28.07
Dust Formation in Novae

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Dust formation is a process which occurs in many astrophysical environments, yet is not fully understood. We have developed a kinetic approach for grain nucleation based on the suggestions of Donn et al. (1981) who use the Kassel theory of nucleation reactions to estimate the atomic sticking coefficients. This is being applied to carbon-rich novae. Our preliminary calculations show that without some inhibiting factor, the number of nucleation sites is so high that the grains produced are small, a few hundred angstroms in size. Recent infrared and visible light data suggest the presence of grains a few tenths to a few microns in size. We have developed a model in which the temperature fluctuations of the tiny clusters are taken into account. In this approach, the arrival of photons is treated as a Poisson process, while the cooling rate is proportional to the energy of the cluster. A probability distribution for the cluster energy is derived for a given photon flux and the evaporation rate is obtained from it using the Kassel theory. The fluctuating temperature leads to an increased mean evaporation rate which decreases the number of nucleation sites and hence increases grain size.

28.08
Red Supergiant Infrared Shells and the Galactic Metallicity Gradient

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A comparison of IRAS observations of 40 oxygen rich red supergiant field stars and a number of red supergiant members in a set of galactic OB star associations suggests several significant trends. First, there is a gradual transition between the occurrence of chromospheres and circumstellar dust. This transition occurs at warmer spectral types (K5 II) among non- or weakly-pulsating supergiants, than for giants (around M5, separating Miras from non-pulsators). This argues that a quasi-stationary, density sensitive process, such as molecular catastrophes, can help create the circumstellar dust in the supergiants.

Second, we have discovered substantial amounts of 60μm emitting material extending several arc-minutes around several of these sources, intrinsic to the stars and not part of the general "circus" background. Simulations using standard grain properties (Q, of Draine and Lee) suggest the circumstellar shell should appear far more extended in the 60 μm band than in the 12 or 25 μm IRAS bands. Point Source Catalog fluxes may be slightly underestimated in such cases. The angular extent of the far infrared shell may also be related to distance and the details of the pressure interface with the ambient interstellar medium.

Third, there is an indication that this extended circumstellar debris, as well as the strength of the 10μm silicate emission, is more pronounced around red supergiants located nearer to the galactic center than the Sun, compared with those farther away. These latter results are consistent with the general galactic metal abundance gradient and metallicity-enhanced mass loss.

28.09
Heating by PAH Molecules or Small Grains

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Large molecules such as polycyclic aromatic hydrocarbon (PAH) molecules have been proposed as the origin of infrared emission features seen in the spectra of many objects. We calculate the contribution to heating from photoionization of PAH molecules and photodetachment of PAH^- molecular ions. This heating is greater than the standard grain heating given by Draine (1978) for abundances of PAH molecules relative to hydrogen larger then 10^-7. We also investigate the enhancement to the standard grain heating resulting from extending the grain size distribution to very small grains.

28.10
Ultraviolet Stellar Polarimetry from the Solar Maximum Mission Satellite

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In August 1980, the Ultraviolet Spectrometer and Polarimeter experiment on the Solar Maximum Mission satellite attempted to measure polarization in the ultraviolet at 1558.7 Å (3 Å bandpass) on two B stars, chosen because they are bright in the ultraviolet and because their positions in the sky were conveniently close to the Sun at that time. The two stars were Alpha Leonis, spectral type B7V, for which no visible polarization has apparently been observed and little would be expected, and Rho Leonis, spectral type B1V, for which polarization equal to 0.1% per cent in the visible has been observed (listing by D. S. Mathewson and V. L. Ford 1970, Mem. Roy. Astr. Soc. 74, 139). The measurement technique involved analyzing the effect of a rotating quarter-wave plate on the observed signal. No evidence for ultraviolet polarization in the two stars was obtained; the upper limits were set by the observed count rates and are fairly high compared to commonly observed levels in visible stellar polarimetry. The 3-sigma upper limits are 3 per cent for Alpha Leonis and 7 per cent for Rho Leonis.

28.11
The Diffuse Ultraviolet Background and Interstellar Dust

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We present a preliminary analysis of spectra of the diffuse ultraviolet background interspersed with a model of dust scattering of starlight. The spectra cover the wavelength range 1390 to 1850 Å with a resolution of ~ 13 Å and were taken with the Berkeley spectrometer of the Ultraviolet Experiment which flew aboard STS 61-C in January of 1986. A plane-parallel model of a galaxy with exponentially distributed stars and dust is used to constrain the dust albedo and scattering phase function. Our preliminary results suggest that the dust albedo is ~ 0.2 and that the scattering is relatively isotropic. This research is supported by NASA Contract NAS5-20598.

28.12
Interstellar Extinction in Trumpler 37. Infrared Results

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Anomalous far-ultraviolet extinction has been reported in the lines of sight of several stars in the young open cluster Trumpler 37 (Clayton and Fitzpatrick, 1987). In this work, near infrared observations of the same sample are presented and analysed. With the exception of two stars, E(V-K) vs. E(B-V) for the rest of the sample correlates very well, with a value of R (total to selective abs.) of 2.95 ± .1, which is in good agreement with generally accepted values. The two stars which deviate from this extinction law are located in the extreme periphery of the cluster. The stars that deviate from the general law would be consistent with a different reddening model. This could be consistent with other determinations of the far-ultraviolet extinction in regions of abnormal reddening.

REFERENCE