



How fast does Earth move?



COLLEGE OF
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Overview

If you're reading this at your desk, it probably feels like you are sitting still.... But you aren't.

Theory

Right now, you and all your surroundings are moving about 340 meters per second (about 750 mph) to the east as the Earth rotates about its axis. This is more than 3 football fields every second — faster than airplanes fly, and about the same as the speed of sound. This motion is pretty easy to demonstrate. (The Earth is moving 100x faster than this as it orbits the Sun — fast enough to get you to Denver in 3 seconds. But we'll focus on the first part, the motion due to the Earth's rotation.)

Doing the activity

This one is pretty quick and easy, and pretty surprising. Find a tall pole, such as a lamppost or telephone pole, that casts a long shadow. (For best results, you'll want to plan this activity for a sunny early morning or late afternoon.) Have a student position themselves at the tip of the shadow (alternatively, you could mark it with an object from your classroom or with sidewalk chalk). Start measuring time, and watch the shadow move. You should only need to wait a few minutes before there's an observable change in the location of the shadow.

Here's an image of someone from Team LSOP standing on the shadow from a tall light pole, and then the same view 2 minutes later:

Necessary materials:

- sunny day
- tall pole (e.g., a lamppost)
- something to measure time with



An image of a woman with blond hair, a black face mask, and a black-and-white tie-dye t-shirt who is outside on a sunny day. She is standing with both her feet in the tip of a shadow cast by a light pole on a quiet campus street.



An image of the same woman standing in the same location. The tip of the light pole's shadow has now moved toward the right of the image (the woman's left), so the woman's right foot is no longer within the shadow.

If you'd like, you can extend this activity by asking students to mark the location of the tip of the shadow at set time intervals (you could ask your students to determine what they think the best measurement interval is). Your students will find that the shadow moves about the same distance per time interval — the Earth's rotational speed is just about constant (it has changed over very, very long time scales). If you do this experiment over many hours, you may see some confounding effects from the angle of the Sun above the horizon.

Summing up

It's not the Sun or even the shadow that's moving... It's the Earth, which is rotating. We don't feel this motion, but it's important for understanding many phenomena we observe every day. This activity is an easy and memorable way to investigate Earth's rotation!

For more information

Little Shop of Physics: <https://www.lsop.colostate.edu>

Colorado State University College of Natural Sciences: <https://www.natsci.colostate.edu>