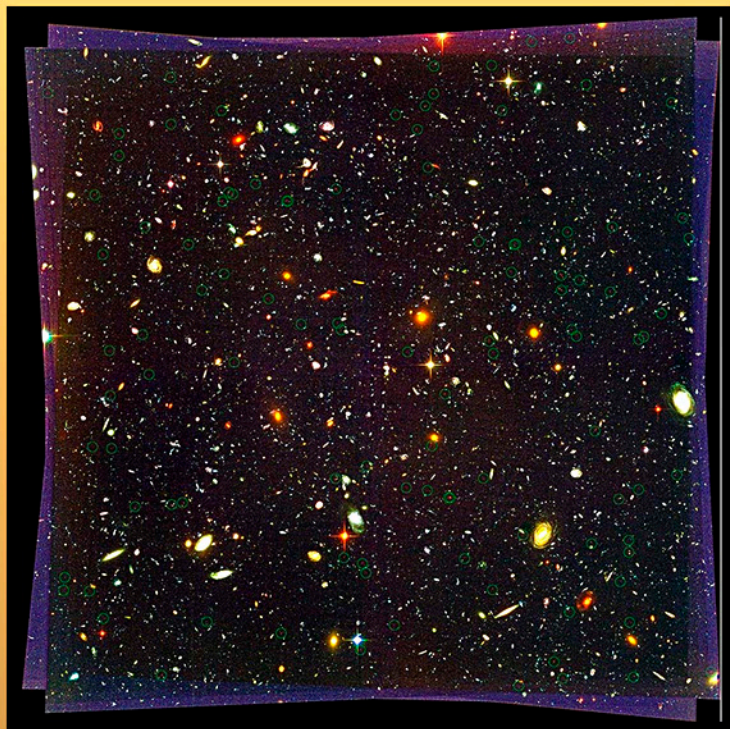


COSMIC DAWN Summary

Richard Ellis
CalTech



Richard Ellis: "Cosmic Dawn" Summary

- The UDF has been a remarkably successful campaign!
- What are we learning about the early Universe, and why is it significant?
- Where do the present teams agree and disagree ... and why?
- Where do we go next with Hubble, and what does this mean for the exploitation of future facilities?

Richard Ellis: "Cosmic Dawn" Summary

The UDF is a big hit!!

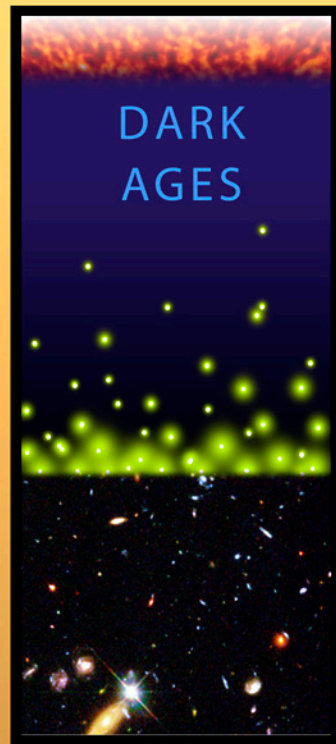
- The deepest image is inspirational, galvanizing public interest as well as that of astronomers.
- The first scientific results have emerged remarkably quickly.
- HUDF illustrates the unique role of deep Hubble data and the merits of publicly available data sets pioneered at STScI.



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What we have learned and why it is so significant

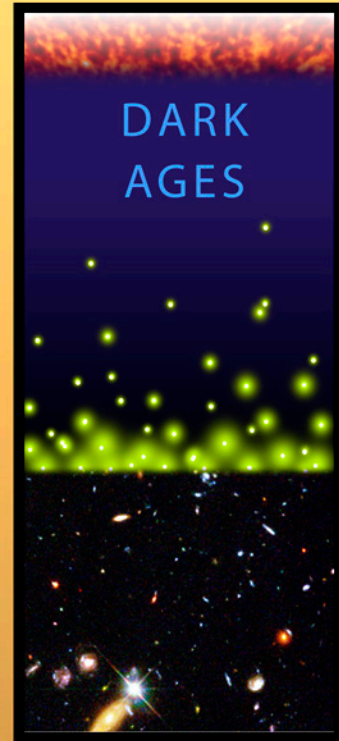
Hubble's optical and near-infrared cameras have determined the abundance of early young galaxies, seen when the Universe was only 600–900 million years old — 95% of the way back to creation — This is an observational first!



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What we have learnt and why it is so significant

- Has Hubble found **the very first sources** switching on after the “dark ages,” when there was only pure hydrogen and helium?
- Are these sources sufficient to be responsible for **“lifting the curtain” and ending the dark ages?**



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THE ISSUES

While the data sets agree,
the devil is in the interpretation!

