5.06

A 1 kpc LMC Supershell H II Region Complex Engulfing SN 1987A

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We present imagery of an unusually large, ≈ 1 kpc, H II region complex in the LMC showing; in optical narrow bandpass imagery taken in the light of [O III], λ 5007 Å; emission engulfing 30 Doradus and significant portions of Shapley's Constellation II. Similar imagery acquired in the optical continuum at 4215 A reveals a 1.5 x 2.0 kpc Dust Ring structure larger than Supershell LMC4 around Shapley's Constellation III. This Dust Ring, which encloses most of the diffuse [O III] emission, delineates the periphery of a supershell structure encompassing at least 830 OB stars with $M_v$ brighter than -4.2. Simple theoretical modelling suggests that the EUV radiation from these massive stars ionize the H II region complex, while their winds have served as the driving mechanism for the expansion of the Dust Ring supershell, triggering the recent star formation activity in 30 Doradus. The implications for SN 1987A, which appears to have occurred inside this large ionized gas complex, and ambient interstellar environment of SN 1987A, are discussed.

5.07

Confirmation of Interstellar HNO in the Galactic Center

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The $J_{KK} = 2_{02} - 1_{01}$ transition of nitroxyl has been detected in emission toward the direction of Sgr B2 and represents the second (i.e., confirming) transition reported for this Galactic center source. This result was achieved using a combination of 3-mm observations of the $1_{01} - 0_{00}$ transition with the BIMA array to determine the best HNO position and subsequent 2-mm spectral line observations of the $2_{02} - 1_{01}$ transition with the FCRAO 14-m telescope. Clumps of emission were observed that would have been encompassed by the beam of the NRAO 11-m telescope which was employed in the discovery of HNO at 3 mm (Ulich, Hollis, and Snyder 1977, Ap. J. Letters, **217**, L105); these clumps likely account for the original low abundance estimates which assumed the source had filled the beam. Thus, the new observations are consistent with the formation of interstellar HNO by gas-phase ion-molecule chemistry. Recent studies have shown that NO is a rather common and abundant constituent of dense clouds, and since HNO is part of the chemical network involving NO, it would be surprising if HNO were not also prevalent in the interstellar medium. The rarity of N-O bonded interstellar molecules must be regarded as one of the outstanding problems of interstellar chemistry and our positive results for HNO should provide encouragement to those who would conduct sensitive searches for similarly bonded species.

5.08

NO in Dense Molecular Clouds

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A survey has been conducted for the J = 3/2 → 1/2 rotational transitions of NO at 150.2 and 150.5 GHz towards dense molecular clouds, using the FCRAO 14 m telescope. The molecule has a $^2\pi$ ground state, and thus its spectra consist of both λ doubling and hyperfine components. The species has been newly detected towards several star-forming regions, including Orion-KL, SgrB2N, W33, W51 and DR21, as well as towards the dark cloud L134N. Column densities for NO towards the warmer sources are NL ~ $10^{15}$ - $10^{16}$ $cm^{-2}$, corresponding to fractional abundances of $f$ ~ $10^{-8}$. Towards the cold cloud L134N, the column density is estimated to be ~ 5 x $10^{14}$ $cm^{-2}$, or a fractional abundance of 6 x $10^{-8}$. These fractional abundances are in reasonable agreement with predictions of low temperature ion-molecule chemistry.

N-O bonds were thought to be uncommon in interstellar chemistry. The widespread abundance of NO evidenced by these observations suggests that the N-O bond is far more prevalent than previously considered.

5.09

Measurement of Dielectronic Recombination in C IV in an External Electric Field

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To infer the physical conditions in low density sources such as coronal gas, one must know the rates of the relevant atomic processes. In particular, relevant recombination rates needed for ionization balance calculations are not precisely known. In the case of the solar transition region, they are dominated by dielectronic recombination (DR). Recent theoretical calculations predict that electric fields of a few volts per centimeter in the region where DR occurs can affect the DR cross sections over the values predicted by the Burgess General Formula by factors of 2 to 6. The cross section for DR in C IV, which results in the formation of states in C III with n in the range 15 to 41 and emission of satellites of the λ1550 Å (2s $^2S$ - 2p $^2P^o$) transition, has been measured for an external electric field of 12 V/cm. An inclined colliding electron-ion beams method is used. The final products of the DR process, a stabilizing photon and a recombined ion, are detected in delayed coincidence. Results will be presented and compared to the relevant theories. Future DR measurements will be made as a function of the external field.

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5.10

Modifications to the Relation between the Magnetic Field and Weak Zeeman Features in the Spectra of Astrophysical Masers

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W. D. Watson (Univ. of Illinois)

We focus upon the circularly polarised, spectral features that occur in the radiation of astrophysical masers in a magnetic field for which the Zeeman splitting is much smaller than the spectral line breadth, as is expected for $H_2O$, SiO, $CH_3OH$, and perhaps other masers. Previously unrecognised, intensity dependent effects are incorporated into the calculations. When an astrophysical maser is radiatively saturated, and its rate for stimulated emission is within a few orders-of-magnitude of the Zeeman frequency (conditions considered likely for many masers), the circular polarisation found here is quite different from that given by the standard treatment for polarised Zeeman spectra. As a result, there is increased uncertainty in the quantitative understanding of the circularly polarised features of water masers which have recently been interpreted to yield the strongest magnetic fields yet detected in star-forming regions.