Radio Continuum Mapping of HII Regions: IRAS 17009-4042 and IRAS 17008-4040

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ABSTRACT

We present low frequency radio continuum maps (GMRT: 610 and 1280 MHz) of two southern Galactic HII regions associated with IRAS 17009-4042 and IRAS 17008-4040. The morphology of the ionized gas and its radio properties are investigated. The spectral index map is generated to understand the mechanism behind the observed emission. The spectral types of the ionizing source, the dynamical ages of these HII regions are estimated.

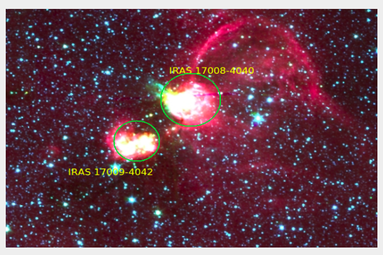

Fig 1: 3.6 μm (blue), 4.5 μm (green), 5.8 μm (red) IRAC Colour composite image of the HII regions: IRAS 17009-4042 and IRAS 17008-4040.

Fig 2: J (blue), H (green), K (red) 2MASS Colour composite image of the HII regions: IRAS 17009-4042(*left*) and IRAS 17008-4040(*right*).

IRAS 17009-4042 AND IRAS 17008-4040

High mass stars emits copious amount of Lymann continuum photons which ionizes the neutral hydrogen to form an ionized region, called as “HII Regions”. This is a part of the warm component of the interstellar medium (ISM).

IRAS 17009-4042 and IRAS 17008-4040 are both HII regions with fan-like cometary morphologies (Garay et. al., 2006), at a distance of ~2 kpc. Maser emissions are observed towards these sources. A strong Galactic H_2O source was observed across IRAS 17009-4042 (Kaufmann et al. (1977)). H_2O, OH and methanol masers have been detected towards IRAS17008-4040. IRAS 17008-4040 is catalogued as a source having an extended green object (EGO).

IONIZED EMISSION FROM THE HII REGIONS

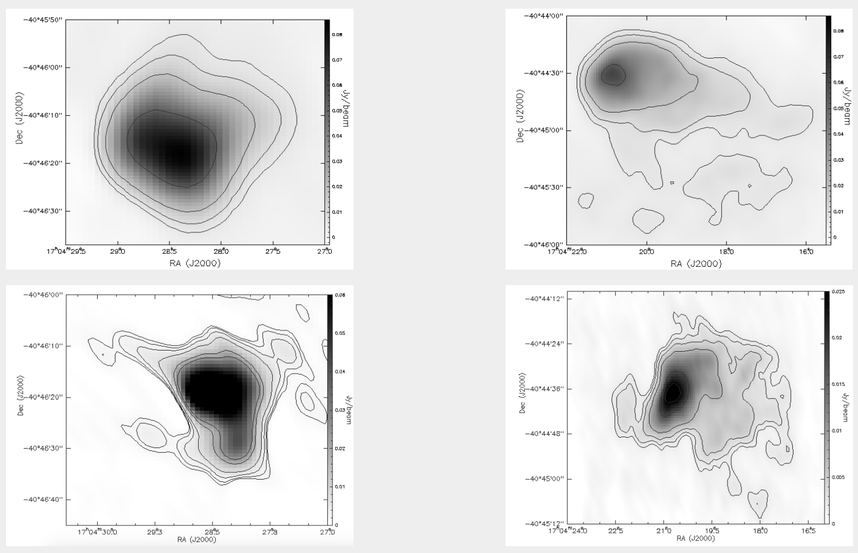

Fig 3: Radio continuum emission at 610 MHz of IRAS 17009-4042 (top left) and IRAS 17008-4040 (top right) [contours:1.7882 mJy*(3, 5, 10, 30, 50, 70]; Radio continuum emission at 1280 MHz of IRAS 17009-4042 (bottom left) and IRAS 17008-4040 (bottom right) [contours:0.356 mJy*(3, 7, 11, 20, 50,]

A cometary morphology could be inferred for both the sources from the contours of 610 MHz. IRAS17008-4040 has a bright head towards the northwest direction and a diffused tail in the south-east direction. As for IRAS17009-4042, the cometary head is in the south-west direction and the tail is towards the north-east direction. Assuming optically free-free emission from a single ionizing star, the spectral type is determined to be B0 – O9.5 for both IRAS 17009-4042 and IRAS 17008-4040 from the 1280 MHz radio map.

EMISSION CHARACTERSTICS OF THE HII REGIONS

The values of the spectral indices varies as -2.25 to 1.858 for IRAS 17009-4042 and -2.12 to 1.259 for IRAS 17008-4040. It is dominated by thermal emissions, but a slight amount of non-thermal emissions could be observed across the edges.

