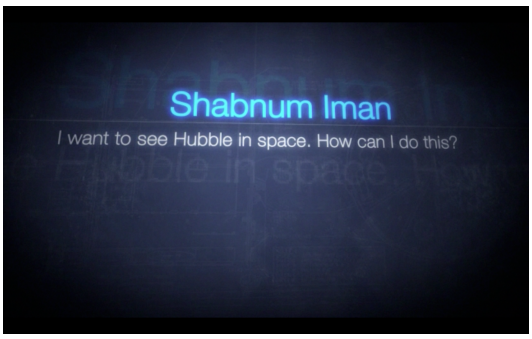
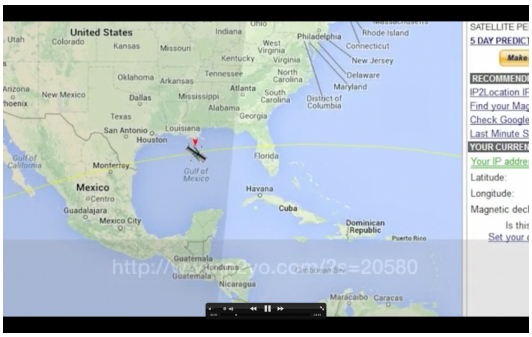
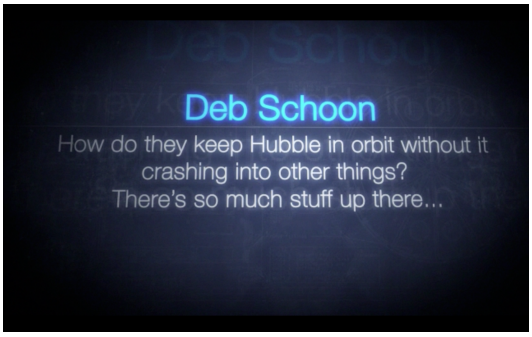
ESO, Karl-Schwarzschild-Str.2
D-85748 Garching bei München,
Germany
Telephone: +49 (0)89 3200 6855
Telefax: +49 (0)89 3200 6480
hubble@eso.org

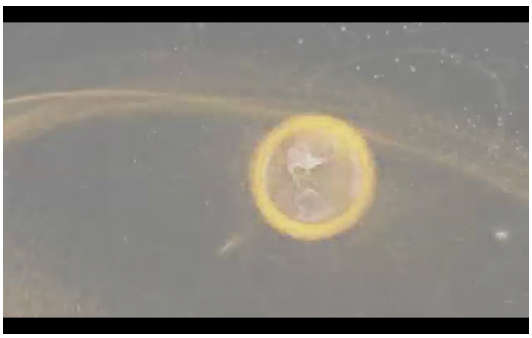
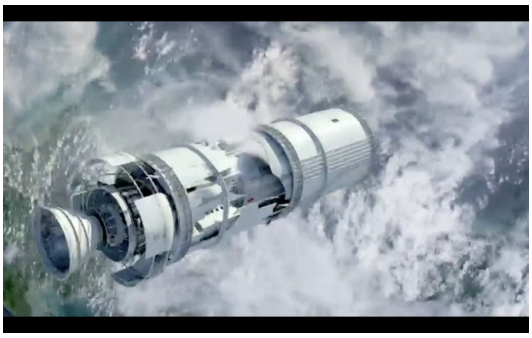
www.spacetelescope.org

