The HAWK-I Distant Cluster Survey

Chris Lidman[1], M. Huertas-Company[2], R. Sánchez-Janssen[3], A. Rettura[4], G. Wilson[4], A. Muzzin[5], R. Demarco[6], S. Mei[2], W. Couch[7], P. Rosati[3], M. Tanaka[8] and M. West[3]
[1]Australian Astronomical Observatory, [2] Paris Observatory/University of Paris, [3]ESO, [4]University of California Riverside, [5]Yale, [6]Universidad de Conception, [7]Swinburne University of Technology, [8]IPMU

Abstract

Distant galaxy clusters allow us to study the processes that drive galaxy evolution in the densest environments of the Universe. At these distances, near-IR observations are essential, as the rest frame optical is redshifted into the near-IR. However, with one or two exceptions, there is a distinct lack of high-quality imaging data at these wavelengths. To overcome this limitation, we have obtained a uniform set of deep near-IR images of some of the most distant galaxy clusters currently known. We summarize the current status of the survey and present a first look at some of the data.

The Cluster Sample

During 2005 and 2006, the Supernova Cosmology Project (SCP) used the ACS camera on HST to search for Type Ia supernovae in 25 distant galaxy clusters [1]. The observations consisted of multi-epoch i_{775} and z_{850} band images that were taken over the duration of the search.

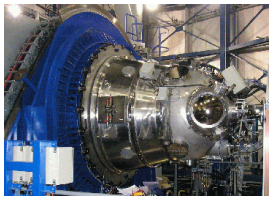
Our HAWK-I sample consists of a subsample of clusters that were targeted by the SCP together with the addition of two other clusters. The redshift range of the clusters is broad (covering 2 Gyr of cosmic time) and each cluster contains between 10 and 100 spectroscopically confirmed cluster members. All of the clusters, except RDCS J1252-2927, were targeted with HAWK-I.

Cluster Name	Redshift	Selection	Comments
RX J0152-1357	0.84	X-ray	Not part of the SCP sample
RCS 2319+0028	0.91	Optical	
XMM J1229+0151	0.98	X-ray	
RCS 0220.9-0333	1.03	Optical	
RCS 2345-3633	1.04	Optical	
XMM J0233-0436	1.22	X-ray	
RDCS J1252-2927	1.23	X-ray	Observed with ISAAC
SpARCS J0035-4312	1.34	Spitzer	Not part of the SCP sample
XMMU J2235.3-2557	1.39	X-ray	
XMM J2215-1738	1.45	X-ray	

HAWK-I

HAWK-I is ESO's wide-field near-IR imager on the VLT. It's wide field-of-view, high throughput and excellent image quality combine to make it one of the most powerful ground–based near-IR images

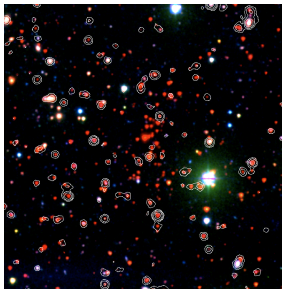
Our program was completed earlier this year. The data are now being processed. An initial inspection of the data shows that the image quality is excellent, with values as low as 0.25 arc seconds in the fully processed images. The image quality is good enough to morphologically classify galaxies, and to look for evidence of major merging, as we will demonstrate with SpARCS J0035-4312, which is the only cluster in the sample lacking deep ACS data.



Above: HAWK-I on the Nasmyth focus of Yepun

SpARCS J0035-4312

SpARCS J0035-4312 was discovered in the Spitzer Adaptation of the Red Sequence Cluster Survey (SpARCS) [2-4]. Based on the cluster red-sequence technique of Gladders and Yee [5], SpARCS extends the redshift limit of this technique to higher redshifts by combining ground based optical and Spitzer [3.6] and [4.5] data. With a redshift of z=1.34, SpARCS J0035-4312 is one of the most distant clusters currently known.

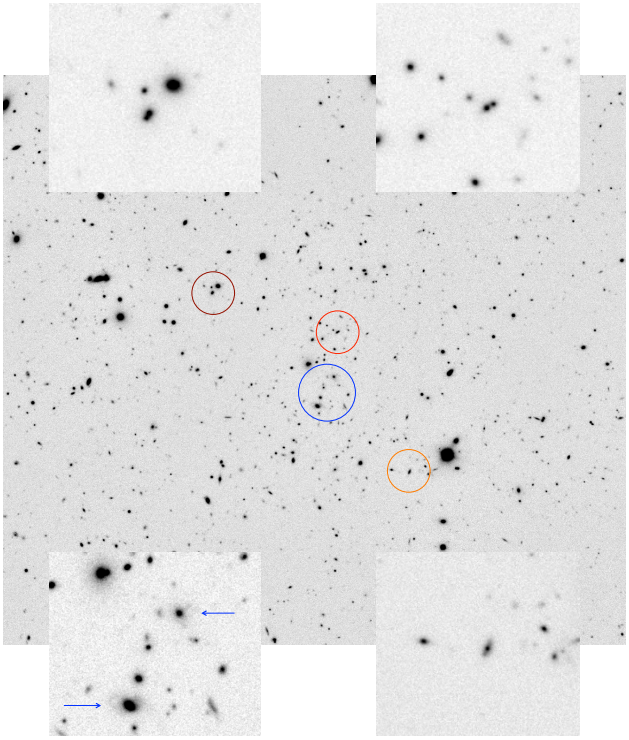


Right: A false-color image combining z, [3.6] and [4.5] pass-bands of the central regions of SpARCS J0035-4312. The MIPS 24 micron contours are also shown.

A First Look at the HAWK-I Data

HAWK-I image of SpARCS J0035-4312. The image spans 200 arc seconds, or 1.7 Mpc at the cluster redshift.

Close galaxy pairs. Several examples can be found throughout the cluster.



Evidence for two major mergers. One merger is detected in the MIPS 24 micron image; the other is not.

An edge-on dusty disk galaxy. This galaxy is significantly redder than the red sequence and is detected in the MIPS 24 micron image.

References and Acknowledgements

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A picture of the author

HCS Web Site : http://hcs.obspm.fr/
SpARCS Web Site: http://www.faculty.ucr.edu/~gillianw/SpARCS/

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