4. Studies of the Interstellar Medium Near the Sun

The local interstellar medium was the subject of a meeting held in Madison Wisconsin in June 1984. Much of the discussion centered around the structure of the local interstellar medium (LISM). Results presented at the meeting included observations of the very local interstellar medium within a parsec of the sun probed by spacecraft using backscattered solar radiation (38.131.240, 38.131.241). The diffuse warm gas in the LISM has been explored by a variety of means including various UV and optical absorption lines (38.131.243), chromospheric Lyman α (38.131.245), Mg I and Mg II (38.131.246, 38.131.247, 38.131.248, 38.131.249, 39.131.004), H_α emission (38.131.254) and Na (38.131.255, 38.131.256, 38.131.257). Other probes of the diffuse gas come from hot DA dwarfs (38.131.253), EUV and continuum absorption (38.131.263), observations of β Canis Majoris (38.131.250), and HI and radiocontinuum observations (38.131.273). The surprising existence of a cold component is inferred from CO observations (38.131.267) and possibly from extinction maps (38.131.258, 38.131.260, 38.131.266). The hot component is seen by means of soft X-rays (38.131.265, 38.131.280), Fe XIV (38.131.264), and OIV lines (38.131.262). An observational overview was presented by York and Frisch (38.131.244) and Cowie presented a theoretical model of the LISM as a supernova remnant (38.131.279).

One of the new results regarding the structure and composition of the LISM this triennium has been that of the clear identification of a cold component seen in both molecular line emission and infrared continuum detected by *IRAS*. The discovery of the infrared 'cirrus' (37.133.021) and the high latitude molecular clouds (HLCs; 38.131.021) was followed by work showing that the two are intimately related (42.131.049), and that the distances to them puts one cloud clearly within the local hot interstellar cavity (42.131.051), and the remainder at distances of about 100 pc (42.131.161). Other studies give the properties of the HLCs, and show that the Sun is about 30 pc above the galactic midplane defined by the clouds (40.155.015, 40.131.291, 40.131.263). Keto and Myers made an independent study of the southern hemisphere HLCs (41.131.276), and Magnani *et al.* estimated the completeness of the surveys (41.131.104, 41.131.391). Other reviews of the cirrus were done by Gautier (41.131.348), and de Vries (42.131.345); southern hemisphere cirrus was also studied (42.131.063).

Other work on the local dark cloud and molecular cloud components included two new large scale surveys of obscuring material (41.131.022, 41.131.390, 42.155.092). CO surveys have shown that half of the emission from the Cygnus Rift can be decomposed into 10 molecular clouds at distances of 200–2300 pc (40.155.049), and that an extended complex of molecular clouds close to the Sun can be linked to the Aquila Rift, ρ Ophiuchus, and Gould's Belt (37.131.321).

Work on the warmer components of the LISM examined the vertical distribution and extent of the local HI halo (41.131.103), and the source of ionization for the warm local gas. (42.131.173). The warm LISM was probed by a variety of optical and UV absorption line studies, some using high resolution spectroscopy (42.131.352, 42.131.353), Ca II (42.131.157), Mg I (42.131.360), Mg II (42.131.068, 42.131.348), CIV and Si IV (42.131.359), as well as the hot gas sampled by Fe X (37.131.228), and Fe XIV (37.131.322).

An already frequently cited work by Paresce gives a local N(HI) map from *EUV* observations of local stars that clearly shows the low density hole in which the Sun is embedded (38.131.007). Both Soviet and American space probes as well as European rocket flights have sent back data allowing the analysis of the heliospheric bow shock caused by the LISM (37.131.318, 38.131.226, 40.131.154). UV, HI, and soft X-ray data were analyzed to constrain the nature and location of the hot bubble (39.131.119, 42.131.346, 42.131.349). Theoretical investigations suggested an origin for the hot gas (38.131.002, 42.131.355) and examined absorption line mechanisms to constrain the relationship of HI to HII in the bubble (40.131.154). Although not necessarily related to the bubble, one work suggested that some of the high velocity clouds are less than 150 pc from the Sun (38.131.079).

Finally, an important review of galactic constants by Kerr and Lynden-Bell (42.155.028) provided the basis for the revision of the rotation constants recommended by Commission 33 at the previous IAU.

5. Stellar Studies of the Overall Galactic Structure

During the triennium, there have been relevant symposia on "Luminous Stars and Associations in Galaxies" (41.012.079) and "Star Forming Regions" (Peimbert and Jugaku, 1987). The first *IRAS* conference "Light on Dark Matter" was held in Noordwijk (41.012.080) and the second conference on "Faint Blue Stars" took place in Tucson during June 1987. A meeting on "Stellar Populations" (42.012.082) was held at in Baltimore, May 1986.

