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MS0440+204 and MS0302+1658  
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The cluster of galaxies MS0440+02, originally discovered through its X-ray emission, was part of an optical observational program to search for arcs and arclets in a complete sample of X-ray luminous, medium-distant clusters of galaxies.

Mauna Kea CCD images of MS0440+02 showed a remarkable optical morphology. The core of the cluster contains 6 bright galaxies and numerous fainter ones embedded in a low surface brightness halo. Besides, MS0440+02 is the most spectacular example that we have found of an arc system in a compact condensed cluster, with arcs symmetrically distributed to draw almost perfect circles around the cluster center. Giant arcs are magnified images of distant galaxies, gravitationally distorted by massive foreground clusters. It is of great importance to compare the results of the lensing studies with those derived from X-ray observations, as the two are independent methods of studying the mass distribution. Thus MS0440+02 was the ideal target to obtain temperature measurement with ASCA and good spatial resolution X-ray observations with ROSAT. The X-ray data have been used in conjunction with Hubble Space Telescope observations to put more stringent constraints on the mass estimates. Most of the different wavelength datasets have been reduced and analyzed. Mass determinations have been separately obtained from galaxy virial motions and X-ray profile fitting using the cluster gas temperature as measured by the ASCA satellite. Assuming that the hot gas is in hydrostatic equilibrium and in a spherical potential, we find from the X-ray data a mass distribution profile that is well described by a Beta model. From the multiple images formed by gravitational lensing (HST data) using the modelling of the gravitational lensed arcs, we have derived Beta model. To reconcile the mass estimates we have explored the possibility of having a supercluster surrounding the MOS0440 cluster, that is a model with two isothermal spheres, one embedded inside the other. These results have been published or are in press.

Below we list the papers which were produced during the duration of this Grant and which acknowledge the partial support from NAG 5-2914. We are grateful to NASA who made this research possible.

#### Publications:

X-ray Selected Clusters of Galaxies (Isabella M. Gioia), in "Mapping, Measuring and Modelling the