Ultra-compact HII regions: Are they constant or not?

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Abstract

Massive stars are stars with masses in excess of 8 $M_{\odot}$ and usually form at large distances and are very rare because of the initial mass function (IMF). At that mass, and even slightly before that, the star starts producing copious amounts of ultra-violet (UV) radiation capable of ionizing the surrounding material. The size of such an ionized region depends on the amount of ionizing photons produced by the star and the density of the molecular core in which the star resides. As a result of this region of ionized material, the free electrons and protons (the core is predominantly made up of hydrogen) and ions interact, and this produces a spectrum of free-free emission. Astronomers creatively dubbed these bubbles of ionized material as HII regions. At radio frequencies, we can observe the spectrum from these regions across a wide range of frequencies.

At the early stages of star formation, these regions are called hyper- and ultra-compact HII regions. For a constant density and constant temperature ultra-compact HII region, the spectrum should follow the theoretical predictions. In order to test these predictions on observed ultra-compact HII regions, we will use the Cornish south survey at 5 GHz (C-band) and extrapolate the fluxes observed down to 1.6 GHz (L-band) using the theoretical prediction. We will then use the MeerKAT Galactic Plane Survey (GPS)'s sensitivity to see whether MeerKAT would have been able to detect these ultra-compact HII regions. Given a detection, we will also comment on the nature of the ultra-compact HII region.

Skills:

1.**Using astronomical archival data for research**

2. **Building programming skills to generate the theoretical spectrum of an HII region.**

3. **Use MeerKAT catalog data to determine whether the ultra-compact HII regions follow theoretical predictions or deviate from them.**

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References