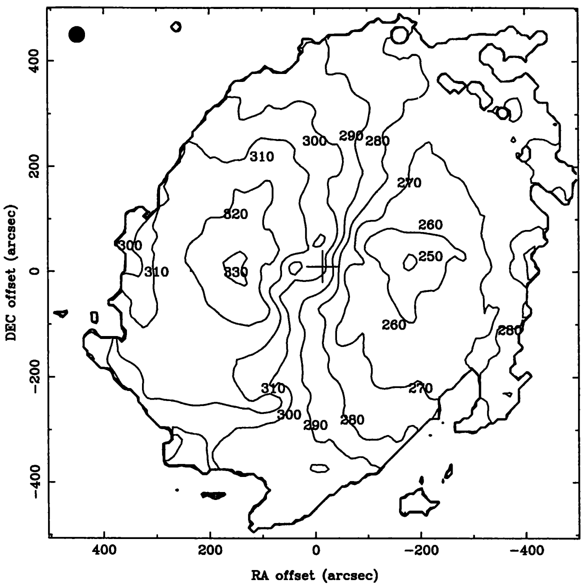

Figure 2—Velocity field of NGC 4214, at 30″ resolution. The cross marks the rotation centre obtained from the model fit described in the text.

ridge, the surface density is within a factor of 2 of the critical value. Considering the uncertainties and lack of data on the distribution of the molecular gas component, it seems possible that the outer star formation regions NGC 4214 can be explained by gravitational instability.

The striking features of the velocity field (Figure 2) are the strong decline in the projected velocity at large radii, and the twist of the isovelocity contours in the central regions. As discussed by Allsopp (1979), there is a number of ways in which such a velocity field could be produced. A warp of the disk to lower inclination at large galactocentric radius seems quite likely, given that deep CCD images (McIntyre 1997, in preparation) show increasingly circular isophotes in the region where the rotation curve is falling. How much of a warp is required depends on the inclination of the galaxy as a whole, which is uncertain. For an inclination of 30°, the inclination of the outer disk must decrease by 15° over the outer 200″.

However, a warped-disk model cannot explain the strong central isovelocity twist. I have attempted to model the velocity field as a disk with oval orbits in the central regions, that smoothly become more circular with increasing galactocentric radius. The orbit shapes are parametrised in a way similar to that of Staveley-Smith et al. (1990). I took the inclination to be constant at all radii and fitted the shape of the rotation curve with a Brandt (1960) parametrisation. This assumption does not significantly affect the fit to the central regions, as the region of interest is well within the turnover radius. Since it is rather low, the inclination was not fitted automatically; several fixed values were tested. All the free parameters were fitted together, using a simulated annealing algorithm adapted from Press et al. (1992) to minimise the rms difference between the computed and observed velocity field. The best fits were for orbits with rather low ellipticity ($e \leq 0{\cdot}05$–$0{\cdot}10$) with major axes along PA $\simeq 110°$, roughly parallel to the long axis of the bright optical bar. The orbits were significantly oval only for $R \leq 60''$. The fitted rotation curve has a Brandt n parameter of ~ 10, and peaks at $\sim 35/\sin(i)\ \mathrm{km\,s^{-1}}$, 160″ from the rotation centre.

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A UKST Hα Survey of the Galactic Plane

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Abstract: We describe a major Anglo-Australian project to undertake a UKST Hα survey of the Southern Galactic plane, Magellanic clouds and selected regions. The survey will use a new 12×12 inch monolithic Hα interference filter of high specification and Tech Pan film which offers significant advantages over other emulsions due to its peak sensitivity at Hα and its extremely fine grain, high resolution, exceptional DQE, excellent imaging and low noise. A survey of unprecedented area coverage, depth and resolution should result, superior to any previous optical survey of ionised

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gas in the galaxy. It is certain to lead to exciting new discoveries and new avenues of research.