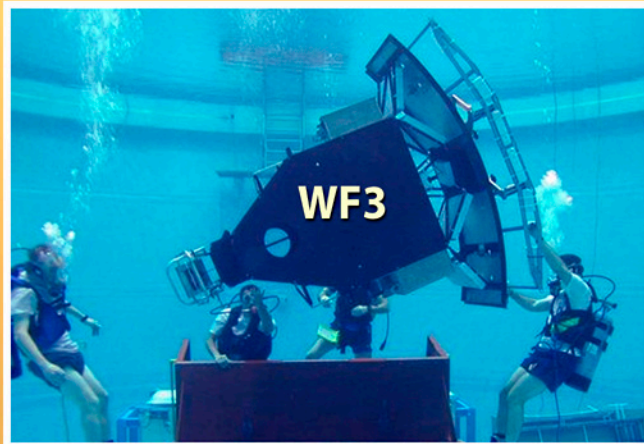
- The UDF is a small field; clustering effects counting in such small areas (Rhoads and Malhotra) — continued surveying is essential.
- The limits to which the sources can reliably be detected will be addressed by further data (Windhorst & Bunker)

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- The question of more distant (and earlier) sources is of crucial importance (Illingworth & Bunker).
- Firm answers to the big questions may require detailed knowledge about the physical conditions of individual sources — how hot? — What composition? (Stiavelli et al.)

**The most effective way to resolve many of the present issues is to explore further back in time
... Are there yet earlier sources?**

HUBBLE'S NEXT STEP



Hubble has demonstrated its capability of taking improved measures of this population and has potential for finding earlier examples.

Reliable census of sources **beyond current limits** will be possible with newly completed infrared WideField Camera 3 (WF3).

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TOWARD THE DETAILED PICTURE

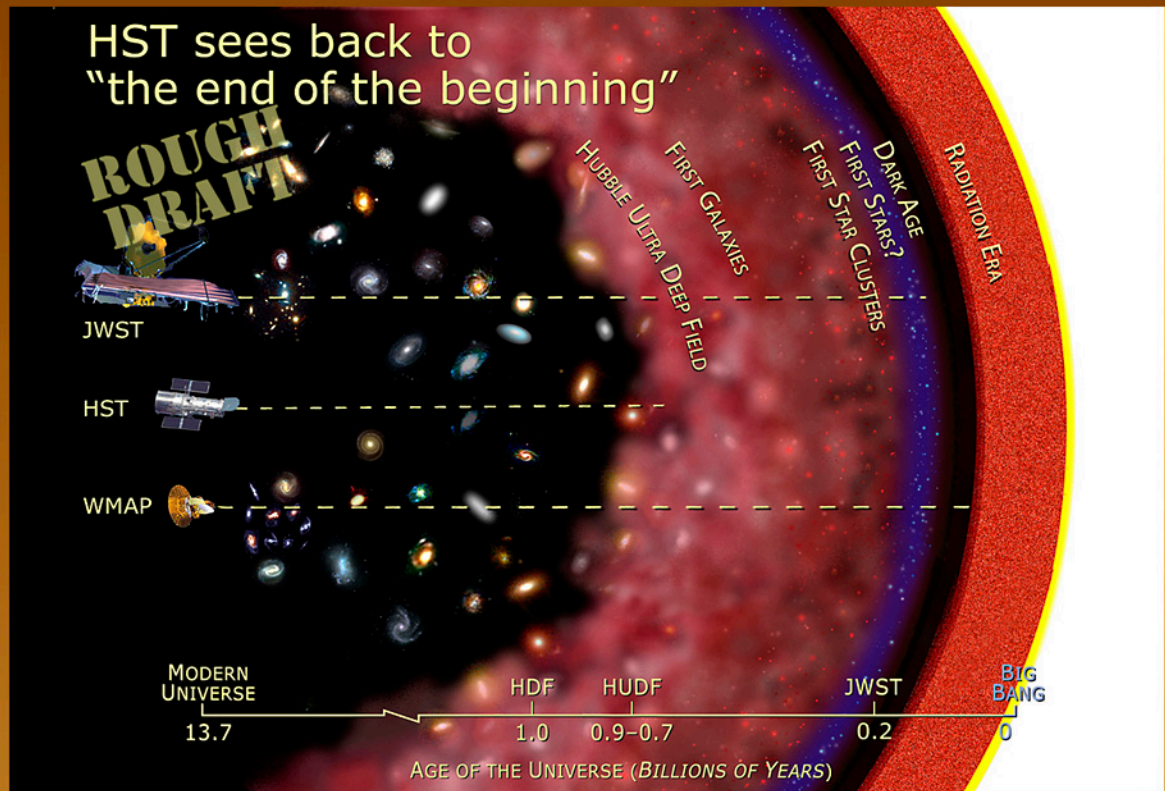


The James Webb Space Telescope will undertake physical studies of such early sources. Further Hubble data will enable us to plan how to use this future facility.

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COSMIC DAWN: EARLY RESULTS FROM THE HUBBLE ULTRA DEEP FIELD

September 23, 2004



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