

GRAPES

(Grism ACS Program for Extragalactic Science)

SPECTRA OF THE ULTRA DEEP FIELD

James Rhoads, Sangeeta Malhotra,
Norbert Pirzkal, Chun Xu, et al.
Space Telescope Science Institute

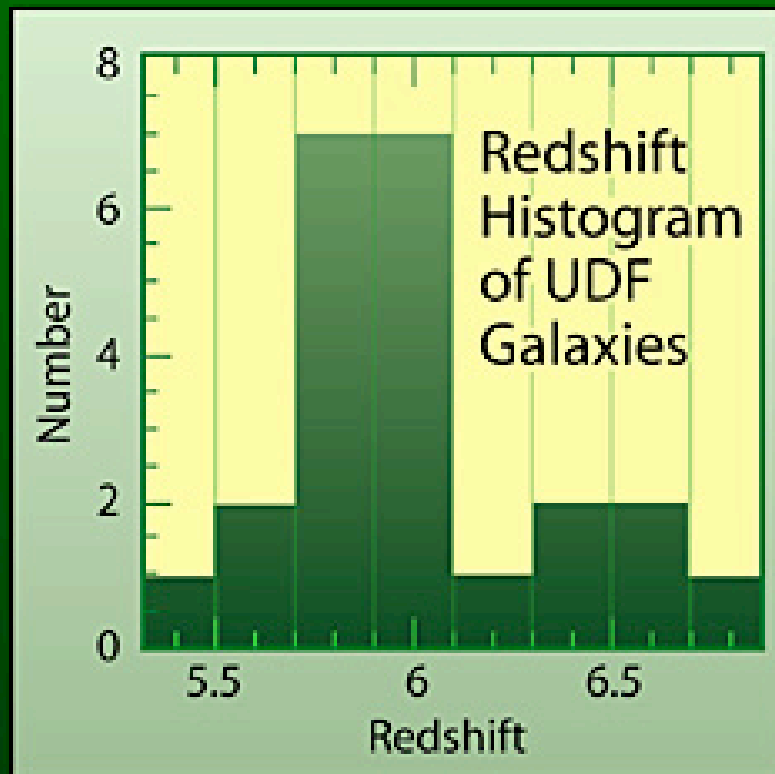
Rhoads, Malhotra, et al.: GRAPES — Spectra of the UDF

GRAPES Spectra of the Ultra Deep Field

- We spread the light of each UDF object into a spectrum, using the Hubble's Advanced Camera for Surveys.
- We confirm that 80% of objects having the colors of $z \sim 6$ galaxies indeed **are** $z \sim 6$ galaxies.
- Some features in the spectrum yield measurements of galaxy distances.
- These measurements are much more precise than estimates derived from galaxy colors alone.

Rhoads, Malhotra, et al.: GRAPES — Spectra of the UDF

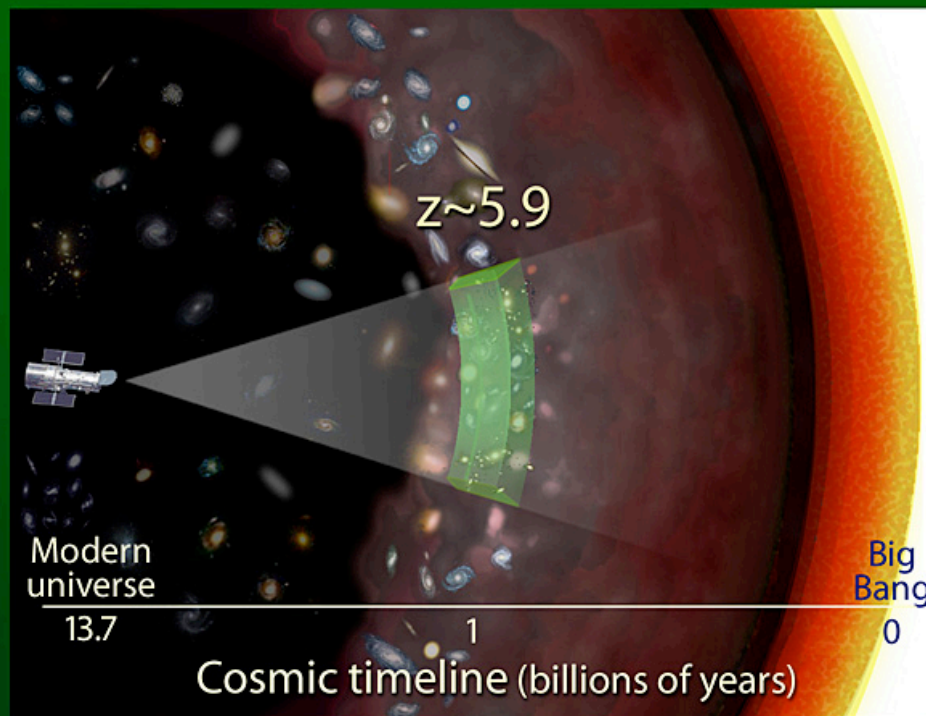
- Distribution of redshifts for galaxies in the Ultra Deep Field.
- The spike at redshift 5.9 shows a sheet in the galaxy distribution.
- The most distant structure of this type yet seen!