1 The Need for the Survey

Considering the importance of star formation and its variation within and between galaxies it is surprising how little survey work has been done. Gunn made a systematic Hα survey in the 1950s using coarse grained emulsion and a 6 inch telescope, but other work has concentrated on relatively small areas for specific study. The only existing UK Schmidt Telescope (UKST) wide area Hα survey work dates to the late 1970s (Davies, Elliot & Meaburn 1976) using mainly coarse grained (though fast) 098 emulsion and a far from optimum filter. Many parts of the plane are unsurveyed, particularly the outer extensions beyond a few degrees from the Galactic equator, whilst the northern Milky Way above Dec $= -20°$ has not been covered at all. Progress in other wavebands highlights the paucity of the optical counterpart for the study of Galactic gas. There is a clear need for a high resolution optical survey to complement studies at other wavebands.

2 Advantages of Tech Pan Film and the UKST

The nearest star forming complexes may lie as close as 100 pc with sizes of tens of parsecs. Such structures often present large angular sizes (a degree or more) yet exhibit fine detail at arc-second level. To study the interaction of ionised structures with their large scale environment we need surveys of considerable extent at good resolution. CCDs cannot yet match the wide-area coverage, uniformity and resolution of the UKST/Tech Pan combination (Parker et al. 1995). A wide angle, yet deep Hα survey of the Galactic plane is particularly suited to the UKST and Tech Pan film.

3 Tie-ins with Other Surveys

Of particular interest on the large scale will be comparisons between Hα emission and other indicators of interstellar gas and/or star formation activity. These include giant molecular cloud complexes and the general molecular ISM traced by CO observations, radio continuum emission, γ-rays, H I, dust clouds or IRAS far infra-red flux. This survey should complement the radio maps from the ATNF and MOST, those of the new Parkes H I multibeam survey as well as those from mm wave telescopes here and overseas. The prospects for collaboration and comparison from studies in other wavebands is excellent.

4 Scientific Aims and Details of the Survey

Hα emission lines from H II regions are one of the most direct optical tracers of current star formation activity. These lines also trace out the distribution of ionised gas in the ISM in general revealing for example: stellar outflows in regions masked by strong reflection nebulae; shocks from high velocity galactic H I clouds; the optical counterparts of supernova remnants; stellar wind-blown bubbles, shells, sheets and filaments and emission nebulosity close to young stellar sources. The spatial extent and detailed morphology of H II regions, OB associations and the wide variety of structures (shells, rings, holes, bubbles, filaments and arcs) over a range of scales from a few arcseconds to tens of degrees can be particularly well studied by Hα imaging.

The new survey, timely in respect of telescope loading, should commence towards the end of 1996 and will initially include about 160 standard UKST fields. This will then be extended to the outer regions of the Galactic plane and to declinations from +0 to +15 degrees. Exposures will be of the order of 3 hours and the survey will take about 3 years to complete. The narrow-band nature of the Hα filter means that the survey can proceed in grey/bright time when the sky is too bright for normal observations. The photometric integrity of the survey will be assessed via independent narrow band photometry with CCDs on other telescopes and with reference to previously studied objects over a range of UKST fields.

5 Survey Availability

The survey will be made available to the astronomical community as quickly as possible. The consortium will determine field priority selection and have some initial scientific exploitation rights. All original films will be scanned on the SuperCOSMOS machine at 10 μm resolution to produce digital pixel maps of each field. The data will be disseminated on CD-rom at high 10 μm resolution (1·5 Gbyte). A small number of film copies of the survey will also be made according to demand, but with copies likely at the AAO, Bristol, ROE and Wollongong.

6 The Consortium

Professor W. J. Zealey and students (University of Wollongong), Dr A. Green et al. (University of Sydney), Mr M. Hartley, Dr J. Bland-Hawthorn, Dr D. Malin (AAO), Dr M. Mashedar and students (University of Bristol), Dr M. G. Edmunds (University of Cardiff) and Dr D. Morgan (Royal Observatory Edinburgh).

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