Blue Dust in IC 405 Detected by JHU Sounding Rocket

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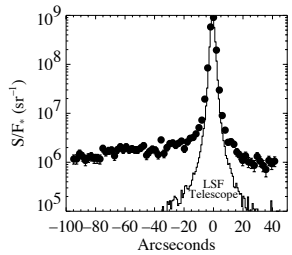
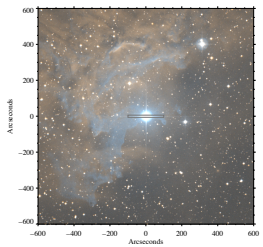
IC 405 Scattered Light: Spatial

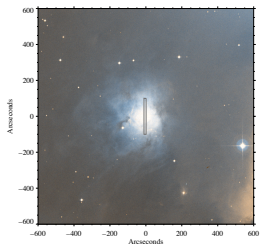


DSS Blue and Red Plate Composites

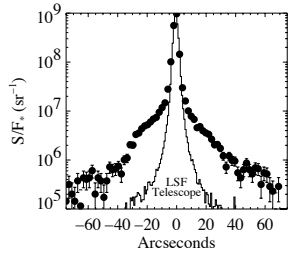
IC 405



NGC 2023

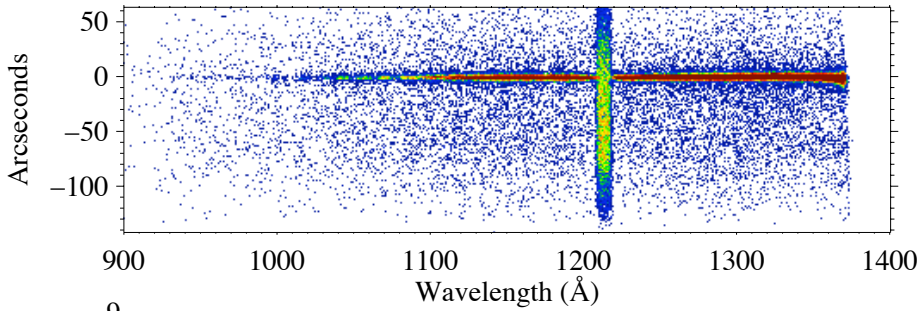


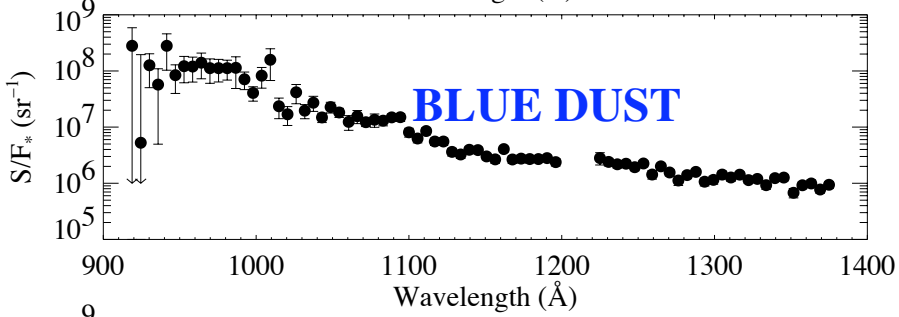
NGC 2023 Scattered Light: Spatial

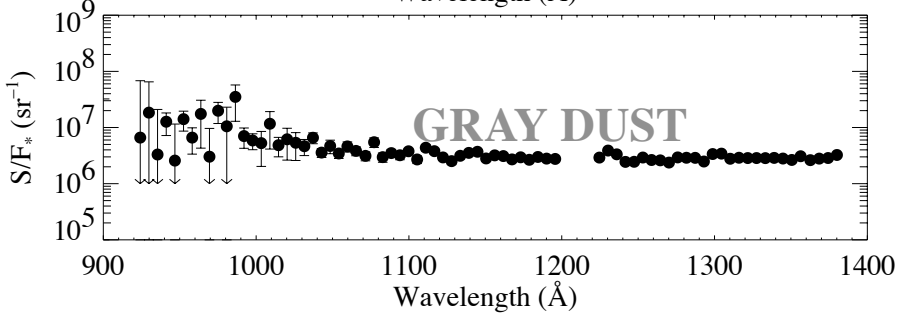


Far-UV Longslit Nebular Spectra and Surface Brightness to Stellar Flux Spectral Ratios

