

Appendix A

UCH II Candidates in the Magellanic Clouds

In the Galaxy, UCH IIs have been identified by their thermal radio spectra and their IRAS colors. Just as the UDH IIs discussed in Chapters 4 and 5 have flat or inverted radio spectra at cm wavelengths, individual UCH IIs are expected to have thermal radio spectral energy distributions as well. However, in the catalog of UCH II regions by Wood & Churchwell (1989b), many of the UCH II regions have radio spectral indices consistent with optically thin thermal free-free emission. Wood & Churchwell (1989a) also found that UCH IIs in the Galaxy strictly obey a set of color criteria in the infrared with $\log(F_{60\mu m}/F_{12\mu m}) \geq 1.30$ and $\log(F_{25\mu m}/F_{12\mu m}) \geq 0.57$, while very few other types of objects had IRAS colors fitting these criteria. For example, in the sample of Arendt (1989), none of the SNR meet both of these criteria. Therefore, these color criteria appear to be relatively robust for identifying UCH II regions. Wood & Churchwell (1989b) also note that 60% of the brightest IRAS sources ($> 10^4$ Jy at $100 \mu m$) in the range of their survey are UCH II regions. Therefore, we expect UCH II regions to be among the brightest mid- to far-infrared sources in the Magellanic Clouds.

The radio observations used in this appendix were originally obtained by Filipovic et al. (1995, 1997) using the Parkes radio telescope. The beamsize at the frequencies used here are 3.6 arcmin at 8.85 GHz, 5.2 arcmin at 4.85 GHz, and 5.6 at 4.75 GHz. These beamsizes are large compared to the expected size of a UCH II region in the Magellanic Clouds of $\lesssim 0.5$ arcsec. Consequently, these observations are likely to suffer from severe contamination by other radio emitting objects and background radio continuum. The RMS noise for these frequencies

was typically ~ 8 mJy/beam, and the flux uncertainties are typically $\sim 10\%$. The infrared observations used in this chapter were taken with the Infrared Astronomical Satellite (IRAS) and published in Schwering & Israel (1990). The IRAS beamsizes are similar to those of the radio observations, with the $12\ \mu\text{m}$ beam ~ 3.7 arcmin. However, unlike their radio fluxes, the IRAS fluxes of UCH II regions should be among the brightest in the Magellanic Clouds, and therefore contamination by other mid- to far-IRAS sources is not likely to be as severe, although we might expect to find *multiple* UCH II regions within a single IRAS beam. The uncertainties in the IRAS fluxes are estimated to be $\sim 10 - 20\%$.

Using these color standards, I have utilized previously published radio data on the Magellanic Clouds in combination with the IRAS Point Source Catalog to identify UCH II region candidates. The data in Filipovic et al. (1998) was used to select objects in the Magellanic Clouds detected in both radio and IRAS observations. These objects were compared to the IRAS colors in order to create the list of objects satisfying both detected in the radio and meeting the IRAS color criteria. It should be noted that *only* objects first identified as radio sources were considered in this process. This process resulted in 56 UCH II region candidates in the LMC and 11 candidates in the SMC which were both detected in radio observations *and* have IRAS colors meeting the selection criteria. The $\log(F_{60\mu\text{m}}/F_{12\mu\text{m}})$ and $\log(F_{25\mu\text{m}}/F_{12\mu\text{m}})$ values are plotted in Figures A.1 and A.2. These sources are listed in Tables A.1 and A.2 along with their radio fluxes. Given the strong contamination possible in the radio observations, I have not imposed a standard on the radio spectral index α as in Chapters 4 and 5. Of the 56 sources in the LMC, only 21 have one or both of the radio indices $\alpha_{4.85\text{GHz}}^{8.55\text{GHz}}$ or $\alpha_{4.75\text{GHz}}^{8.55\text{GHz}} \geq -0.1$. For the SMC, only 5 of the 11 sources have $\alpha_{4.85\text{GHz}}^{8.55\text{GHz}}$ or $\alpha_{4.75\text{GHz}}^{8.55\text{GHz}} \geq -0.1$.

In order to improve the knowledge of these sources, I have begun an observing campaign with the Australia Telescope Compact Array (ATCA), which is currently the only telescope available which can observe the Magellanic Clouds at sufficient spatial resolution ($1'' - 2''$, two orders of magnitude better than the existing observations presented here). In addition, the upcoming Space Infrared Satellite Facility (SIRTF, scheduled to launch in 2002), will provide

higher resolution mid- to far-infrared data on these sources.

Table A.1: UCHII candidates in the LMC.

