



<p>ESOCast Episode 18: Exoplanet Caught on the Move</p>	
<p>00:00 [Visuals start]</p> <p>[Narrator] 1. For the first time, astronomers have been able to directly follow the motion of an exoplanet as it moves to the other side of its host star. The planet has the smallest orbit of all directly imaged exoplanets so far, lying as close to its host star as Saturn is to the Sun. This discovery proves that gas giant planets can form in only a few million years, a short time in cosmic terms.</p>	<p>The planet Beta Pictoris b Artist impression of the motion of the planet around the young star Beta Pictoris.</p>
<p>00:30 ESOCast intro</p> <p>This is the ESOcast! Cutting-edge science and life behind the scenes of ESO, the European Southern Observatory. Exploring the ultimate frontier with our host Dr J, a.k.a. Dr Joe Liske.</p>	<p>ESOCast introduction</p>
<p>00:48 [Dr J] 2. Hello and welcome to the ESOcast.</p> <p>In this episode, we'll talk about the planet around the star Beta Pictoris. This star has not quite twice the mass of the Sun, and is about 12 million years old. Although this sounds like a lot, it's actually a really young star. For example, the Sun is already about 4.7 billion years old.</p> <p>Beta Pictoris is one of the best-known examples of a star surrounded by a so-called dusty debris disc. Now the debris in this disc comes from collisions among larger bodies such as planetary embryos or asteroids.</p> <p>Earlier observations had already shown that this debris disc is actually warped, and that there are comets falling onto the star. Now these are telltale signs that strongly suggest the presence of a massive planet in orbit around the star. Now, with the new observations obtained with ESO's Very Large Telescope, we have definitive proof.</p>	<p>Dr J in virtual studio Slate: Episode 18: Exoplanet Caught on the Move HOST: Dr J</p> <p>Zooming on Beta Pictoris b Crossfading to image with disk</p>

<p>01:42 [Narrator] Because the star is so young, the planet must also have formed in only a few million years. This is good news because we already knew that discs around young stars disperse in a few million years, and astronomers were looking for proof that giant planet formation can occur within this time.</p> <p>The planet has a mass of about 8 Jupiter masses. It has the right mass and location to explain the observed warp in the inner parts of the disc.</p>	<p>The planet Beta Pictoris b Artist impression of the motion of the planet around the young star Beta Pictoris.</p>
<p>02:10 [Dr J] 3. The team used the NACO instrument, which is mounted on one of the four 8.2-m Unit Telescopes of ESO's Very Large Telescope or VLT. They observed the immediate neighbourhood of Beta Pictoris in 2003, 2008 and 2009. Now the 2003 observations clearly showed a massive planet in the disc, but in 2008 and in early 2009, it had disappeared!</p> <p>However, in the most recent observations, in late 2009, the planet has reappeared, but on the other side of the star. Clearly in the earlier observations, the planet was hidden, either in front or behind the star. So now, for the first time, we can actually see an exoplanet moving around its host star from one side to the other! This also gives the astronomers a much better estimate of the distance between the star and the planet.</p>	<p>Dr J in virtual studio</p> <p>Background images: NACO at the VLT VLT footage</p> <p>2-frame animation of actual Beta pic observations</p>
<p>03:05 [Narrator] 4. Among the handful of planets already imaged, the planet around Beta Pictoris, designated "Beta Pictoris b," has the smallest orbit so far. It is located between 8 and 14 Earth-Sun distances — or Astronomical Units — from its star. This is about the distance Saturn is from the Sun. The short period of the planet will allow astronomers to record the full orbit within the next 15 to 20 years, and further studies of Beta Pictoris b will provide the first insights into the physics and chemistry of a young giant planet's atmosphere.</p>	<p>Image with 2 positions of the planet, with orbit and labels</p> <p>Artist's impression showing disk and planet from outside</p>
<p>03:43 [Dr J] 6. Super-Jupiters like Beta Pictoris b are exceedingly rare around Sun-like stars. However, the planets found around the stars Fomalhaut and HR8799, together with the existence of Beta Pictoris b, seems to suggest that super-Jupiters may be a more frequent by-product of the formation of stars that are more massive than our Sun.</p> <p>Such planets strongly disturb the discs around their stars, and that creates structures that will be easily</p>	<p>Dr J in virtual studio.</p> <p>Background images: Image C: Beta Pictoris b (artist's impression)</p> <p>ALMA footage, computer animation</p>

<p>observable with ALMA, which is a revolutionary new millimetre and submillimeter telescope that is being built right now by ESO together with international partners.</p>	
<p>04:21 [Narrator] 7. A few other exoplanets have been imaged, but they are all located farther away from their host star than Beta Pictoris b is. If located in the Solar System, they would lie close to or beyond the orbit of the farthest planet, Neptune. The formation processes of these distant planets are likely to be quite different from those in our Solar System and in Beta Pictoris.</p>	<p>Images of exoplanets, Fomalhaut image – from HST 821c.html HR8799 image from Gemini/Keck</p>
<p>04:46 [Dr J] 8. The recent direct images of exoplanets illustrate the diversity of planetary systems. Among these, Beta Pictoris b is the most promising case of a planet that may have formed in a similar way as the giant planets in our own Solar System. This is Dr J signing off for the ESOcast. Join me again next time for another cosmic adventure.</p>	<p>Dr J in virtual studio. Background: direct images of exoplanets Video B – Animation with 2 frames Or Video E – artist’s impression showing disk and planet from outside</p>
<p>05:07 [Outro]</p>	<p>ESOcast is produced by ESO, the European Southern Observatory. <i>ESO, the European Southern Observatory, is the pre-eminent intergovernmental science and technology organisation in astronomy designing, constructing and operating the world’s most advanced ground-based telescopes.</i></p>

05:20
END