

Summary of Scientific Results – 2002

One of the goals of the Subaru Telescope involves exploring the Universe further and wider to observe the formation of the first generation of galaxies. This year that goal was realized with observations near the edge of the known Universe. To accompany that feat, astronomers also observed unique stellar and galactic phenomena in areas closer to home.

One of the advantages of the Subaru Telescope is that its large 8.2-meter mirror collects a lot of visible and near-infrared light, which is then directed toward highly sophisticated instruments. The adaptive optics (AO) system is designed to remove atmospheric turbulence from the photon wavefront before it reaches the IRCS or CIAO instruments. The unique talent of AO can be seen in a near-infrared test image of Uranus showing two of moons or satellites and a ring system. Spectrographic observations with AO began this year in January, allowing astronomers to fully appreciate the capabilities of the AO system. Using AO, light can be concentrated and a narrow slit can be used to obtain high wavelength resolution without losing any light. Subaru is one of only two telescopes on Mauna Kea that takes spectroscopic observations with an AO system.

Other discoveries made this year using the high resolution and sensitivity of our telescope included odd-shaped structures in a popular planetary nebulae located a scant 450 light years away. Subaru detected what can only be described as “bullets” and “horns” in the gas and dust surrounding the aging star AFGL 618. This level of detail assists astronomers to understand the complex processes that accompany the aging of a low-mass star similar to our Sun. A bit further away but still relatively close by is the spiral galaxy NGC 4388 found within the Virgo Cluster. Astronomers imaged long filaments of ionized hydrogen gas extending over 100,000 light years from the galaxy; a truly unexpected event. Several hypotheses attempt to explain the presence of the gas, but none fit the pieces of the cosmological puzzle perfectly together. Nevertheless, understanding the origin of the gas will contribute to the larger understanding of how galaxies evolve in the crowded environment of a cluster of galaxies.

The principal benefit of such a large mirror at Subaru is that astronomers can detect very faint light from very far away when galaxies were first evolving. Teams of astronomers have discovered unique traits and behavior to galaxies found when the Universe was in its infancy less than a billion years old. One team observed a high-speed outflow of hydrogen gas associated with a massive burst of star formation, while another team used gravitational lensing of massive cluster galaxies to discover a galaxy at about 780 million years old. Both research groups centered on the goal of catching galaxies in their infancy to understand how they are born and evolve.