GRAPES
(Grism ACS Program for Extragalactic Science)

Spectra of the Ultra Deep Field

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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.

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• 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!

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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.

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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.

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• 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.

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