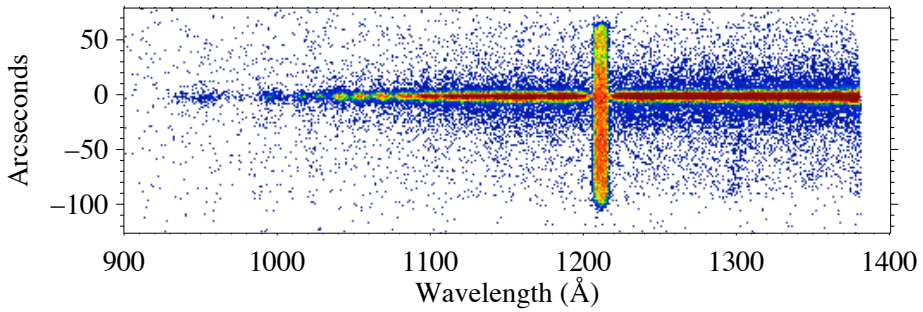
IC 405 – 36.198 UG Launched February 09, 2001 at 21:00 MST from WSMR







NGC 2023 – 36.186 UG Launched February 11, 2000 at 20:27 MST from WSMR



Blue Dust

A recent NASA sounding rocket, flown from White Sands Missile Range in NM, on a mission to observe the reflection nebula IC 405 and its exciting star AE Aur (HD 34078), found an extremely blue dust surface brightness to starlight ratio. In contrast, an observation of NGC 2023, a reflection nebula in Orion, revealed a gray ratio. AE Aur is a runaway star that left the Orion constellation approximately 2.5 million years ago and is now entering a region that is relatively devoid of star formation activity. The central star in NGC 2023 (HD 37903) is still embedded within the the nebula from which it formed. This result is exciting because we have found different dust properties in nebulae with dissimilar star formation histories. This has important implications for the role dust plays in star formation. Dust regulates the far-UV radiation field, which effects the formation and destruction of molecules. Molecules are key coolants in the stellar formation process, providing a means for gas to radiate away excessive gravitational energy released by the collapse of interstellar clouds. In future work, we will seek to correlate the different dust properties with the molecular gas content of these two nebulae.

Figure Descriptions and Credits

The color figures shown at the top and bottom of the middle panel are longslit spectrograms. They are in effect long thin pictures of the nebulae smeared into their component colors by the spectrograph dispersion. The orientations of the slit on the nebulae are overlaid on the Digital Sky Survey two color composites shown at the left. Note how the region around the slit is much bluer in IC 405 than it is in NGC 2023. Within the spectrograms: the vertical stripe at 1216 Å is the geo-coronal Lyman-α line emitted by hydrogen atoms at the top of the earth's atomosphere (it marks the extent of the slit on the detector), the horizontal stripe is the continuous spectrum of the nebula's exciting star, and the diffuse emission surrounding the stellar spectrum is the stellar light scattered by the nebular dust. At the top and bottom left, the variation of the scattered light along the slit is overlaid with the measured line spread function (LSF), showing the measured scattering is indeed much higher than can be attributed to the optics alone. The two graphs in the center of the middle panel are the dust surface brightness to stellar flux ratio. Note the very steep rise, **by two orders of magnitude,** toward shorter wavelengths in IC 405, top center, as compared to NGC 2023, bottom center.

The payload was designed by members of the Johns Hopkins University sounding rocket group under the direction of Professor Paul D. Feldman with funding provided by NASA grant NAG5-5122. Launch services were provided through the NASA Sounding Rocket Operations Contract (NSROC) based at Wallops Island Flight Facility in VA.