




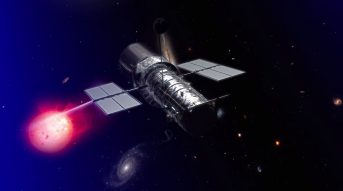

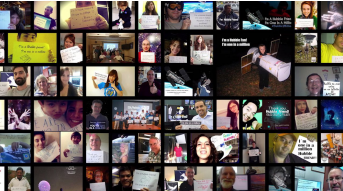



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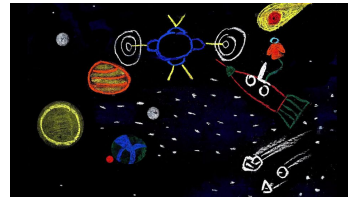
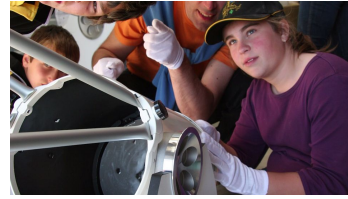
Hubblecast Episode 94: The Future of Hubble, part II	Visual notes
<p>00:00 [Narrator] 1. In 2016 Hubble celebrated its 26th year in space. More than a quarter of a century of intriguing observations and remarkable discoveries.</p> <p>But what is there left for Hubble, and the forthcoming James Webb Space Telescope, to do? We have asked astronomers working with, and developing, the telescopes what they think we can expect over the coming years.</p>	
<p>00:28 [Ken Sembach, STScI director] 2. <i>The things that we're thinking about are changing rapidly, and so questions that we're trying to ask today, we've only just begun to think about them in many cases. They're new questions, and so when you have observatories that have the kind of transformational abilities like Hubble, or Webb to really take you places you haven't gone before, to make you think about</i></p>	

<p><i>questions you haven't asked before, it can move the whole field forward very quickly.</i></p>	
<p>00:57 3. Intro</p>	
<p>01:13 [Narrator] 4. Hubble is one of the most successful astronomical instruments in history and has made its mark on almost every field of astronomy.</p> <p>But its achievements go beyond science to its unique influence on wider society. Hubble has always been a telescope for the public and as such it has changed humanity's view of the Universe.</p>	
<p>01:42 [Corinne Charbonnel, Professor of Astrophysics at the University of Geneva] 5. <i>Well I think that Hubble has been really revolutionary in the field also because the public can be in contact with space and really feel part of it. Not only, I mean as a scientist of course, I would have many things to tell about the great opportunities for science, but I think that great opportunity is for the public to meet the science, and to meet the Universe was incredibly nice.</i></p> <p>[Ken Sembach, STScI director] <i>Hubble's biggest accomplishment has been just opening up the entire Universe to us in ways that we hadn't really imagined before. [..] I think it's the cumulative sum of all of the observations that Hubble has taken, that has given us just such a different view of what the Universe is like and our place in it that's been really revolutionary.</i></p>	  

02:37

[Narrator]

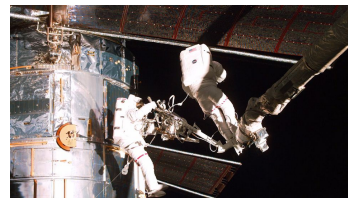
6. Hubble's place in popular culture has inspired the public to consider the Universe differently, and it will continue to do so. But its very human appeal has also influenced the work, and the lives, of the many astronomers who have built careers around it.



03:18

[Boris Gänsicke, Professor of Physics at the University of Warwick]

7. I've been growing up with Hubble since I started working in astronomy so Hubble has become a very close friend of mine and I've been through all the ups and downs that Hubble had and it fell ill and it needed cure and I'm thrilled by the human aspect with that we had to have astronauts going up servicing it and I had the opportunity to meet some of them. Beyond the science there's a very human story of exploration of the Universe involved, which that I find very fascinating and seeing the next big observatory being ready to launch is a very exciting moment in time, so I'm thrilled that I will hopefully have the opportunity to make use of that myself.



04:02

[Narrator]

8. As the astronomers who grew up with Hubble await the launch of the James Webb Space Telescope a key question to ask is — what is left for Hubble? What more does it have to show us?



