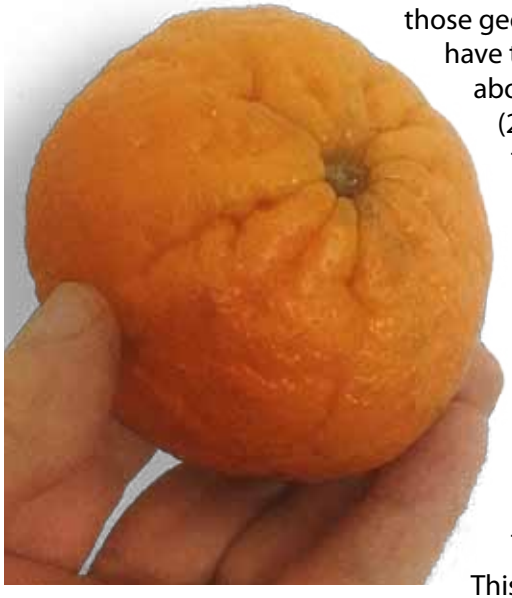
On the International Space Station, are they at risk of hitting one of the satellites we use for phone links and GPS?

Let's talk about the earth using a scale we can all understand.

Imagine a sphere 3-1/8" (8cm) in diameter. A bit smaller than a baseball; a large clementine. We'll measure the distance around this sphere (its circumference) by sticking a long piece of tape around its "equator," cutting it off so it doesn't overlap. Now imagine pulling the tape off and using its length to measure a distance from the earth (the clementine). Your tape will be 10" (25 cm) long.

The distance around the earth is 25,000 miles and the distance those geostationary satellites have to be from the earth is about this same distance (22,236 mi.) in order for their orbits to match the speed of the earth's rotation to stay directly above the same place on the equator. So in our scale model, imagine a thin ring above the "equator" of your clementine suspended the length of your tape (10") away from the clementine, like a two-foot diameter thin wire halo floating around your clementine.



This demonstrates the scale of the earth in relation to the orbits of those satellites. At this small scale, the geostationary satellites around our clementine would be so small they'd be invisible, just as you wouldn't be able to discern a cruise ship on our clementine-size earth.

Now imagine measuring that 10" (25cm) with a ruler. The International Space Station's orbit is only 248 miles above the earth. That's about one ***hundredth*** of the distance to the orbits of those geostationary satellites, one tenth of an inch (2.5mm) above the skin of the clementine. The ISS orbit is tilted in relation to the earth unlike satellites on equatorial orbits. The space station is going 17,150 miles per hour, completing an orbit every hour and a half, 16 times per day.

Well, that's pretty low! Why doesn't the ISS need to be streamlined like a plane, to deflect the wind?

The air around the earth (the tropo-sphere) is only about 9 miles deep. The passenger planes you use for vacations fly at about 35,000 feet. That's about 6-1/2 miles up. At 248 miles, the ISS doesn't encounter any air.

*Since those geostationary satellites are so very far out there (your 10 inches from the clementine) how far away from the earth is the **moon**?*

The moon is about ***ten times*** as far from the earth as those satellites! (238,855 mi.) So in our clementine scale model, a hundred inches (2.5 meters)! Eight feet four inches. (The ceiling in an average bedroom is eight feet above the floor.)

The moon is about 1/4 the size of the earth, so about 3/4 of an inch (a large, spherical grape) way out there over eight feet from the clementine.

OK, on this scale model, now that we have the earth and the moon, where's the sun? How far away and how big is it compared to our clementine and our grape that's eight feet away?

This is going to be harder to visualize. If you're a football fan, it might help. If you were in the stands in a football stadium or watching the game on TV, you wouldn't be able to even SEE our clementine down there on the field. Let's put our clementine outside one end zone. Beyond the far end zone is a huge sphere, over a hundred times the size of the clementine, the size of a two-story house, 28 feet tall. That's the sun. It takes light 8 minutes and 20 seconds to reach the earth from the sun. Light reflected from the moon takes one and a third seconds to reach the earth. Here's the scale of the solar system: https://youtu.be/Kj4524AAZdE

—12/02/20 Bruce Philpott