Rhoads, Malhotra, et al.: GRAPES — Spectra of the UDF

Geometry of the Redshift Spike

Schematic shows Hubble's view through a sheet of galaxies at redshift 5.9. We see a relatively crowded neighborhood when the universe was just 1 billion years old.

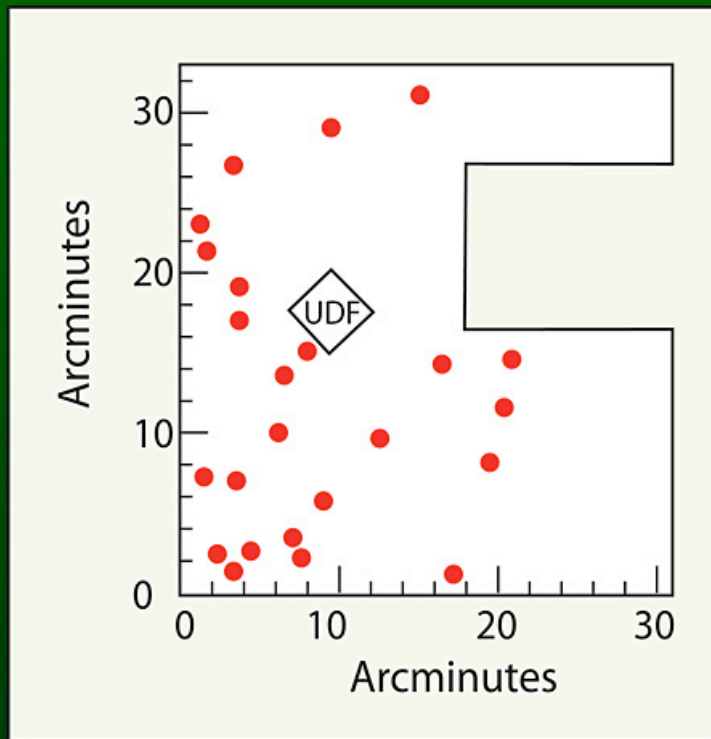


Rhoads, Malhotra, et al.: GRAPES — Spectra of the UDF

A Map of Galaxies in the Redshift Spike

We used the Blanco Telescope at the Cerro Tololo Interamerican Observatory in Chile to identify brighter galaxies at redshift 5.7 to 5.8 in a large region around the UDF.

We see that the spike corresponds to a large sheet of galaxies.



Rhoads, Malhotra, et al.: GRAPES — Spectra of the UDF



COSMIC DAWN: EARLY RESULTS FROM THE HUBBLE ULTRA DEEP FIELD

September 23, 2004

- We obtained spectra of all objects in the UDF.
- Eighty percent of the high-redshift candidates identified by their colors are indeed high-redshift galaxies.
- We obtained distances for these galaxies, and found a spike in the distance distribution at redshift 5.9.
- Ground-based images show that this spike occurs where the UDF line of sight crosses a sheet of galaxies.
- Such concentrations of galaxies and gas mean that reionization will be patchy.

Rhoads, Malhotra, et al.: GRAPES — Spectra of the UDF