The initial mass function (IMF) for luminous stars was discussed by Humphreys and McElroy (38.155.041) and by Garmany (40.155.067, 41.155.119). The issue was reviewed by Scalo (41.155.121), who found no convincing

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evidence of systematic variations of the IMF over the Galaxy. Oda (39.155.071) constructed a model distribution of stellar radiation accounting for the galactic light in the B and V bands. Van der Kruit (41.155.032) analysed the surface brightness of the galactic background in terms of models of stellar distribution.

Francois (41.155.047) discussed the chemical evolution of the Galaxy on the basis of light-metal abundances relative to iron. Gilmore and Wyse (42.155.005) showed that consideration of the chemical properties of the thick-disk population of the Galaxy results in a self-consistent model for galactic chemical evolution. Clayton (39.155.076) studied models of chemical evolution with star formation rate proportional to the square of the mass of gas. Lacey and Fall (39.155.088) presented models with radial inflows as well as infall from outside the Galaxy. Rana and Wilkinson (41.155.008, 41.155.009) developed a model of chemical evolution showing that the star formation rate is correlated with the surface density of molecular hydrogen and has remained practically constant over the lifetime of the disk. Guesten (39.155.118, 41.155.051) has reviewed the framework of chemical evolution models and has given some special solutions. Giridhar (41.155.117) used 23 Cepheids to analyse chemical inhomogeneities. A scenario involving supernova-induced star formation is invoked. Olive *et al.* (1987) identified constraints on the history of the galactic star formation rate, and found that reliable predictions of stellar and supernova nucleosynthesis are required for optimal use of the methods.

Bahcall and Casertano (42.155.033) reanalysed Eggen's proper-motion and radial-velocity data for high transverse velocities. Bahcall *et al.* (40.155.086) discussed the 12 Basel fields that are situated above $b = 20°$. Observations require the presence of a thin as well as of a thick disk. The latter may satisfy the model of Bahcall and Soneira (37.155.078) as well as that of Gilmore (37.155.016).

Tritton and Morton (38.155.008, 41.155.083) made an exhaustive survey down to $B = 20$ in a field at $l = 36°.5$, $b = -51°.1$. Comparisons with the Bahcall-Soneira model revealed considerable discrepancies. Gilmore *et al.* (39.155.062) derived structural parameters of the galactic spheroid from about 28,000 stars in 17 sq. deg. towards $l = 37°, b = -51°$. Bahcall and Ratnatunga (39.155.063) found these results in good agreement with the Bahcall-Soneira standard model of the Galaxy. Inante (41.155.066) studied stars near the south galactic pole down to $J = 22$. The data agree well with the model of Bahcall and Soneira; they are not consistent with the Gilmore-Reid normalisation of the thick disk component, although they do not rule it out.

From the metallicity distribution perpendicular to the plane to distances of the order of 2 kpc, Gilmore and Wyse (40.155.023) divided the stars into components with quite different spatial density distributions. Sandage (1987) and Sandage and Fouts (1987) used star counts and radial velocities to derive density ratios of 1:0.11:0.005 for the thin disk, the thick disk, and the halo. Friel and Cudworth (41.155.088), from photometry in two high-latitude fields, find good agreement with the Bahcall and Soneira model, although they do not find as many blue stars.

Whitford (39.155.103) reported a considerable spread of metallicity among bulge giants, the dominating component being super metal rich. Drilling (42.155.103) concluded that extreme helium stars and cool, hydrogen-deficient stars belong to the bulge population. Habing *et al.* (40.155.051) reported more than 2500 *IRAS* stars with flux densities above 1 Jy at 12 μm. According to Habing (41.155.122), the faintest and reddest of the *IRAS* sources show the bulge of the Galaxy. Feast (41.155.076, 41.155.123) suggested that the majority of the *IRAS* sources in the bulge are Mira variables. Frogel (41.155.124) found that the M giants of the bulge have significantly different colours and luminosities than the solar neighbourhood giants. Feast (41.155.123), Feast and Whitelock (preprint), and Feast and Spencer Jones (preprint) identified the majority of *IRAS* sources in the bulge with Mira variables.

Henry, DePoy and Becklin (38.155.047) identified, from a deep CCD image, the galactic center non-thermal radio source with IRS 16. A visual extinction of 38 magnitudes was extrapolated from the infrared measurements of IRS 14. Sandqvist (preprint) demonstrated the great resolving power of lunar occultation observations of the galactic centre. Adams *et al.* (preprint) resolved IRS 16 into 3 sources. Winnberg *et al.* (39.155.102) found 33 OH/IR stars strongly concentrated towards Sgr A West. Shklovskij (39.155.081) explained a number of features of the galactic centre by a permanent star formation process, while Maddox (39.155.092) concluded from the measurements of the size of the galactic core that it contains a black hole. Lo *et al.* (39.155.093) found from *VLBI* measurements an upper limit of 20 *AU* to the diameter of Sgr A, also revealing an elongated structure at 3.6 cm. Crawford *et al.* (39.155.143) studied the mass distribution from spectroscopic measurements in the central 10 pc of the Galaxy. Data are consistent with a large point mass. Serabyn and Lacy (39.155.149) observed [*NeII*] emission from Sgr A West and found a mass distribution suggestive of a black hole.