04:22

[Corinne Charbonnel, Professor of Astrophysics at the University of Geneva]

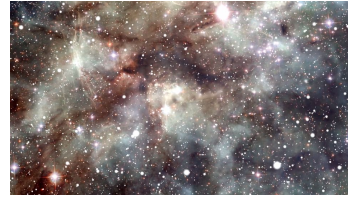
9. We will probe stellar populations in other galaxies and so that will give clues on some mysteries that we have today, and that we'll probe a very large Universe, but not only in space but also in time, and we really



need to look back in time and to have information about was the situation very similar in the very early Universe. For example for the formation of stars, or was it very different, do we have something that is related in terms of star formation that is related to cosmology or does it happen that everywhere in the same way independently of the time, the cosmic time that these stars formed.

[Ken Sembach, STScI director]

I think we're going to learn a lot more about how stars form, and I suspect we're going to learn a lot more about what's happening in the early Universe. Even though that's one of Webb's prime science drivers, you still need the Hubble data for context, and so I think that those are all big areas.



05:27

[Narrator]

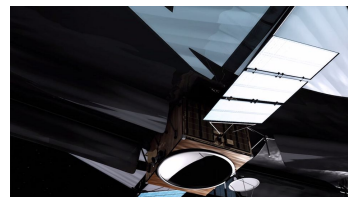
10. The mysteries lurking in the early Universe, and uncovering the very first galaxies that reside there, are areas that will be tackled by the Hubble and Webb teams. A new collaboration of telescopes that will take Hubble into the future with the same huge potential for discovery that we have seen over the last 26 years.



05:53

[Ken Sembach, STScI director]

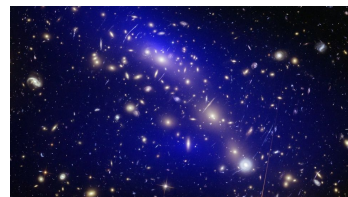
11. *So in the infrared Webb will provide images and information with the kind of clarity that Hubble provides at optical and ultraviolet wavelengths. And I think when you see an astronomical object at one wavelength, you immediately want to know what it looks like in a different colour or a different wavelength and so having both of them together is certainly going to be more powerful than either of them alone.*



06:21

[Narrator]

12. So will Hubble, with the help of James Webb, be able to solve the big mysteries of modern astronomy? The origins of the Universe, the formation of stars, the nature of dark matter and dark energy?



The answer is that nobody knows. And as we have seen in the past it is not just the new answers, but the new, and currently inconceivable, questions thrown up by telescopes such as Hubble that make them revolutionary. And Hubble is still up to the challenge.



07 :00

[Boris Gaensicke, Professor of Physics at the University of Warwick]

13. Well more generally speaking we are entering new territory in many fields of astronomy so we have discovered in the past twenty years that the Universe is filled with dark energy and is actually accelerating in this expansion; we have discovered extrasolar planets; [...] There's a huge range of absolutely novel physics and astronomy that we didn't even know that it existed when Hubble was launched so I think that's one of the big fascinations in astronomy that we simply don't know what the future holds, and in having, having these very powerful observatories both in space at the same time I'm really sure that there will be new discoveries coming along.



[Corinne Charbonnel, Professor of Astrophysics at the University of Geneva]

[...] I think that with these new instruments we will have a lot of surprises that we don't expect now and I think that's really the place, the moment when you will have exciting discoveries.

07:49

[Narrator]

14. There is a lot of work left to do in astronomy and astronomers will continue to work with Hubble to make sense of the Universe. We are ready to be surprised by nature beyond our wildest imaginations.



08:07

[Ken Sembach, STScI director]

15. As a kid you learn these basics, right, that the Universe is unchanging and that the stars are there forever, and that you know, it's more or less a static Universe out there. And when you start working in this field you realise how dynamic it is, how much things change, even how much your understanding changes which is just as remarkable. I think in that sense it's really exciting to be part of something where everyday you come in and you know, the next big discovery is just a few hours away or a few days away, and that's the way it is with Hubble and that's the way it's going to be with Webb.



Ends 08:51