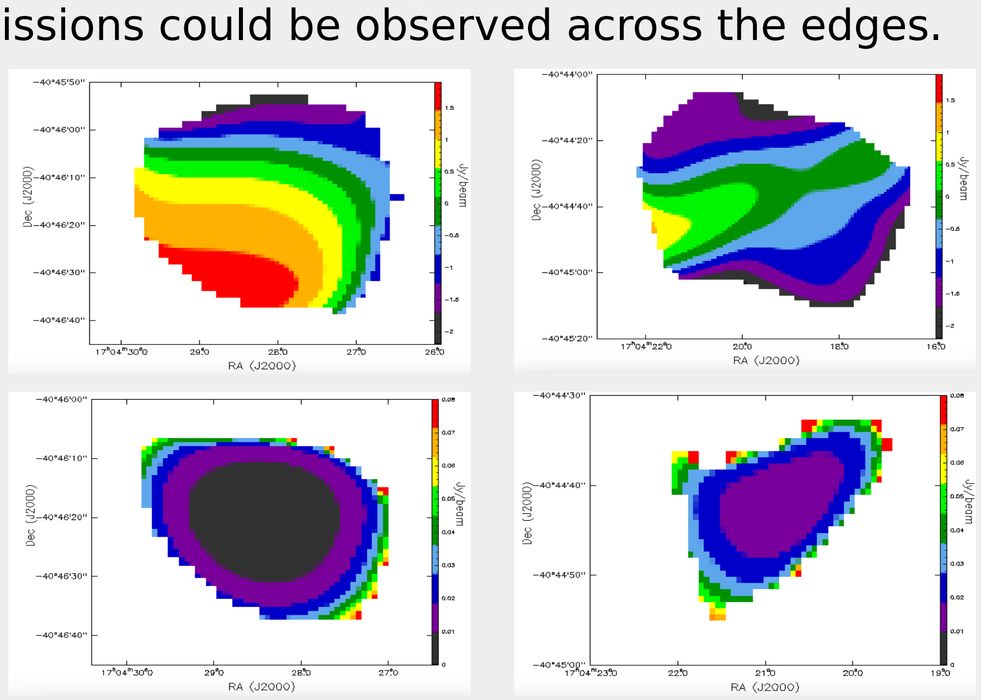

Fig 3: Spectral index map of IRAS17008-4040 (top left) and IRAS 17008-4040(top right). The error map of IRAS 17009-4042(bottom left) and IRAS 17008-4040(bottom right). The rms noise level of 610 MHz and 1280 MHz for the convolved maps being 3.589 mJY and 1.388 mJy respectively.

STELLAR POPULATION ASSOCIATED WITH THE HII REGIONS

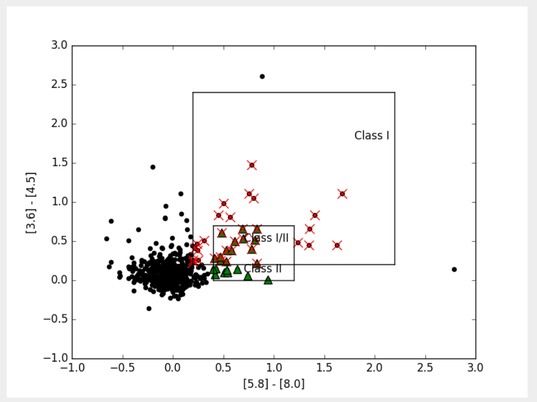

Fig. 5. Classification of YSOs into different evolutionary classes in Allen et al. (2004). The boxes on the plot, adapted from Vig et al. (2007). The red crosses represents class I objects (Allen et al., 2004); The green pyramids indicates class II objects (Allen et al., 2004).

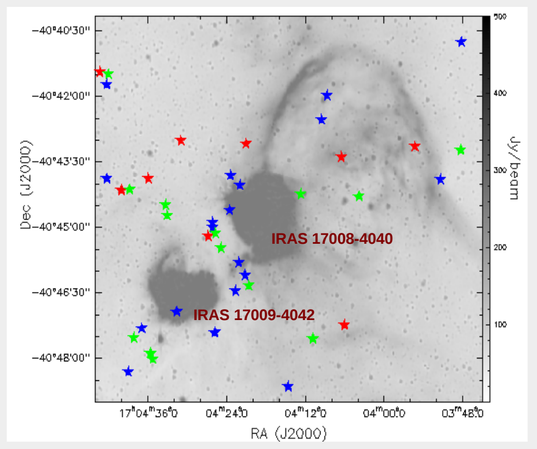

Fig. 6. IRAC 8μm image of IRAS 17009-4042 and IRAS 17008-4040.. The red stars represents class II objects(Allen et al., 2004); The blue stars indicates class I objects(Allen et al., 2004)

The young stellar population associated with these HII regions are either Class I or Class II objects.There are approximately 9 Class II objects, 19 Class I objects and 14 YSOs which are either Class I or Class II. There is an enhancement of Class I objects between IRAS 17009-4042 and IRAS 17008-4040.

FUTURE WORK

Further plans are to study the cold dust and molecular cloud associated with these HII regions using the Herschel data and also carry out a molecular line study using the data from MALT90 survey.

REFERENCES: [1] Allen, L. E., Calvet, N., D’Alessio, P., et al. 2004, ApJS, 154, 363; [2] Garay, G., Brooks, K. J., Mardones, D., & Norris, R. P. 2006, The Astrophysical Journal, 651, 914; [3] Kurtz, S., Churchwell, E., & Wood, D. O. S. 1994, ApJS, 91, 659; [4] Martín-Hernández, N. L., van der Hulst, J. M., & Tielens, A. G. G. M. 2003, A&A, 407, 957; [5] Panagia, N. 1973, The Astronomical Journal, 78, 929 [6] Vig, S., Ghosh, S. K., Ojha, D. K., & Verma, R. P. 2007, A&, 463, 175; [7] Walsh, A., Hyland, A., Robinson, G., & Burton, M. 1997, Monthly Notices of the Royal Astronomical Society, 291, 261