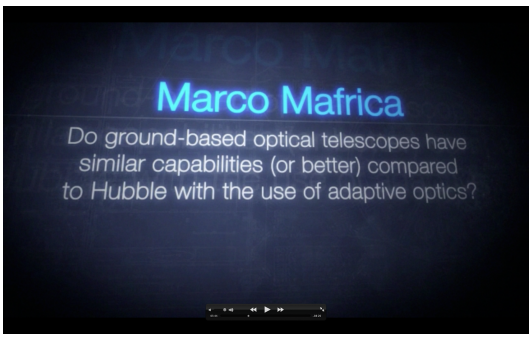
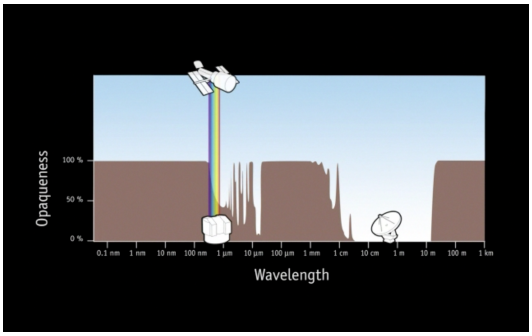
[Facebook note]

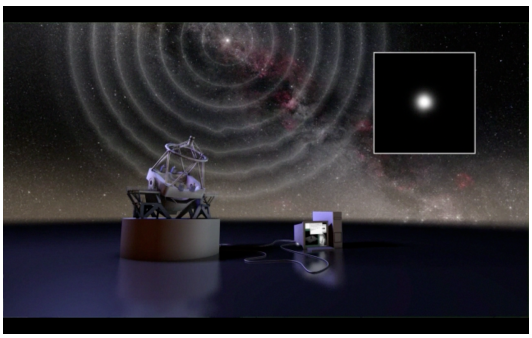
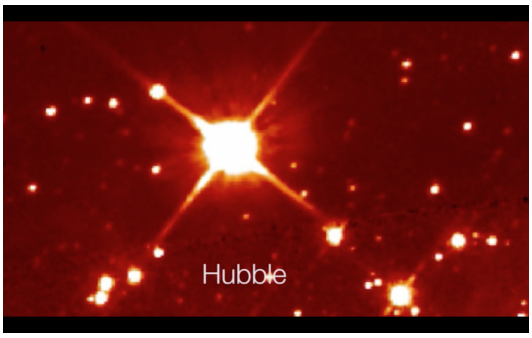
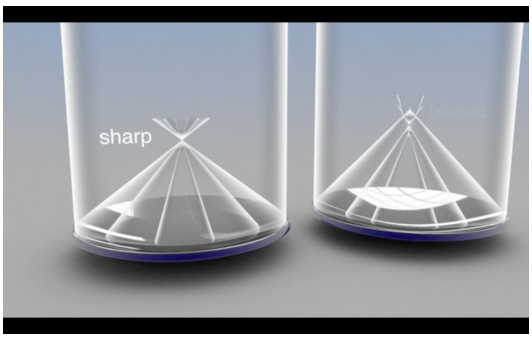
Hubblecast 78: Q&A with Dr J part 1	**Visual notes**
00:00 [Dr.J] 1. Hello and welcome to the first of a very special pair of Hubblecast episodes. So last month we asked you to send us your Hubble and astronomy related questions and the response we got was incredible! So what we'll do is that in this episode we'll try to answer your questions that were specifically about Hubble itself and in the next episode we look at the more science related questions.	 

