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Cometary Spectroscopy and Imaging

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Strategy

The objective of this continuing observational program is to investigate the spectroscopic and morphological characteristics of comets and selected minor planets over a wide range of heliocentric distances as they may suggest or constrain models of cometary processes, their formation environments and evolution. Direct images of all observable comets ($M_v < 22$) and 300-800nm spectra of the brighter ones are obtained (weather permitting) on a monthly basis with a novel CCD spectrograph-camera. The direct images may be used for astrometry, photometry and studies of coma and tail morphology. In some cases, anisotropic dust emission can provide information on the nucleus spin vector. Spectra may provide data on strengths of the principal emissions for comparison of gas/dust ratios of a large sample of comets. Long integrations of minor planets in comet-like and nearby orbits are made to search for faint comae.

Progress and Accomplishments

Direct CCD images and sometimes spectra were obtained (and reported in the indicated IAU Circulars) of Comets Arai (1990B), Austin (1989C1); IAUC 4973, Encke, Gehrels 2, Harrington-Abell (1990m), Helin-Roman-Alu (1989w, 1989y), Holt-Olmstead (1990k), Honda-Mrkos-Padjusakova, Johnson (1990h), Kearns-Kwee, Levy (1990c); IAUC 5098, Lovas 1 (1990p), McKensie-Russell (1989f1), Metcalf-Brewington (1990a), Mueller 2 (1990j), Mueller 3 (1990l), Peters-Hartley (1990d), Russell 4 (1989g1), Shoemaker-Levy 1 (1990o), Shoemaker-Levy 2 (1990p); IAUC 5149, Shoemaker-Levy 3 (1991d); IAUC5183, Skochenko-George (1989e1), Schwassmann-Wachmann 1, Schwassmann-Wachmann 3, Taylor (1990n), Tuttle-Giacobini-Kresak (1989b1), Tsuchiya-Kuichi (1990i), VanBiesbroeck (1989h1), and Wild 4 (1990a); IAUC 4954. 300- 860nm spectra of minor planets 41, 66, 130, 181, 229, 489, 559, 691, 776, 951 and 1301 were also obtained. Deep CCD integrations of 1990 UL₃ showed a tail leading it to be renamed Comet Shoemaker-Levy 2 (1990p). 360-950nm spectra of Comet Austin (1989c1) were obtained simultaneously with 900-1200nm spectra by Tegler *et al.* from which relative band fluxes of the blue and red CN systems have been measured. Continuum band images of Comet Austin were obtained simultaneously with 10 micron images obtained by McFadden *et al.*

Projected Accomplishments

Continued monthly imaging, spectral and astro-metric observations of comets and minor planets with emphasis on mission target objects. An offset guider for the CCD camera/spectrograph will be added to eliminate the apparently random, few arcsec guiding errors in the 1.5 m Catalina Telescope. Analysis of the tails of some 30 comets at large heliocentric distance is underway, and papers on ion tails will be submitted for publication.

Publications

Larson, S.M. (1990) Near-nucleus H_2O^+ structures in comets Brorsen-Metcalf, Okazaki Levy-Rudenko, and Austin. *Workshop on Observations of Recent Comets (1990)*, Ed. W.F. Huebner, J. Rahe, P.A. Wehinger and I. Konno, Southwest Research Institute, San Antonio, TX.

Kim, S.J, A'Hearn, M.F. and Larson, S.M. (1990). Multi-fluorescence: Application to S_2 in Comet IRAS-Araki-Alcock 1983VII, *ICARUS* **87**, 4440-451.

Johnson, J.R., Larson, S.M. and Singer, R.B. (1991). Remote sensing of potential lunar resources: I. Global compositional mapping. Submitted to JGR.