Jeff Williams, Astronaut, NASA: Hello, I’m Jeff Williams onboard the International Space Station, Expedition 22, and today I would like to talk to you about centripetal force, a big word, but I know you use it and take advantage of it every day. We’ve heard about acceleration, linear acceleration and angular acceleration. With angular acceleration there’s a force that’s produced. A force is required to produce an acceleration. That’s true in linear acceleration and angular acceleration.

Let’s say we were to take this object here. This is a special tool we use onboard the space station, actually during space walks. But it’s a heavy metal object and that’s what I really wanted to use. You can see I have it tied here with a string onto this bungee right here, and it’s just floating here in weightlessness. And you can see the string here is rather loose and it’s just kind of floating randomly. If I were to rotate this thing around the string, around this bungee, and let me do this, you can see that the string pulls taut and stays tight and the tool continues to rotate around the bungee. In fact, if you look really closely at the bungee, you can see that the bungee bends at the point that it’s rotating, and it bends towards the tool. And that is caused by the centripetal force due to the angular acceleration of the tool as it rotates around, keeping this string tight and keeping the rotation in a circular motion. It’s the same kind of force that applies to the rotation of planets around the Sun, or the Moon around the Earth, or the Space Station around the Earth.

Well here in space, in weightlessness, I have this bag of tea, and you can see it has bubbles in it, but they don’t rise to the top. In fact I’ll shake them up here, and you can see the bubbles spread out throughout the tea. Of course, we’re in weightlessness, we have the absence of gravity, and we know that bubbles rise for what reason? In the presence of gravity, the air is lighter than the liquid, so the air floats to the top. Gravity causes the liquid to go down and it actually pushes the bubbles up. There’s the bubbles spread throughout the tea, and if I rotate it, the bubbles coalesce to the center of the tea and eventually form a circle. Why do they do that? Because of the centripetal force spread throughout the tea, the liquid tea goes to the outside of the bag and it forces the air into the center because the air is less dense than the liquid, so the air goes to the center. I’ll try it one more time. See the air coalesce to the center and form a circle due to the centripetal force applied to this. Because it’s turning, it’s rotating, the liquid goes to the ends and the air ends up in the center of the liquid.

Okay, that’s enough, I’m just going to pull away from there. I’m going to take my piece of dental floss and I’m just going to use my dental floss to guide the water bubble. So let’s see here. What I’m going to do is I’m going to try and rotate the water bubble and we’ll see what happens. Actually, I’m going to rotate the water bubble this way because if I give you this angle, you’ll be able to see it change shape, and actually break into several parts. And you can see they’re no longer spheres. This one is rotating like this, and that’s due to the centripetal force in the water bubble.