G29: fitting the full SED

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Introduction

An Ultra-Compact HII (UCHII) region is a small ionized nebula that surrounds a young massive-star that is still embedded within its natal cloud.

G29.96-0.02, hereafter G29, is a prototypical UCHII region (Wood & Churchwell 1989), located at a distance of 8.9 kpc (Sewilo et al 2004). Its driving source is an O5-6 star which has a luminosity of 3-4x10^6 L_{sol} (Watson & Hanson 1997, Martin-Hernandez et al 2003).

The UCHII region is embedded within the submillimetre clump G29.956-0.016SMM (Thompson et al 2006).

We have used the *Herschel* SPIRE FTS spectrograph (Griffin et al 2010, Swinyard et al 2010) to observe the clump containing G29.

The FTS has two spectral bands:

SSW 194-313μm, Beam FWHM ~19 arcsec

SLW 303-671μm, Beam FWHM ~35 arcsec

The spectrograph was used in its high-resolution mode. The spectral resolution, after apodization, was 2.17 GHz.

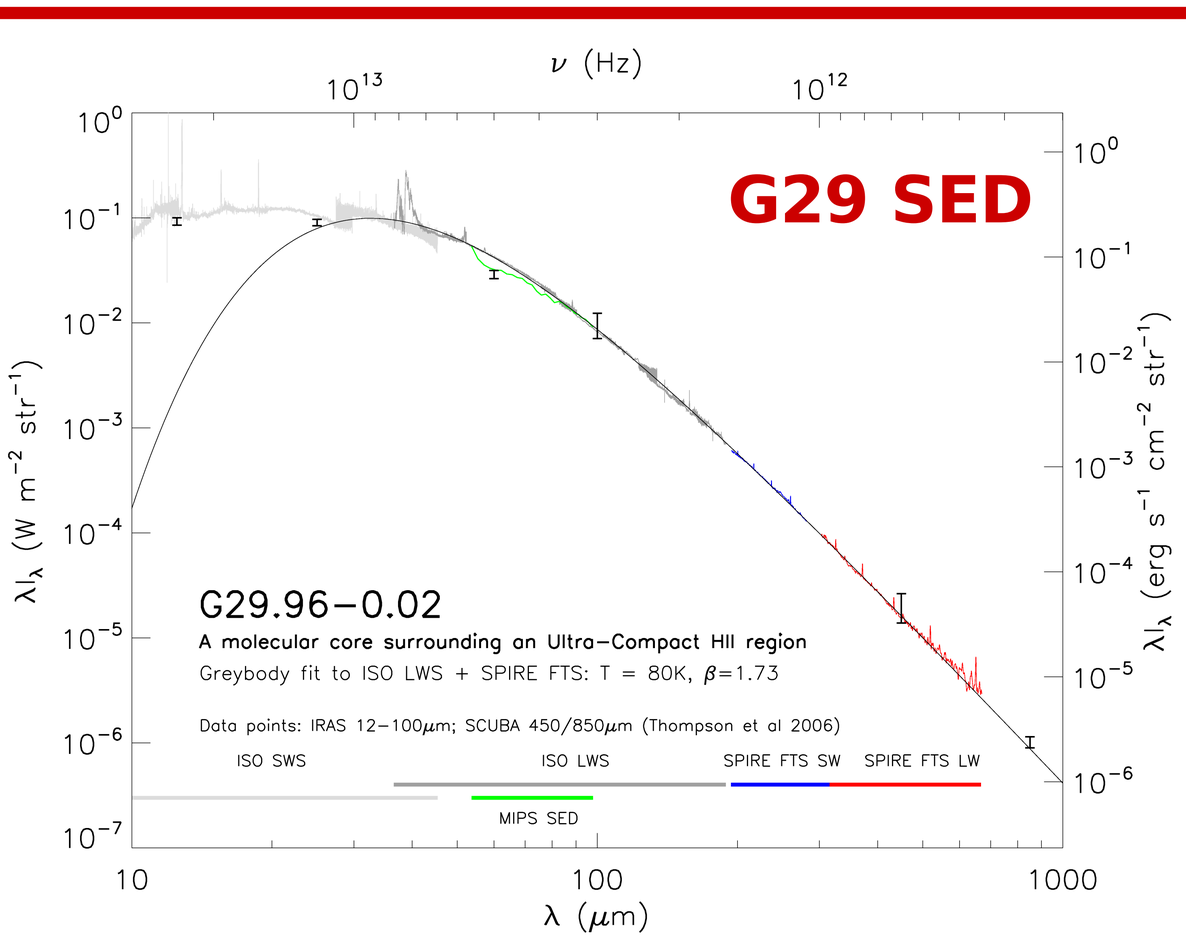

Figure 2: Spectral Energy Distribution towards G29 constructed using data from the literature and archives over-plotted on the new SPIRE FTS spectrum.