IRAS ID	100 μm Jy	60 μm Jy	25 μm Jy	12 μm Jy	4.75 GHz mJy	4.85 GHz mJy	8.55 GHz mJy
0449-6917	139.4	62.1	7.99	1.74	0.25	0.32	0.24
0452-6700	191.4	116.7	13.99	3.63	0.22	0.36	0.25
0452-6722	—	10.3	0.78	0.19	0.096	0.079	0.083
0452-6727	353.6	343.6	65.16	9.1	—	—	—
0453-6807	60.3	35.6	4.16	1.0	0.16	0.14	0.13
0454-6716	27.0	8.3	0.5	0.37	0.3	0.28	0.46
0454-6916	280.8	178.	17.2	4.25	0.54	0.87	0.46
0456-6629	520.	244.3	32.74	4.25	2.1	3.4	1.5
0456-6636	93.6	37.3	4.0	0.96	0.68	0.65	1.2
0457-6830	228.8	118.	12.88	2.81	0.45	0.61	0.4
0457-6849	97.8	47.6	4.99	1.26	0.12	0.12	0.12
0458-6626	62.4	33.1	3.88	0.81	0.31	0.27	0.23
0459-6620	20.8	8.3	1.66	0.33	0.081	0.083	—
0503-6722	77.	31.9	3.66	0.93	0.09	0.064	—
0505-6659	43.7	31.9	7.66	0.59	0.11	0.11	0.094
0505-6807	54.1	25.3	2.11	0.41	0.31	0.29	0.35
0505-7010	52.	24.8	2.55	0.59	0.21	0.24	—
0505-7058	85.3	62.9	11.77	1.55	0.064	0.064	0.045
0510-6857	447.2	314.6	52.17	7.14	1.2	1.2	1.1
0513-6729	112.3	60.9	9.43	1.33	0.19	0.2	0.16
0513-6925	301.6	256.7	41.07	6.03	0.64	0.78	0.51
0516-6722	39.5	27.3	2.55	0.37	0.042	0.033	—
0519-6941	249.6	124.2	11.1	2.96	0.87	1.2	—
0520-6655	39.5	27.3	2.55	0.37	0.042	0.033	—
0522-6757	52.	70.4	4.55	1.11	0.24	—	0.16
0522-6800	312.	246.3	32.19	3.96	1.1	2.1	0.77
0523-6806	104.	89.	16.65	3.14	0.58	0.6	0.4
0523-7138	35.4	9.1	1.0	0.26	0.18	0.16	—
0525-6618	228.8	91.1	14.1	2.4	1.2	1.3	1.2
0525-6831	83.2	39.3	4.88	1.11	0.29	0.26	0.39
0526-6731	20.8	8.3	1.44	0.22	1.7	1.2	1.5
0526-6740	20.8	11.6	1.0	0.22	0.38	0.29	0.36
0526-6751	18.7	4.6	0.22	0.26	0.16	0.098	0.15
0528-6730	62.4	41.4	5.22	0.74	0.56	0.5	0.4
0531-7106	243.4	105.6	12.32	2.22	1.1	1.6	0.86
0532-6629	224.6	83.6	6.88	1.07	0.41	0.5	0.31
0532-6743	280.8	113.8	8.88	1.78	0.77	1.1	0.84
0532-6826	62.4	31.9	3.88	0.93	—	—	0.074
0533-6948	87.4	70.4	8.88	1.33	—	0.12	0.096
0534-6847	106.1	64.2	6.88	1.41	0.16	0.14	0.068
0535-6603	97.2	43.3	6.39	1.25	0.7	1.1	0.4

Table A.1: continued.

IRAS ID	100 μm Jy	60 μm Jy	25 μm Jy	12 μm Jy	4.75 GHz mJy	4.85 GHz mJy	8.55 GHz mJy
0535-6736	384.8	265.	35.3	4.74	1.4	2.3	1.3
0536-6735	—	33.1	4.22	0.44	—	—	0.11
0536-6941	208.	78.7	9.99	2.59	0.49	0.48	0.37
0537-6914	104.	41.4	3.33	1.04	—	—	1.5
0538-6911	312.	124.2	22.2	2.96	3.6	—	3.1
0538-7042	74.9	41.4	5.11	1.29	0.14	0.16	0.18
0539-6907	3120.	2794.5	471.75	74.	36.	36.	35.0
0539-6931	312.	248.4	31.08	4.44	1.3	—	1.4
0540-6927	—	41.4	2.77	0.74	—	—	0.27
0540-6940	769.6	662.4	111.	14.98	1.9	1.9	1.7
0540-6946	624.	414.	33.3	4.07	4.2	4.0	4.0
0540-7111	141.4	61.7	8.66	2.	0.081	0.087	0.081
0542-7121	124.8	53.	5.22	1.15	0.26	0.35	0.19
0543-6752	20.8	12.	1.33	0.3	0.25	0.29	0.28
0545-6947	33.3	33.1	4.44	0.56	0.079	0.06	0.084
0549-7004	208.	58.4	4.99	0.96	0.7	0.74	0.55

Table A.2: UCH II candidates in the SMC.

IRAS ID	100 μm Jy	60 μm Jy	25 μm Jy	12 μm Jy	4.75 GHz mJy	4.85 GHz mJy	8.55 GHz mJy
0043-7321	27.	14.	0.89	0.22	0.078	0.09	0.13
0046-7333	128.	56.	9.77	1.07	0.24	0.26	0.41
0047-7343	27.	14.	1.11	0.19	—	0.046	0.079
0050-7329	27.	9.7	0.71	0.19	0.13	0.095	—
0056-7254	17.	9.1	0.78	0.19	0.12	—	—
0057-7226	242.	200.	43.5	5.99	1.6	1.6	1.5
0103-7216	59.	45.	10.9	1.37	0.18	0.17	0.18
0107-7327	27.	18.	2.55	0.44	0.086	0.064	0.051
0112-7333	117.	46.	2.22	0.52	0.5	0.53	0.4
0113-7334	88.	32.	2.22	0.33	—	—	0.38
0122-7324	46.	55.	22.9	2.21	0.12	0.12	—

Figure A.2: The values of the $\log(F_{60\mu m}/F_{12\mu m})$ and $\log(F_{25\mu m}/F_{12\mu m})$ color selection for the UCH II region candidates in the SMC.

