ESOcast Episode 42: Looking Up Special 50th anniversary episode #2		
00:00 **[Visuals start]**		**Images:**
00:06 **[Narrator]** 1. 167,000 years ago, a star exploded in a small galaxy orbiting the Milky Way.		Animation of supernova explosion
00:00 2. At the time of the distant explosion, *Homo sapiens* just started to roam the African savannah. But no one could have noticed the cosmic fireworks, as the blast of light had only just embarked on its long journey towards Earth.		Light speed animation, supernova light traveling from LMC to Earth, with year counter and scenes from human history as small inserts of stills *Homo sapiens*
00:00 3. By the time light from the supernova had completed 98 percent of its journey, Greek philosophers had just started to think about the nature of the cosmos.		Greek philosphers
00:00 4. Just before the light reached Earth, Galileo Galilei trained his first primitive telescopes on the heavens.		Images of Galileo, similar to what we used in 'Eyes'
00:00 5. And on 24 February 1987, when photons from the explosion finally rained down on our planet, astronomers were ready to observe the supernova in great detail.		Year counter continues; supernova light reaches Earth; view of SN1987A lighting up in the LMC
00:00 6. Supernova 1987A flared up in the southern sky – unobservable from Europe or the United States. But by this time, ESO had built its first big telescopes in Chile.		Dr J in front of ESO's 3.6-m telescope, first in close up, then zoom-out to reveal big telescope(s) Overlay: SN1987A observations; astronomers studying monitors etc.

A front-row seat to a cosmic spectacle.		
00:00 7.		
00:00 8. The telescope is of course the central tool that allows us to unravel the secrets of the Universe.		Dr J at a smallish La Silla telescope (interior), pref. with long, closed tube
00:00 9. Telescopes collect far more light than the unaided human eye, so they reveal fainter stars and let us peer deeper into space.		Animated graphic to compare light-gathering power of telescope vs. eye
00:00 10. Like magnifying glasses, they also show finer detail.		Animated graphic to reveal increase of spatial resolution obtained by telescope
00:00 11. And, when equipped with sensitive cameras and spectrographs, they provide us with a wealth of information about planets, stars and galaxies.		Hightech-looking footage of science instruments and results (including images, spectra)
00:00 12. Dr J ESO's first telescopes at La Silla were a mixed bunch.		Dr J walking among small telescopes at La Silla
00:00 13. Dr J They ranged from small national instruments to large astrographs and wide-field cameras.		Dr J outside dome of Danish (or other small) telescope at La Silla; stills of GPO astrograph and ESO Schmidt telescope
00:00 14. Dr J The 2.2-metre telescope – now almost 30 years old – is still producing some of the most dramatic views of the cosmos. [PAUSE]		Dr J at 2.2-m MPG/ESO-telescope http://www.eso.org/public/videos/LaSillaTimelapseESOMPG/ Awe-inspiring slideshow of 2.2-m images of nebulas and galaxies : http://www.eso.org/public/images/archive/search/?adv=&facility=15
00:00 15a. Dr J At the highest point of Cerro La Silla lies the biggest achievement of ESO's early years - the 3.6-metre telescope.		Dr J, pointing at 3.6-m from a distance, then fast-zooming in on telescope.
00:00		Inside view of 3.6-m (Dr J not in view)