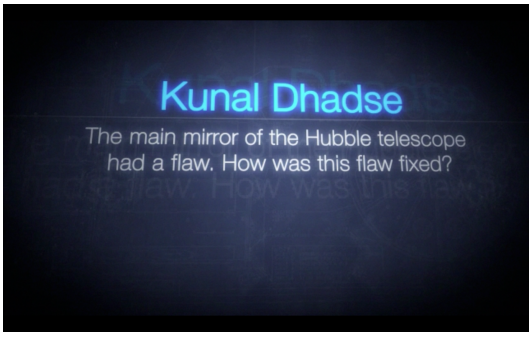
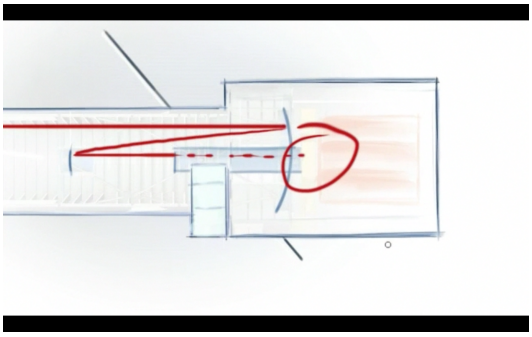
00:28 2. Intro	
00:56 3. [Dr J] A lot of you wanted to know about Hubble's general location. Well, Hubble is of course in orbit around Earth, at an altitude of about 545 kilometres, and its orbit is inclined with respect to the Earth's equator at angle of about 28.5 degrees. Now Hubble zooms along in its orbit at a speed of 28 000 km/h, meaning that it completes an entire orbit in just under 97 minutes. In other words, Hubble circles the Earth almost 15 times every day! And yes, you CAN see it, even with the naked eye if you know where to look...	  

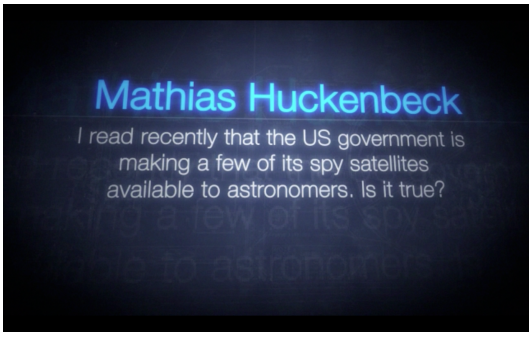
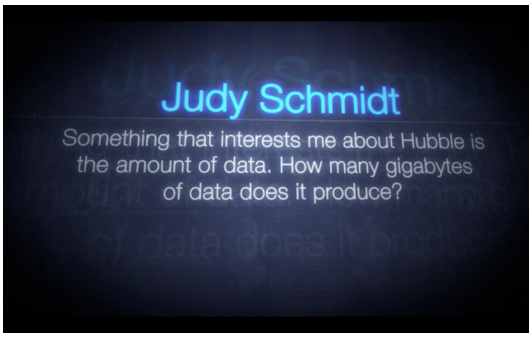
01:44 4 [Public question] I want to see Hubble in space. How can I do this? [Public Question] So, where IS Hubble? [Dr J] Track the location of Hubble, or a host of other satellites and space telescopes, here:	 
02:04 5 [DR J] So Hubble isn't up there all by its lonely self. Space is actually quite a busy place and there are lots of other active satellites as well as space debris in orbit around Earth. So how come Hubble doesn't bump into anything?	
02:19 6 [Public Question] How do they keep Hubble in orbit without it crashing into other things? There's so much stuff up there...	

