



**Key words:** Exoplanet, 51 Pegasi b, Solar System, VLT, La Silla.

<p><b>ESOCast Episode 79: Twenty Years of Exoplanets</b></p>	
<p><b>00:00</b> <b>[Visuals start]</b></p> <p>1. Twenty five years ago not a single planet outside the Solar System had been detected. But, remarkably, we now know of thousands and have studied many in surprising detail.</p> <p>ESO's observatories in Chile have been at the forefront of this enormous expansion in knowledge. And their state-of-the-art instruments are continuing to discover and study the extraordinary diversity of exoplanets.</p>	<p><b>00:00</b> <b>[Visuals start]</b></p> <p>Computer animation: Solar System and exoplanets.</p> <p>Night timelapses</p>
<p><b>00:35</b> <b>ESOCast intro</b></p> <p>2. This is the ESOCast! Cutting-edge science and life behind the scenes at ESO, the European Southern Observatory.</p>	<p><b>00:00</b></p> <p>ESOCast introduction</p>
<p><b>00:55</b> <b>[Narrator]</b></p> <p>3. Looking up at the night sky, people throughout history have wondered if there are planets — and especially planets bearing life — beyond the Solar System.</p> <p>Astronomers have also asked themselves these questions, and many more. Are planets common? Or very rare? Do they resemble planets in the Solar System, or are they totally different?</p> <p>Frustratingly, until very recently, observational techniques were not advanced enough to be able to answer any of these questions.</p>	<p>Timelapses and still images of the night sky</p> <p>Computer animations: exoplanets</p>
<p><b>01:34</b></p>	

<p><b>[Narrator]</b>  4. But in 1995, this changed overnight. The first exoplanet orbiting a Sun-like star was detected.</p> <p>The monumental discovery was made by Geneva-based astronomers Michel Mayor and Didier Queloz around the star 51 Pegasi.</p> <p>The exoplanet, named 51 Pegasi b, has around half the mass of Jupiter and travels around its parent star in just over four Earth days.</p> <p>But this was only the beginning.</p> <p>The initial trickle of discoveries became a flood. Thousands of exoplanets have since been detected in a huge variety of sizes and orbits.</p> <p>Many of these discoveries have been made by ESO's observatories in Chile.</p>	<p>Timelapse of the ESO 3.6-metre telescope</p> <p>Still image of Michel Mayor and Didier Queloz</p> <p>Computer animation: 51 Pegasi b</p>
<p><b>02:26</b>  <b>[Narrator]</b>  5. But the hunt for exoplanets is a challenging one. These alien worlds hide in the shadows, giving off little or no light of their own.</p> <p>Any light that they do emit is swamped by the overwhelming brilliance of their parent star.</p> <p>However, advanced observational methods can be used to spot these elusive exoplanets.</p>	<p>Computer animation: exoplanets</p>
<p><b>02:51</b>  <b>[Narrator]</b>  6. The weak gravitational pull of an exoplanet in orbit causes its parent star to wobble back and forth.</p> <p>This tiny motion causes a small shift in the star's spectrum, which extremely sensitive spectrographs such as ESO's HARPS can detect through radial velocity tracking.</p>	<p>Computer animation: radial velocity tracking</p>
<p><b>03:11</b></p>	<p>Videos and still images of HARPS.</p>

<p><b>[Narrator]</b>  7. HARPS, installed on the ESO 3.6-metre telescope at the La Silla Observatory, is the world's foremost exoplanet hunter. It's the most successful finder of low-mass exoplanets to date.</p> <p>In 2010, the instrument discovered the richest planetary system yet. The system, located over 120 light-years away around the Sun-like star HD 10180, contains at least five exoplanets.</p> <p>There is also tantalising evidence that two more planets may be present in this system, one of which would have the lowest mass ever found.</p>	<p>Computer animations: HD10180 planetary system</p>
<p><b>03:57</b>  <b>[Narrator]</b>  8.  Planetary transits can also be utilised by astronomers to indirectly detect distant worlds.</p> <p>When an exoplanet passes in front of its parent star — as seen from the Earth — it blocks a small fraction of the star's light from our view.</p> <p>This creates a dip in the brightness of the star which can be measured. In addition to determining the size of an exoplanet, planetary transits can reveal the composition of an exoplanet's atmosphere.</p>	<p>Computer animations: planetary transit</p>
<p><b>04:31</b>  <b>[Narrator]</b>  9. The atmosphere around a super-Earth exoplanet was analysed for the first time by astronomers using the Very Large Telescope.</p> <p>The planet, which is known as GJ 1214b, was studied as it passed in front of its parent star and starlight passed through the planet's atmosphere.</p> <p>This starlight revealed that the planet's atmosphere is either mostly water in the form</p>	<p>Timelapses of the Very Large Telescope</p> <p>Computer animations: GJ 1214b</p>

<p>of steam, or is dominated by thick clouds or hazes.</p>	
<p><b>05:05</b>  <b>[Narrator]</b>  10. Directly observing an exoplanet is a monumental feat, but one that was first achieved by ESO.</p> <p>The Very Large Telescope obtained the first-ever image of a planet outside the Solar System.</p> <p>2M1207b is five times more massive than Jupiter. It orbits a failed star — a brown dwarf — at a distance 55 times larger than the Earth to the Sun.</p>	<p>Timelapses of the Very Large Telescope</p> <p>Still image of 2M1207b</p>
<p><b>05:35</b>  <b>[Narrator]</b>  11. ESO's telescopes are equipped state-of-the-art instruments, but to remain at the forefront of exoplanet research, ESO has recently commissioned two new instruments for the VLT.</p> <p>SPHERE is able to find and study faint planets masked by the glare of their host stars.</p> <p>And in the near future, the ESPRESSO spectrograph will arrive at the VLT, where it will surpass HARPS.</p>	<p>Timelapse of the ESO 3.6-metre telescope</p> <p>Video of the interior of a Unit Telescope of the Very Large Telescope.</p> <p>Still image of ESPRESSO</p>
<p><b>06:07</b>  <b>[Narrator]</b>  12. The European Extremely Large Telescope, which is currently under construction in Chile, will take the hunt for exoplanets even further.</p> <p>Once operational, this 39-metre telescope could detect Earth-like planets and possibly evidence of alien biospheres.</p>	<p>Computer animations: European Extremely Large Telescope</p>
<p><b>06:29</b>  <b>[Narrator]</b>  13. The search for planets outside the Solar System constitutes a key element of what is possibly the greatest question of all: is there</p>	<p>Computer animations: exoplanets</p>

<p>life elsewhere in the Universe?</p> <p>Over the past 20 years, our knowledge of exoplanets has advanced dramatically. But the quest for Earth-like planets and those that harbour life remains one of the great frontiers of astronomy.</p> <p>Are we alone? We do not know, but the answer is almost within reach.</p>	<p>Still image of the night sky</p>
<p><b>07:04</b>  <b>[Outro]</b>  14.</p>	<p>ESOcast is produced by ESO, the European Southern Observatory.</p> <p><i>ESO builds and operates a suite of the world's most advanced ground-based astronomical telescopes.</i></p>