ESOcast Episode 44: Changing Views Special 50th anniversary episode #4		
00:00 **[Visuals start]**		**Images:**
00:38 [Music] 1.		Symphony orchestra preparing to perform, tuning their instruments; then change to part where they play very recognizable part of Beethoven's 9th
00:51 **[Dr J]** 2. Great music, isn't it?		Dr J walks in front of camera (symphony orchestra becomes very much out of focus)
00:53 **[Dr J]** 3. But suppose you had a hearing impairment. What if you couldn't hear the low frequencies? Or the high frequencies?		Closeup of Dr J, still with orchestra in background. Music changes to reflect disappearance of first low notes, then also high notes
01:04 **[Dr J]** 4. Astronomers used to be in a similar situation. The human eye is only sensitive to a small part of all the radiation in the Universe. We can't see light with wavelengths shorter than violet waves, or longer than red waves.		Dr J somewhere in astronomy exhibit (or telescope control room) points to various parts of spectrum in front of him
01:19 **[Dr J]** 5. We just don't perceive the whole cosmic symphony.		Closeup of Dr J; Beethoven's 9th audible in background again
01:25 **[Narrator]** 6. Infrared, or heat radiation, was first discovered by William Herschel, in 1800.		Image of Herschel discovering infrared radiation. Zoom out to reveal image is on a monitor (maybe in VLT control room again?), watched by Dr J, who looks over his shoulder into camera
01:33 **[Dr J]** 7. In a dark room, you can't see me. But put on infrared goggles, and you can "see" my body		Light dims; picture turns black. Then switch to infrared / night vision view; Dr J becomes visible again

warmth.		
01:45 **[Narrator]** 8. Likewise, infrared telescopes reveal cosmic objects too cool to give off visible light, like dark clouds of gas and dust where stars and planets are born.		Astronomical pictures/animations of nebulae etc
01:58 **[Visuals]** 9.		Infrared/Visual image swapping
02:05 **[Dr J]** 10. For decades, ESO astronomers have been keen to explore the Universe at infrared wavelengths.		
02:11 **[Dr J]** 11. But the first detectors were small and hence inefficient.		Closeup of Dr J's hands, holding old, small IR detector
02:15 **[Dr J]** 12. They gave us a blurry view of the infrared sky.		First low-res pictures of IR observations
02:20 **[Narrator]** 13. Today's infrared cameras are huge and powerful.		Closeup of one of the big infrared cameras/spectrographs of the VLT
02:25 **[Narrator]** 14. They're cooled to very low temperatures to increase their sensitivity.		Technicians working with liquid nitrogen
02:31 **[Narrator]** 15. And ESO's Very Large Telescope is designed to make good use of them.		Zoom out to reveal one Unit Telescope (seen from within enclosure)
02:40 **[Narrator]** 16. In fact, some of its technological tricks, like interferometry, only work in the infrared.		Scientifically-looking images (fringes, spectra, images, scientists)
02:49		Outside panoramic night view of VLT

[Narrator] 17. We've broadened our view, to reveal the Universe in a new light.		
02:57 **[Narrator]** 18. This dark blob is a cloud of cosmic dust. It blots out the stars in the background.		Zoom in on optical image of B68
03:05 **[Narrator]** 19. But in the infrared, we can look straight through the dust. And here's the Orion Nebula, a stellar nursery. Most of the newborn baby stars are hidden by dust clouds. Again, infrared comes to the rescue, revealing stars in the making!		Crossfade to infrared image of B68 Optical image of Orion Nebula Zoom in to part of Orion Nebula that has been imaged in the infrared
03:35 **[Narrator]** 20. At the end of their lives, stars blow out bubbles of gas. Cosmic showpieces at optical wavelengths — but the infrared picture shows much more detail.		Cat's Paw nebula, optical Cross fade, visible/IR
03:49 **[Narrator]** 21. Don't forget the stars and gas clouds captured by the monstrous black hole in the core of our Milky Way galaxy. Without infrared cameras we would never see them.		Movie of red giants orbiting supermassive black hole in Milky Way core (same movie that has been used before)
04:03 **[Narrator]** 22. In other galaxies, infrared studies have revealed the true distribution of stars like our own Sun.		M83, crossfade from optical to infrared, maybe zooming/rotating in the meantime
04:12 **[Narrator]** 23. The farthest galaxies are best studied in the infrared. Their light has been shifted to these long wavelengths by the expansion of the Universe.		Slow pan/zoom in on Deep Field image
04:23 **[Dr J]** 24. Close to Paranal is a small mountain peak with an isolated building on top.		Dr J at Paranal, pointing at VISTA in the distance.
04:28 **[Dr J]**		Dr J outside VISTA; enters VISTA building

25. Inside this building is the 4.1-metre VISTA telescope. It was built in the United Kingdom, ESO's tenth Member State.		
04:43 **[Narrator]** 26. For now, VISTA only does infrared. It uses a giant camera, weighing as much as a pickup truck.		Closeups of VISTA's camera
04:52 **[Narrator]** 27. And yes, VISTA offers unprecedented vistas of the infrared Universe		Impressive showcase of VISTA images
04:59 **[Dr J]** 28. ESO has been doing optical astronomy since its birth, fifty years ago. And infrared astronomy for about thirty years.		Dr J in pickup truck, seen from outside (from right side). Non-descriptive background. Between sentence 1 and sentence 2, he starts the engine. After sentence 2 he drives away.
05:15 **[Narrator]** 29. But there are more registers to the cosmic symphony.		Close up of Dr J driving on road to Tocanao, seen from passenger seat (moving landscape in background) Beethoven's 9th is again faintly audible
05:19 **[Narrator]** 30. Five thousand metres above sea level, high in the Chilean Andes, is the Chajnantor plateau. Astronomy doesn't go higher than this.		Dr J's car seen from behind. He drives on ALMA road, in direction of OSF. Mountains in background.
05:33 **[Dr J]** 31. Chajnantor is home to ALMA – the Atacama Large Millimeter/submillimeter Array.		High site, moving transporters in background?
05:42 **[Dr J]** 32. ALMA is still under construction. At a site that is so hostile, it's even hard to breathe!		Dr J on Chajnantor, between ALMA dishes. Dressed in warm clothing; has trouble to breathe and speak against the wind. In the background: ALMA transporter moving; construction workers hammering
05:51 **[Narrator]** 33. With just ten of the 66 antennas in place, ALMA made its first observations in the autumn of 2011.		Wide-angle time-lapse movie of ALMA (night view)

06:02 **[Narrator]** **34.** Millimetre waves from space. To observe them, you need to be high and dry. Chajnantor is one of the best places in the world for this.		More night views of ALMA (tele views)
06:18 **[Narrator]** **35.** Clouds of cold gas and dark dust become visible in a pair of colliding galaxies. This is not where stars are born, but where they are conceived.		Hubble photo of the Antennae galaxies, crossfading to combined optical/ALMA picture
06:32 **[Narrator]** **36.** And these spiral waves in the outflow of a dying star — could they be due to an orbiting planet?		New ALMA result
06:43 **[Narrator]** **37.** By changing the way we look, we're closing in on the origins of planets, stars and galaxies. On the full symphony of the cosmos.		Impressive cosmic scenery; maybe with closing part of Beethoven's 9th
07:03		**[Outro]**

08:09 END