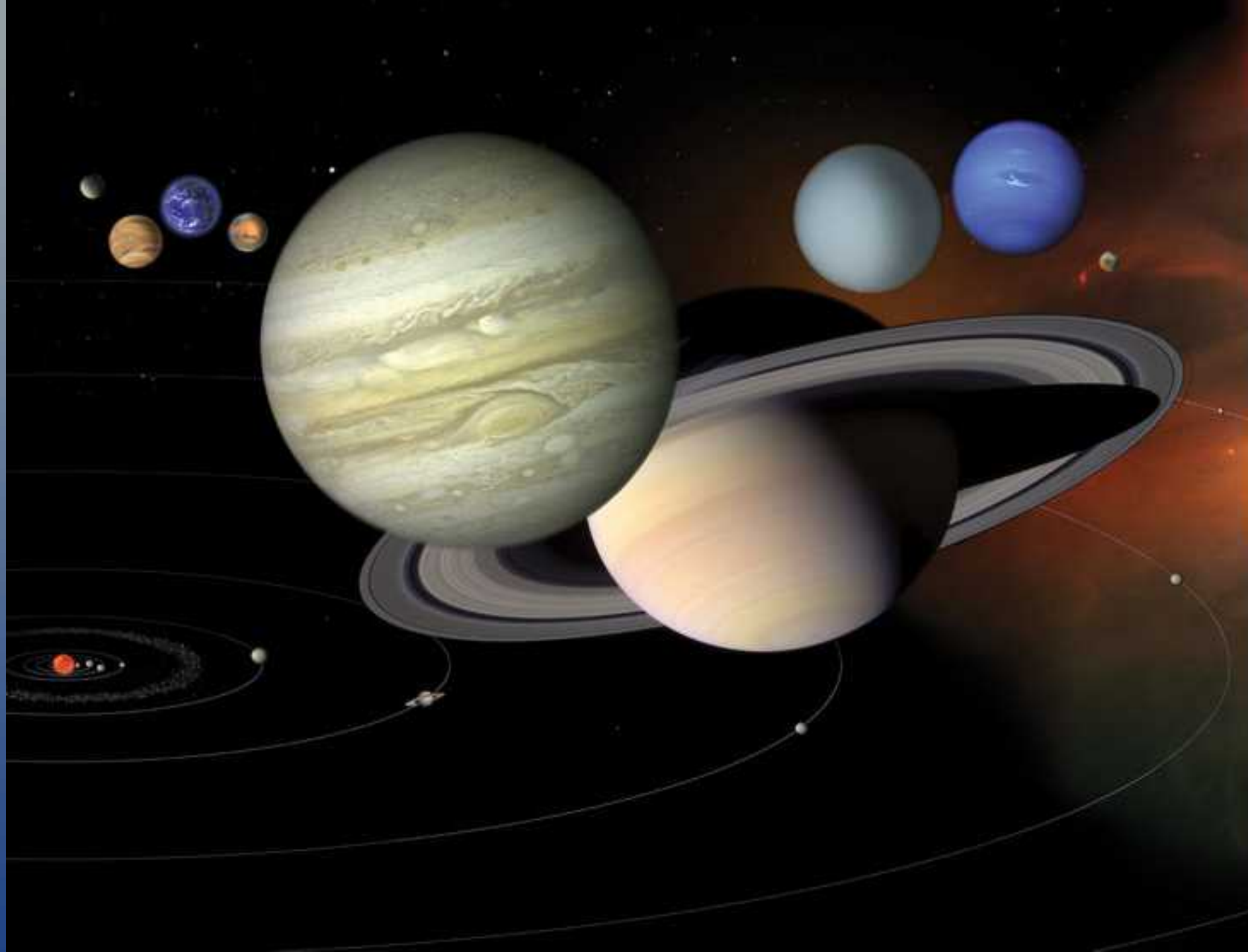
(Not to mention the expansion of the universe!)

In the ~20 minutes so far for this talk, we have moved about 350 miles east and about 21,600 miles around the sun. Our solar system has moved 162,000 miles around the galaxy and we've moved about 340,000 miles closer to Hercules.

For a grand total of about **420,000** miles traveled!

Too bad we don't get frequent flyer miles for this.

The modern Solar System



How large is the Solar System?

- Let's view it *to scale*
 - say the Sun is the size of a CD (~12 cm)
 - then:

Earth – 15 m
Mars – 23 m
Jupiter – 78 m
Saturn – 143 m
Uranus – 287 m

