SMALL MOLECULAR CLOUDS TOWARD THE GALACTIC CENTRE

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Wide-field near-infrared images of a region near the centre of the Galaxy reveal a wealth of stars superimposed on wide-scale diffuse emission. Projected against this emission are many irregularly shaped patches of obscuration which I identify as small molecular clouds. The smallest of these, if near the Galactic Centre itself, are less than 1 pc in diameter. The overall appearance is very similar to that of the Milky Way as seen on a moonless night. Some quantitative results on the diffuse emission and on the molecular clouds are presented.

ON THE ORIGIN OF THE RADIAL ORBIT INSTABILITY

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Spherical systems made up of stars moving on very elongated loop orbits suffer the radial orbit instability that turns them into elongated, bar-like, systems. We show here that loop orbits tend to erase, rather than to reinforce, any incipient bar-like perturbation to a central field, so that the origin of the instability lies in their transformation into box orbits, that bound the motion of the stars to the neighborhood of the bar, and to the containement ever closer to the bar of the box orbits as the bar perturbation increases. For very small angular momenta the transformation of loop into box orbits takes place even for bar perturbation less than 0.00004 of the central field. This result is interesting because it has been suggested that this mechanism is only possible for large values of the perturbation. Stochastic orbits are shown to appear even for small values of the perturbation (less than 0.06 of the central field), and they also contribute to the bar reinforcement.

THE STELLAR CONTENT OF THE OB ASSOCIATION LH 47 IN THE LMC

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The OB association LH 47 in the LMC is embedded in the giant ringlike H II region N44. A bright extended X-ray source is also related with this OB/H II complex. A SNR origin suggested for the extended X-rays appears at variance with the thermal nature of the radiosources contained in N44 (Milne et al. 1980, MNRAS, 191, 469). A comparison of the optical Hα photograph with the X-ray contours (Wang & Helfand 1991, ApJ, 373, 497), and with the radiocontinuum maps of the region shows that the highest X-ray contour happens in the gas poor region inside the giant ring, while the radiosources coincide with the bright gas rich H II regions in the western border of the ring.

In order to evaluate properly a possible stellar wind contribution to the X-rays, we have studied the stellar content of LH 47, obtaining CCD images and spectral types of the member stars. Our observations disclose a pattern of sequential star formation in the sense that the brightest stars located inside the giant ring are early B supergiants, presumably older than the stars embedded in the bright H II regions, which we find to be early O-type. Matching our observed H-R diagram with numerical evolutionary tracks of massive stars indicates that the stars inside the giant ring are less massive than about 25 $M_\odot$, while the stars embedded in the bright H II regions bordering the ring range up to 60 $M_\odot$. Our results imply that the stellar winds contribute negligibly to the X-rays, which may originate from a SNR left by the explosion of a star more massive than 25 $M_\odot$, with non-existent or weak nonthermal radiocounterpart.

ENCOUNTERS WITH GIANT INTERSTELLAR CLOUDS AND MASS EXTINCTIONS

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Galactic orbits of the Sun and of several nearby giant molecular clouds (GMC's) and OB stellar associations were calculated backwards in time. It was found that the Sun passed near two of them, Ori OB1 and Mon OB1, around 15 My and 38 My ago in approximate coincidence with the date

of the Miocene and Eocene mass extinctions. This supports the hypothesis that the encounters with GMC's were the triggering factor of comet falls that led to catastrophic extinctions of species. Besides, the trajectories of the Sun and Mon OB1 indicate that they travelled together for ~ 30 My, and the vertical vibrations of both about the galactic plane determined the Sun's passages through the cloud corresponding to the Cretaceous and Eocene extinctions. Furthermore, it is suggested that the Sun was attached, for 200 My, to the Mon OB1 Giant Cloud and that the Z-vibration about each other explains the extinction cycle of 25 My.

OXYGEN ABUNDANCES IN THE LMC

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Freitas Pacheco et al. (1993, A&A, in press) have studied a sample of type I planetary nebulae in the LMC. From the derived S/O and Ar/O ratios, a relative contribution to chemical enrichment due to type II and type I supernovae was estimated as

$$r = \frac{n_{SNII}}{n_{SNI} + n_{SNII}} = 0.62$$

where n_{SNI}, n_{SNII} are the number of supernovae of types I and II. We recall that in our Galaxy r = 0.80 at [Fe/H] ~ 0.0 (Freitas Pacheco 1993, ApJ, in press).

A plot of ϵ(O) versus ϵ(Fe) for supergiants analysed by (Juettner et al.; Spite & Spite 1992 in New Aspects of Magellanic Clouds Research, ed. G. Klare, Springer, in press) shows a good agreement with the prediction derived from planetary nebulae data in the metallicity range $-0.7 <$ [Fe/H] < -0.1.

For the Galaxy the r value could be estimated in the metallicity range $-1.0 <$ [Fe/H] $< +0.2$ using stellar data by Barbuy & Erdelyi-Mendes (1989, A&A, 214, 239) and planetary nebulae data by Freitas Pacheco et al. (1993).

Conclusions: (1) In a similar range of metallicity, the relative contribution of type Ia supernovae in the LMC is about twice that of our Galaxy. (2) In the same metallicity range, the enrichment in the Large Cloud is consistent with a constant r, while in the Galaxy we observe a decrease in the SNII/SNII ratio. This difference in behaviour may suggest that the IMF has been constant in the LMC in this metallicity interval whereas in our Galaxy the IMF could be enhanced in massive stars in the past.

PHYSICAL CONDITIONS IN H II REGIONS OF THE SMALL MAGELLANIC CLOUD AND THE PREGALACTIC HELIUM ABUNDANCE

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We present long slit spectroscopy in the 3700–7400 A range for NGC 346, NGC 456, NGC 602, N26, N63, N81, and N88 in the SMC. The observations were gathered with the 4-m telescope at CTIO. From these observations we determine the physical conditions and the chemical composition for these objects. By combining their abundances with those of M17 we determine the primordial helium abundance.

THE NEUTRAL PHASES IN THE LOCAL INTERSTELLAR MEDIUM AT $|b| \geq 10°$ AND LOW VELOCITIES

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Our study is based on the atlases of 21-cm profiles by Heiles & Habing (1974) and Colomb, Pöppel, & Heiles (1981) complemented with other data. We separated both neutral phases by fitting a broad Gaussian curve (velocity dispersion $\sigma \sim 10-14$ km s^{-1}) to the profiles and studying the peaks of the residual profiles. We also considered Lindblad's (1967) feature A of cool gas.

For $|b| \leq 40°$ the warm neutral medium (WNM) is very inhomogeneous with a trend for stratification in layers parallel to the galactic plane. The velocity V corresponds to a differential rotation with a nodal deviation. For $|b| > 40°$ V is negative.

The cold neutral medium (CNM) is generally defined by one component of $\sigma \sim 3-4$ km s^{-1}. Six maps were computed showing the distributions of column densities and velocities. The sampling is ~1 sq. degr. The CNM is concentrated at $|b| <$ 30° with kinematics consistent with an expansion. Olano's (1982) shell models fit the mean V at most values of ℓ. However, the data are not sensitive to the *shape* of the shell. We suggest the presence of additional *rolling* motions. Most of the CNM appears correlated with the large molecular complexes and dark clouds belonging to the Gould belt. For $|b|$