Tobin (41.114.017 and preprint) analysed arguments concerning the nature of faint high-latitude B stars and suggested relevant observations. Carney (38.155.076) discussed stellar systems beyond 25 kpc. Saha (39.155.078) studied the space density of RR Lyrae stars out to 33 kpc from the galactic centre. Ratnatunga and Bahcall (40.155.033) predicted the field star densities towards some globular star clusters and local group galaxies as a guide for planning ground-based and *HST* observations of objects at intermediate and high latitudes.

Forward Look: The chemical evolution of the galactic disk has received much attention but no single, convincing model has yet emerged. One would wish for more reliable data pertaining to galactic gradients, the IMF, and other observable features which might form the basis for a unique model. The thick disk has been confirmed by several, independent observations. Its structure and its dynamical properties will be subject of continuing discussions. The precise nature of objects near the galactic centre is still a controversial topic, on which new observations are needed. Observations planned for the Hubble Space Telescope promise considerable advances in all aspects of stellar studies in our Galaxy.

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6. Large-Scale Aspects of the Distribution of Interstellar Matter

6.1 General

The previous report on structure and dynamics of the galactic system was given by Wielen (41.155.100). The recently recommended values for solar distance to the galactic center (8.5 kpc) and our rotation speed around it (220 km.s^{-1}) were discussed by Trimble (42.155.043).

The distance scale of the Galaxy was reviewed by Barkhatova *et al.* (40.155.088). A discussion of typical corrugation scales in the Galaxy was given by Spicker and Feitsinger (42.155.003), who concluded that three distinct scales seem to exist: 1–2 kpc, 4–8 kpc, and > 13 kpc. These corrugations are reflected in the distribution of O and B-stars and HII regions, and to a lesser extent in the HI distribution. Feitsinger and Spicker (39.155.026) investigated the corrugation phenomenon for the (heliocentric) longitude range $10° \leq l \leq 240°$ as derived from HI studies.

The proceedings of the 106th IAU Symposium : "The Milky Way Galaxy", were edited by van Woerden, Allen and Burton (39.012.007).

6.2 Observations and their Interpretations

6.2.1 Neutral Hydrogen

An HI survey of the southern Milky Way for $240° \leq l \leq 350°$ and $|b| \leq 10°$ using the 18-m Parkes antenna, was presented by Kerr *et al.* (42.155.040). The HPBW is 48′, and the velocity resolution is 2.1 km.s^{-1}.

The Leiden-Green Bank survey of atomic hydrogen was published by Burton (40.155.056) and Burton and te Lintel Hekkert (40.155.057). Observations with the *NRAO* 140-foot telescope cover the complete longitude range accessible at $\delta > -46°$ and the latitude interval $|b| \leq 20°$. The sampling interval is 1° in both l and b. The kinematic resolution is 1 km.s^{-1}. The observations are displayed as cross sections through the data cube in longitude, velocity coordinates at constant latitudes, and as cross sections in latitude, velocity coordinates at constant longitudes. Maps of integrated velocity intervals, and of HI column densities are also presented. Burton and te Lintel Hekkert (39.155.024) discuss the HI survey north of $\delta = -40°$ in the latitude range $|b| \leq 20°$. An atlas of cuts through the galactocentric data cube of HI observations at constant R-values in Θ, z coordinates, at constant Θ-values in R, Θ coordinates was published by Burton and te Lintel Hekkert (42.155.025). Maps of the galactic arrangement in R, Θ coordinates of projected HI surface densities, z-height of the gas-layers centroids, maximum volume density, as well as measures of the layer thickness are presented.

Pöppel and Viera (40.155.060) published an HI survey of the region $240° \leq l \leq 359°, +3° \leq b \leq +17°$ with a velocity resolution of 2 km.s^{-1} and an extent from -100 km.s^{-1} to $+100$ km.s^{-1}. The l and b separation was 1°. The region $-3° \leq l \leq 21°$ and $-4° \leq b \leq +3°$ was surveyed with the Effelsberg 100-m telescope by Braunsfurth and Rohlfs (38.131.009). The velocity range was -300 km.s^{-1} $\leq v_{lrs} \leq +300$ km.s^{-1}, with sampling intervals of 0.1 and 2 km.s^{-1}. The sensitivity was about 0.5K. An HI survey in the region $120° \leq l \leq 142°$ and $-5° \leq b \leq +5°$

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