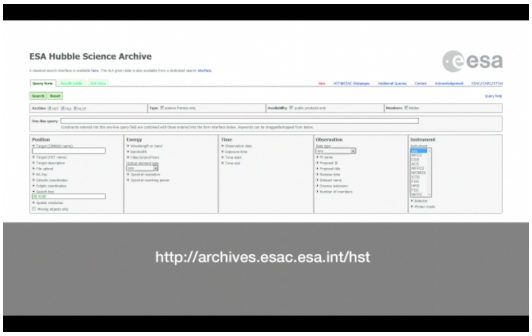
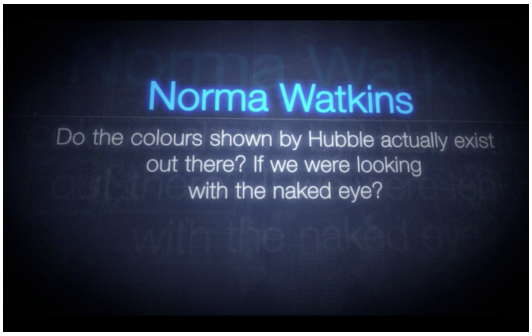
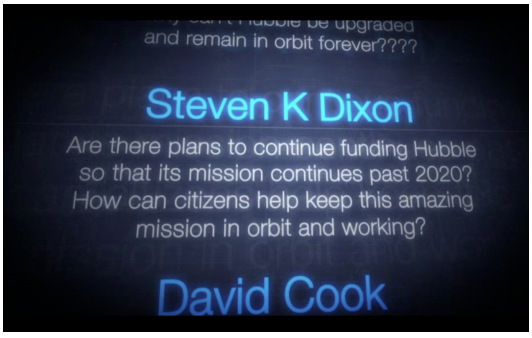
02:28 7 [Narrator] There are not many satellites with similar orbits to Hubble so there is very little risk of a satellite collision. For the visible space debris which is big enough to cause some damage, the orbits are carefully tracked. This makes it possible to predict if and when this debris might collide with Hubble. If a collision is likely Hubble cannot be moved to a different orbit as it has no engine. But we can change its orientation and if the space junk can't be avoided, then the sturdier, less delicate, back of Hubble can be turned towards the impact. A disastrous collision, like the one that ended Hubble at the beginning of the film Gravity, is very, very unlikely.	 
03:29 8 [Dr J] Now the possibility of a collision with space debris is definitely a downside for space telescopes. Some of you wanted to know more about the pros and cons of space versus ground-based telescopes.	

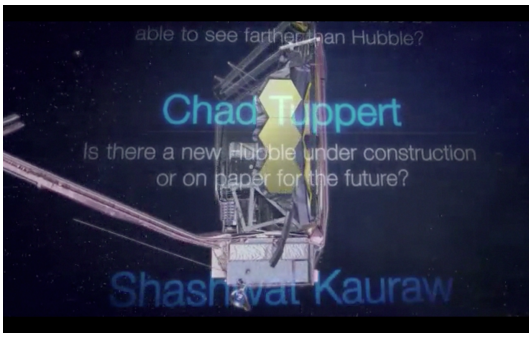
03:41 9 [Public Question] Do ground-based optical telescopes have similar capabilities, or better, compared to Hubble with the use of adaptive optics? Will adaptive optics eventually make space-based optical telescopes redundant? [Dr J] Well, a much younger version of me actually discussed this in some detail back in Hubblecast episode 6.	 
04:08 10 [Clip: Hubblecast 6] The atmosphere blocks certain wavelengths of light. Only space telescopes like Hubble, that fly above the atmosphere, can access the ultraviolet and infrared parts of the spectrum, which are invisible from the ground.	

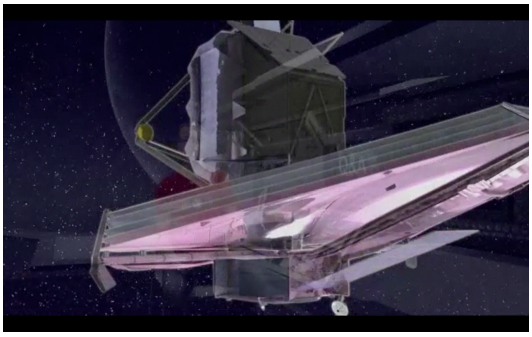
04:27 11 [Dr J] In addition, space telescopes avoid the blurring effects of Earth's atmosphere. Having said that, these days, large telescopes on the ground can correct for this blurring and can actually make images that are sharper than those by Hubble. But this does not work in the optical, but only at longer wavelengths and only over relatively small fields of view. And so, overall, there's definitely still a need for space telescope — even at those wavelengths that do make it to the ground.	 
05:00 12 [Dr J] With space telescopes of course, it's much more of a problem when something goes wrong. As NASA and ESA found out first hand with Hubble.	
05:12 13 [Clip: Hubblecast 41] Spherical aberration, a flaw in the main mirror, meant that the telescope could not focus properly. Where Hubble's images should have been razor sharp, astronomers instead struggled to make out the fine details of their observations.	