15b. Dr J Aged 35, it now leads a second life as a planet hunter.		
00:00 16. Dr J Also, Swedish astronomers built a shiny dish fifteen metres across to study invisible microwaves from cool cosmic clouds.		Dr J's face reflected upside down in dish of SEST; then zoom-out to reveal him standing in front of dish
00:00 17. Dr J Together, these telescopes have helped to unveil the Universe in which we live.		Pan across La Silla observatory; crossfade into night scene Alternative: LS TL: http://www.eso.org/public/videos/LaSillaTimelapseGeneralview/
00:00 18. Earth is just one of eight planets in the Solar System.		Zoom out from Chile to reveal Earth as a planet
00:00 19. From tiny Mercury to giant Jupiter, these rocky spheres and gaseous balls are the leftovers from the formation of the Sun.		Journey across the Solar System, with views of Mercury, Mars, Saturn and Jupiter; then focus on Sun
00:00 20. The Sun, in turn, is a middle-of-the-road star in the Milky Way galaxy. One pinprick of light amidst hundreds of billions of similar stars — as well as bloated red giants, imploded white dwarfs, and rapidly spinning neutron stars.		Sun as a fiery sphere; quick zoom out, so it becomes just one of countless stars;
00:00 21. The spiral arms of the Milky Way are sprinkled with glowing nebulae, spawning bright clusters of newborn stars, while old globular clusters slowly swarm about the galaxy.		Further zoom out. Spiral arms appear, with nebulae, star clusters
00:00 22. And the Milky Way is just one of countless galaxies in a vast Universe, which has been expanding ever since the Big Bang, almost fourteen billion years ago.		Fly-out of Milky Way galaxy, revealing its structure; zoom out to reveal Deep Field-like view of Universe
00:00 23. Dr J Over the past fifty years, ESO has helped to uncover our place in the Universe.		Dr J in control room of big LS ESO telescope, or outside with the domes in the background, intimate voice

24. Dr J And by looking up, we have also discovered our own origins. We are part of the big cosmic story. Without stars, we wouldn't be here.		Dr J in control room of big LS ESO telescope, or outside with the domes in the background, intimate voice
00:00 25. The Universe started out with hydrogen and helium, the two lightest elements. But stars are nuclear ovens, turning light elements into heavier ones. And supernovae like 1987A seed the Universe with the products of this stellar alchemy.		Animation of nuclear processes in stellar cores (?); exploding star, creating expanding supernova remnant
00:00 26. When the Solar System formed, some 4.6 billion years ago, it contained trace amounts of these heavier elements. Metals and silicates, but also carbon and oxygen.		Animation of formation of solar system
00:00 27. Dr J The carbon in our muscles, the iron in our blood, and the calcium in our bones, were all forged in an earlier generation of stars.		Dr J talking into camera, close up
00:00 27+28_28. Dr J You and I are literally made in heaven.		Some subtle effect to reveal our connection to the cosmos
00:00 29. But answers always lead to new questions. The more we learn, the deeper the mysteries become.		Time-lapse movie of majestically rotating night sky with Milky Way
00:00 30. What is the origin and ultimate fate of galaxies? Are there other solar systems out there, and could there be life on alien worlds? And what lurks in the dark heart of our Milky Way galaxy?		Images of LMC/SMC, planetary nebulae, extrasolar planets (artist impressions), and an (optical) zoom-in on the dark dust clouds in the Milky Way center
00:00 31. Dr J Astronomers were clearly in need of more powerful telescopes. And ESO provided them with revolutionary new tools.		Dr J in a nice La Silla location
06:00		**[Outro]**

ESOcast Episode 40: When Speed Matters — Discovery of the Accelerating Universe Wins 2011 Nobel Prize for Physics		
00:00 [Visuals start] 00:06 [Narrator] 1. In the past two decades, astronomers have made a truly revolutionary discovery: that the cosmos is not only expanding, but is doing so at an ever-faster rate. The discovery of the accelerated expansion of the Universe was awarded the 2011 Nobel Prize in Physics.		Images: Animation of accelerating Universe
00:29 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
00:45 [Dr J] 3. Hello and welcome to the ESOcast. In this episode, we're going to find out how astronomers learned that the expansion of the Universe is speeding up and why this finding is so important not only for our understanding of the Cosmos, but in fact, for all of Physics. Now this discovery was awarded the 2011 Nobel Prize in Physics, and observations from ESO's telescopes in Chile played a significant role in this breakthrough.		Dr J in virtual studio Background images: Expanding Universe, deep Cosmos La Silla/Paranal footage
01:18 [Narrator] 4. The Universe we live in was created in the Big Bang some 13.7 billion years ago. Ever since then, the Universe has been expanding. And for decades, astronomers have wanted to learn more about the nature of this expansion. For a long time, there were two main ideas: Either the expansion would gradually slow down and would ultimately come to a halt — after which the Universe would start to contract towards a "Big Crunch". Or that the Cosmos would continue to expand		Deep Universe Existing galaxy fly-through Animations or telescope footage

