ESOcast Episode 60: A Polarised View of Exoplanets		
00:00 **[Visuals start]** **[Narrator]** 1. Astronomers know that planets around other stars beyond the Solar System are common. But these planets are very hard to see and even harder to study. Fortunately, there is a clever trick that helps to separate the feeble glow of a planet from the dazzling glare of its parent star: exploiting the polarisation of the light reflected from the planet. This method will allow future instruments on ESO's Very Large Telescope in Chile, and the European Extremely Large Telescope, to see otherwise invisible planets and even to search for signs of life beyond the Solar System.		**Images** Animation of exoplanet VLT footage
00:52 **ESOcast intro** 2. 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.		ESOcast introduction
01:12 **[Dr J]** 3. In this episode of the ESOcast we'll talk about a very special feature of light and how we can use it to detect planets around other stars. And, we'll talk about about a powerful new instrument that will exploit this feature: the		Dr J in virtual studio. Background image: Animation of light and polarised light. Animation showing SPHERE

planet-finder SPHERE which will be installed at ESO's Very Large Telescope in early 2014.		
01:37 **[Narrator]** 4. Light is an electromagnetic wave. Usually the plane containing a light wave can be in any direction, but sometimes one direction is more likely than others, and the light is said to be polarised. Several of ESO's telescopes can measure this polarisation, offering exciting opportunities to find and study distant objects, including planets around their host stars.		Animation of light and polarised light. VLT footage
02:12 **[Narrator]** 5. Take any star in the sky. Chances are that this star hosts several planets. One of these planets may even be similar to the Earth. But these planets are very hard to see in the glare from the bright star, as they are more than a billion times fainter.		View of night sky Image showing very faint planet next to very bright star.
02:35 **[Dr J]** 6**.** Fortunately, we can use polarisation to help us tease out the very weak light of the planet from the dazzling light of its parent star. So how does this work? In many cases, the light we receive from the planet is actually reflected starlight that is scattered in the planet's atmosphere. The scattering process produces polarised light just like the light we receive from the blue sky here on Earth. The point is that we can detect this polarisation, that is, the preferential alignment of the light caused by the scattering in the planetary atmosphere, using state-of-the-art		Dr J in virtual studio wearing sunglasses against the bright light. Background image: Zoomed-in view of one star, with Jupiter-like and Earth-like planet Star shoots out many yellow transverse waves in all polarisation directions Some of the star-light gets reflected off the planet, and becomes polarised The few waves off the Jupiter are red, the ones off the Earth are blue.

instrumentation on big telescopes.		
03:19 **[Narrator]** 7. Such an instrument — called SPHERE — has been built and will be installed on ESO's Very Large Telescope in 2014. SPHERE will take images of exoplanets. It will combine polarimetry with other methods to suppress the overwhelming light from a star and allow the very feeble light from any planets orbiting that star to be picked up and studied. The first requirement is to have a large telescope, such as the VLT, able — in principle — to take pictures that are sharp enough to allow us to spot any planets next to the star.		VLT/SPHERE UT in dome, rotating
04:09 **[Narrator]** 8. But the Earth's atmosphere blurs the view, so we also need a clever optical system — adaptive optics — to take out this blurring effect as much as possible and bring most of the starlight together into one bright dot. The centre of this bright dot is then blocked out by introducing a mask into the light beam to avoid swamping the fainter nearby objects. But even after all these tricks a halo of starlight remains — much brighter than the planets that we are looking for. However, this halo is unpolarised, whereas the light from the planets is generally polarised. The new SPHERE instrument will be able to pick out a planet's faint signal of polarised light from the unpolarised stellar halo. This trick — along with several others — will help SPHERE to take images of Jupiter-like planets around other stars.		Existing AO animation here? First bright fuzzy image, then sharper image after AO and then with centre masked by coronagraph. Zoom in on SPHERE at Nasmyth platform, follow light through system –Zoom in on ZIMPOL arm Simulated SPHERE-ZIMPOL detection of the Jupiter-like planet

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