05:33 14 [Dr J] Some of you want to know how the effect of the flaw in Hubble's primary mirror was corrected for.	
05:41 15 [Public Question] The main mirror of the Hubble telescope had a flaw. How was this flaw fixed?	
05:49 16 [Dr J] Well, essentially, they built Hubble a contact lens called COSTAR. This piece of corrective optics was installed in place of one of Hubble's instruments during the first servicing mission. COSTAR consisted of small mirrors that were inserted into Hubble's light path, thereby correcting the beam before it reached the scientific instruments. Later instruments were designed to correct for the aberration themselves. Eventually COSTAR was no longer needed and so it was removed during the fourth servicing mission.	 

06:25 17 [Public Question] I read recently that the US government is making a few of its spy satellites available for astronomers. Is it true? [Dr J] Yes, this story is true! Although, the satellites were never actually launched or used by the government. One of these Hubble-like telescopes may be launched for scientific purposes.	
06:50 18 [Dr J] We also received several questions about Hubble data.	
19 [Public Questions] Something that interests me about Hubble is the amount of data. How many gigabytes of data does it produce? How is the great amount of Hubble data stored and processed?	

07:07 20 [Dr J] The amount of data produced by Hubble isn't actually all that much. It sends back about 120 GB of data to Earth every week. That's about 26 DVDs. The data are first sent to New Mexico, then to NASA's Goddard Space Flight Center, and finally to the Space Telescope Science Institute in the USA and to several institutes across Europe where the data are processed and archived. By the way, after one year absolutely ANYONE can download and use the data for free.	 
07:43 21 [Public Question] Do the colours shown by Hubble actually exist out there? If we were seeing them with the naked eye? [Dr J] To answer this you would need a whole Hubblecast. Just as well that we have one! Try Hubblecast 23: Seeing the invisible.	
08:03 22 [Dr J] Many of you were concerned about Hubble's future. And rightly so.	

08:22 23 [Dr J] Sadly, Hubble has already had its final rejuvenation and will not be serviced anymore. We explored its fifth and final servicing mission back in Hubblecast 28, where we also gave some clues as to the final fate of our favourite telescope.	
08:46 24 [Clip: Hubblecast 28] Astronauts will carry out extra space walks to replace some parts that will keep Hubble flying hopefully into the next decade. They will also attach a special mechanism that will allow a future robotic spacecraft to dock with Hubble in order to steer it to a peaceful final resting place in the ocean when its time has finally come.	
09:13 25 [Dr J] So, Hubble will not last forever and although its fate isn't 100% certain it will most likely be guided back to Earth. On its way down, it will partly burn up in the Earth's atmosphere and eventually it will finish its life somewhere in the Pacific ocean. But everyone around here says that Hubble will last at least until 2020, maybe even beyond! And so there are plenty of pictures, science and, of course, Hubblecasts yet to come!	
09:44 26 [Dr J] As to what comes next…..	

09:56 27 [Narrator] This is the James Webb Space Telescope. It‘s due to be sent into an orbit 1.5 million kilometres from Earth in 2018. With a main mirror 6.5 metres in diameter, it will be able to see more distant and fainter objects than Hubble and has been dubbed by some as Hubble’s successor. But are the two telescopes really comparable?	
10:27 28 [Dr J] There are actually a lot of differences between the two telescopes. But that topic deserves a whole Hubblecast episode of its own, which we’ll get to next year — so just wait and see! And now to finish the part one of our Q&A lets get to some burning questions that we know everyone is dying to know the answers to. NO, we have not found little green men. And we have not found Discworld either. We really DON’T KNOW whether we’re alone or not. And NO, the pictures are really not fake! This is Dr J, signing off for the Hubblecast. Once again, nature has surprised us beyond our wildest imagination.	

Ends 12:04