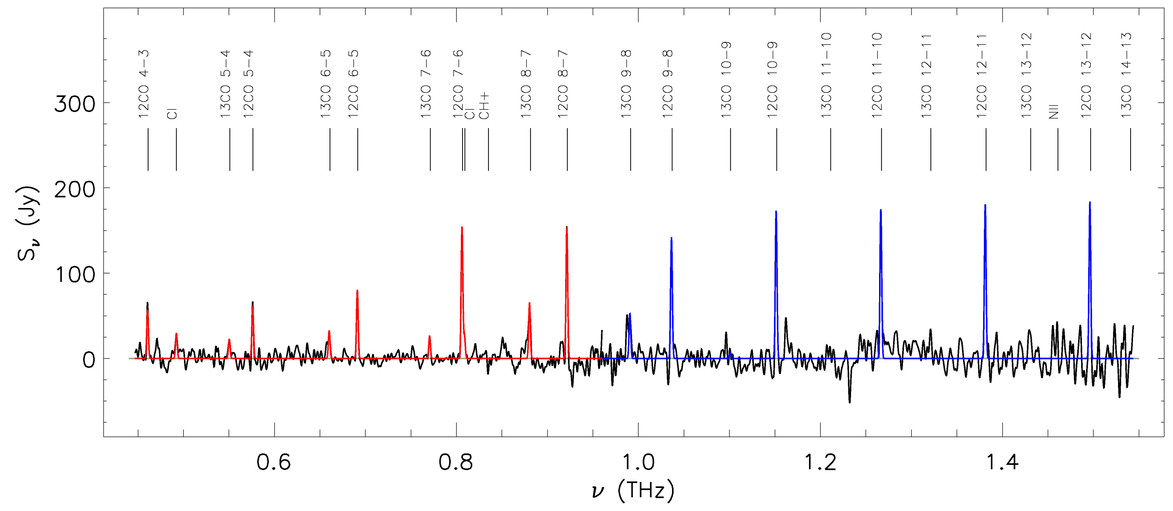

Figure 1: Continuum extracted spectra for the on-source bolometers. Fits to the SLW and SSW data are shown in red and blue respectively. The positions of well known lines are annotated.

Results

The SPIRE FTS was used to simultaneously measure continuum and spectral line emission towards G29.

Spectral Lines: The continuum subtracted spectra are shown in Figure 1. The 13CO and CO spectral line ladders are clearly detected.

Additionally the [CI] and [NII] species were detected. The 835 GHz line of CH^+ was seen in absorption in the FTS spectra and has been studied by Naylor et al (2010).

Continuum: Combining the FTS spectra with archival data shows that they match the long wavelength spectral slope of the existing data. The combined SED is shown in Figure 2.

A single component greybody fitted to the SED gives a characteristic temperature of 80K. The long wavelength slope is consistent with a spectral index of β=1.73.

The bolometric luminosity of the SED was 4x10^6 L_{sol} – comparable to that of the O-star driving the UCHII region.

The estimated mass of of the clump was ~1500 M_{sol} – comparable to that of Infrared Dark Clouds (Rathborne et al 2006).

Extended Emission: Comparison of a sparse sampled map of [NII] emission with archive data shows several neighbouring HII regions. (Figure 3 and 4).

