Hubble Space Telescope

Cycle 16 AR Proposal

Dust Enhancement of the Lyman Alpha Equivalent Width at z ~ 4.5 in the CDF-S

Principal Investigator: Mr. Steven L. Finkelstein

Institution: Arizona State University

Electronic Mail: stevenf@asu.edu

Scientific Category: ISM IN EXTERNAL GALAXIES

Scientific Keywords: DUST, GALAXY FORMATION AND EVOLUTION, HIGH REDSHIFT GALAXIES, RADIATIVE TRANSFER, STELLAR POPULATIONS IN EXTERNAL GALAXIES

Total Budget Amount: $36,133

Abstract

We propose to study high-redshift Lyman alpha emitting galaxies in order to discover the true nature of their large equivalent widths. Lyman alpha galaxies are interesting to study because they are very faint in the continuum but exhibit a very strong emission line, beyond what is expected from normal stellar populations. It has been believed that the large equivalent widths seen in high-redshift galaxies are intrinsic, and are caused by hot stellar photospheres from ongoing star formation. This would indicate that these objects are young, with a primitive composition. It would also indicate that they could be a significant source of reionization photons.

However, there is an alternative scenario for the cause of this large Lyman alpha EW. If the interstellar medium inside one of these galaxies consisted of clumpy dust clouds in a tenuous ionized medium, then continuum photons would penetrate deep into these clouds, while the Lyman alpha photons would be resonantly scattered at the surface. This would result in a much higher escape fraction for Lyman alpha photons than for continuum photons, effectively enhancing the equivalent width. Thus, a galaxy with this ISM and older stars could be made to look like a young, star-forming galaxy on the basis of its Lyman alpha EW.

We will use the GOODS CDF-S treasury data set to measure the continuum colors of Lyman alpha galaxies, and thereby distinguish between these scenarios: If large equivalent widths are due to hot photospheres, the continuum should be blue, while if they are due to dust enhancement, the continuum should be red. The GOODS CDF-S dataset has a limiting magnitude that is 2 magnitudes deeper than our ground-based broad-band dataset. This will reduce the errors on the broad-band colors by up to 75%. To find Lyman alpha galaxies in the CDF-S, we have narrow-band images which will be used for selection of z ~ 4.5 galaxies. By combining our narrow band images with the high quality GOODS data, we will be able to study the cause of the Lyman alpha equivalent width in individual galaxies at high-redshift.

Investigators:

	Investigator	Institution	Country
PI	Mr. Steven L. Finkelstein	Arizona State University	USA/AZ
CoI	Prof. James Rhoads	Arizona State University	USA/AZ
CoI	Prof. Sangeeta Malhotra	Arizona State University	USA/AZ

Number of investigators: 3

Dataset Summary:

Instrument	No. of Datasets	Retrieval Method	Retrieval Plan
ACS	18	FTP	We currently have spinning on disk all v1.0 18 HST-ACS datasets in the GOODS CDF-S.