forever.		
01:52 [Dr.J] 5. But how could astronomers find out which of these models of the Universe is the correct one? Well, one of the simplest ways of doing this is to accurately measure distances to very faraway galaxies, and then to compare these measurements with the predictions from these models for these particular galaxies. The comparison between the measurements and the predictions tells us which of the models is the right one. But how does this work? How can astronomers precisely determine these huge distances across the Cosmos? Well, stellar explosions, or supernovae, play a key role here.		Dr J in virtual studio Background images: Telescopes, galaxies
02:33 [Narrator] 6. Supernovae are rare cosmic events: They are exploding stars. There is a certain type of explosion, known as a Type Ia Supernova, which is ideal for measuring distances in the cosmos. These supernovae are very bright, which means they can be seen even in distant galaxies. And what's more their intrinsic brightness's are always the same, meaning that their distances can be inferred from how bright they appear to us from Earth. By the 1990s two separate research teams had begun to carefully observe these exploding stars. For their studies, astronomers partly used telescopes at ESO's La Silla observatory in Chile.		Animation of supernovae type Ia Animation of distant galaxy with supernova La Silla Footage
03:20 [Statement Spyromilio] 7. "Observing extremely distant supernovae in the mid 1990s was extremely challenging and exciting. We at ESO used the 3.6-metre, the NTT and the 1.5-metre telescopes to observe these high-redshift supernovae discovered at the nearby Tololo Observatory. In those days, 15 years ago, we were actually counting literally every single photon, which is a beautiful experiment to be part of, because it was extremely challenging. The critical component of all of this is of course to realise that we did not set out to find the accelerating Universe, so watching a new paradigm in physics establish itself has of course been very interesting and it's been great fun."		Jason Spyromilio

04:00 [Statement Leibundgut] 9. “Once we had established that the distant supernovae were too far away for a Universe that was dominated by gravity we had to go back and measure this again. So the accelerated expansion that we measured with the first set of supernovae which then was translated very quickly into a new component for cosmology - dark energy - we had to confirm that result. What we did is we asked for VLT time like other groups as well (several other groups did the same thing) to confirm what we had measured to get better data with a bigger telescope and to get a better sampling of the supernovae themselves.”		Bruno Leibundgut
04:38 [DrJ] 10. The discovery of the accelerating expansion of the Universe was one of the most unexpected and important of the last decades. It was so unexpected because up until that point, everyone believed that the expansion of the Universe should be slowed down by the attractive force of gravity exerted by all of the matter in the Universe. But, as it turns out, the Universe is in fact much more interesting than that. But why is this acceleration so important? Well, as far as we know, there are two possible explanations for the acceleration: The number one explanation is that nearly ¾ of the Universe consist of some form of this mysterious dark energy. Dark energy is so mysterious because it exerts negative pressure. That’s pretty exotic stuff. The number two explanation is that there is something wrong with our understanding of gravity. In other words, that Einstein’s theory of general relativity is not quite correct. In either of these cases, we are confronted with completely new physics, and that’s why this is so important and why this discovery was awarded the 2011 Nobel Prize in Physics. This is Dr J signing off for the ESOcast. Join me again next time for another cosmic adventure		Dr J in virtual studio Background images: Expanding Universe Telescopes
00:00 [Outro]		ESOcast is produced by ESO, the European Southern Observatory. *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.*

07:00
END