References

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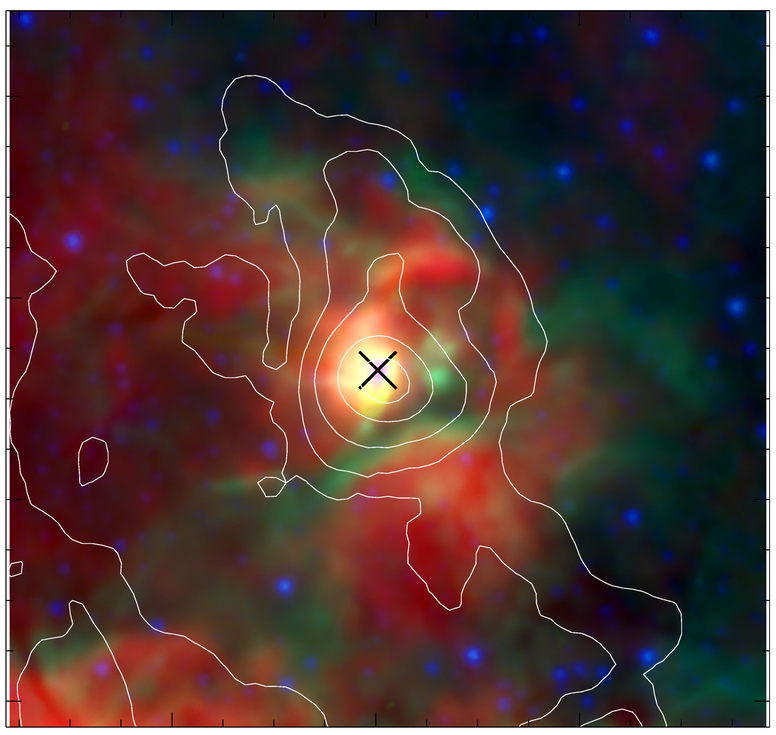
Figure 3: A false-colour image of G29. The X marks the location of the UCHII region, the contours (850μm archival SCUBA data) show the extent of the clump that it is embedded within.

Red MAGPIS 20 cm - extended free-free emission.
Green *Spitzer* 8μm - small (PAH) dust grains in diffuse clouds and dense photo-dominated regions.
Blue *Spitzer* 4.5μm - stellar photospheres.



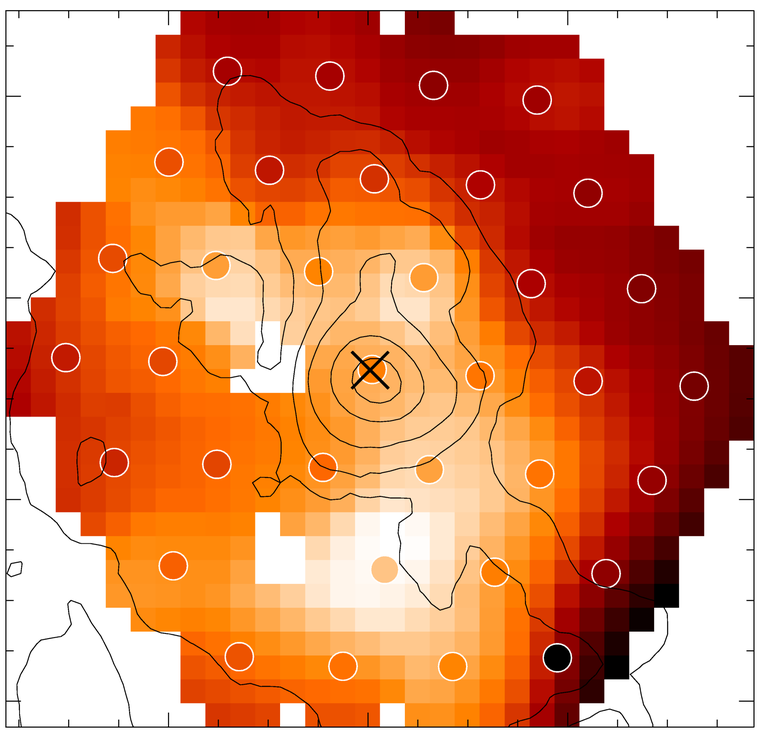


Figure 4: Sparse map of [NII] intensity towards G29. Circles show bolometer positions. Cross and contours as Figure 2.

The morphology of this region is complex showing several, possibly overlapping, features.

The southern [NII] peak is coincident with a region of 20cm emission that is bounded to the north by a 8μm filament. This could be a neighbouring HII region that is separate from the UCHII.