DJORGOVSKI: Information, but we can probably finish this next time. So there is this disk of stuff that's left over. And it's going to start coagulating into bits and pieces, and they'll start piling up, and that's how planets are made. Again, this is not a fantasy. Here is a picture of actual one-- well, first detected proto planetary disk around star Beta Pictoris. The star itself is blotted out here with the paragraph. And many more like that have been seen.

So we've seen these actual cold disks left over from star formation, inside of which planets form. And the formation goes through several steps. First, you have dust grains. They can stick together through more or less chemical forces. And eventually, they have enough mass so gravity becomes important.

So when they stick together, dissipate some energy, they're going to stay together. And you start accumulating ever larger pieces from dust to pebbles to planetesimals, which are like comets or asteroids, to the whole size of planets. So this process is understood why that happens. Although the details, of course, is something that we still study through extrasolar planetary systems.

Now, the important concept here is why do you have different composition of planets depending on how close they are to their sun? If they are closer to the sun, the heat, radiation, will tend to evaporate then push out all the volatiles. And so you'd end up with the rocky planets. But beyond certain line, where things no longer evaporate-- so it's called frostline or snowline-- you're going to keep a lot of volatile things, and they can also be part of the planets.

So indeed, this is what we see. We see inner planets in solar system are rocky planets, and then the outer solar system are gas giants. And the leftover pieces from this whole thing are comets and they're out there in your cloud. So the planet and star formation finishes with a combination of things. First, the radiation pressure. Solar wind pushes particles out.

And then planets themselves go around and sweep the stuff because now they

have enough gravity to accrete material from around their proto-planetary vicinity. And that means in the early stages of planet formation, a lot of asteroids fall down, and you all computed what happens. So this is why planets have molten course. There's a great deal of kinetic binding energy that accumulates those rocks. And that's something you can toss it out.

So the important concept to remember here-- and this will come in very handy next time-- is this concept of a frost or snowline that kind of divides planetary system's inner portions, where you only end up with heavier stuff, rocky planets, outer portions, we get gaseous planets like Jupiter, Saturn, with plenty of methane, ammonia, that kind of thing. And amazingly enough, for some, this is about three astronomical units between Mars and Jupiter, just where it should be. So with that, let's finish for today.