High luminosity hot cores in the southern hemisphere

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Introduction:

We present submm observations of three luminous, massive hot cores in the southern hemisphere.

These sources turned out to be the most line rich sources of a sample of 40 IRAS colour selected potential high mass star forming regions that were observed with APEX in several frequency setups throughout the submm band. Several molecular tracers between 290 GHz and 810 GHz were chosen to classify the physical and chemical conditions in these regions.

On this poster, results of the APEX CH_3CN data and continuum follow-up data with APEX/LABOCA and ATCA are presented.

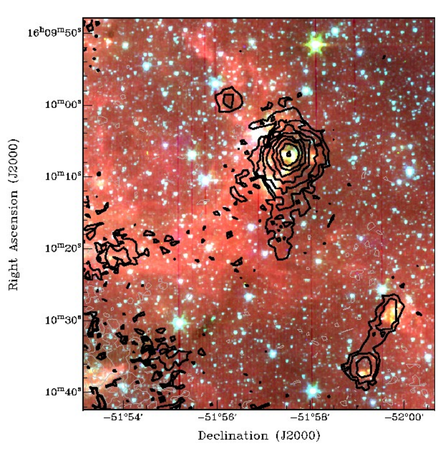
Observations:

The data were taken with the Atacama Pathfinder EXperiment (APEX) in Chile and the Australia Telescope Compact Array (ATCA). The 290 GHz APEX data depicted here was taken with APEX2a, with a beam of 20" (FWHM) and the 345 GHz data with LABOCA (Large APEX Bolometer Camera), with a FOV of 11.4' and a beam of 18.6". The 88 GHz ATCA data was observed in the H75 configuration with an averaged synthesised beam of 5.9"x4.8".

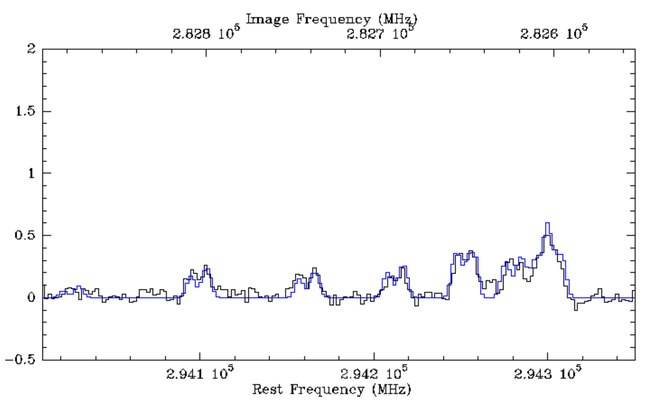
IRAS 16060-5146:

d=5.3 kpc, L=7.5x10^{5}L$_\odot$, M=6.8x10^{3}M$_\odot$

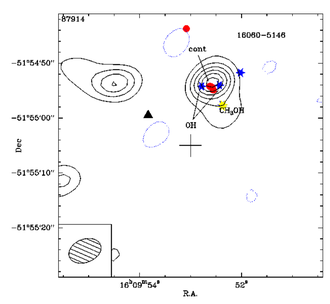
(L, M from Faúndez et al. 2004,A&A 426,97)



LABOCA 345 GHz data overplotted on Spitzer GLIMPSE 3.6 µm (blue), 4.5 µm (green), 8.0 µm (red) emission. Contours of the LABOCA emission (black) are -5σ, 5σ, 10σ, 20σ... with σ=50mJy/beam. 16060-5146 has a remarkable position at the edge of a large shell-like HII complex which hosts the HII regions G331.03-0.15, G331.26-0.19 and G331.52-0.07 (McClure-Griffiths et al. 2001, ApJ 551,394). This location strongly suggests triggered star formation for 16060-5146. There are two other regions of dust emission visible in the picture, which might indicate clustered star formation in the region.



CH_3CN(16-15) spectrum in 16060-5146. Overplotted in blue is a synthetic spectrum created under assumption of LTE with XCLASS (Schilke et al. 1999,pcim.conf,330). 16060-5146 shows two components with temperatures T_1= 170 K and T_2= 180 K for the compact hot core.



86 GHz emission (ATCA) of 16060-5146. Contour levels are -3σ, 3σ, Δσ=1 with σ=0.1Jy/beam . The cross marks the pointing position of the setup. Blue stars mark OH masers (Caswell et al. 1998,MNRAS 297,215), yellow stars CH_3OH masers and red dots cm continuum positions (Walsh et al. 1998,MNRAS 301,640; Urquhart et al. 2007,A&A 461,11). The black triangle shows the APEX pointing position. In this high resolution data, 16060-5146 displays two cores, of which only the right one seems to be associated with masers and continuum emission

IRAS 16065-5158:

d=4.0 kpc, L=2.9x10^{5}L$_\odot$, M=2.7x10^{3}M$_\odot$

(L, M from Faúndez et al. 2004)

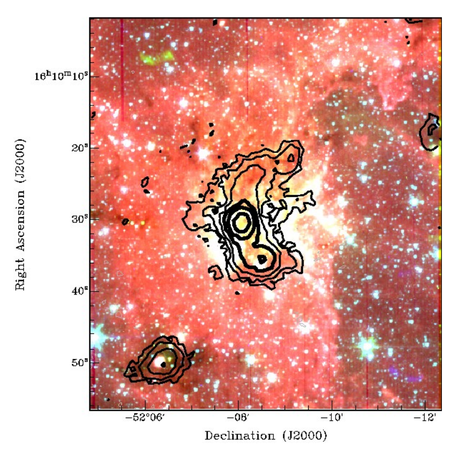
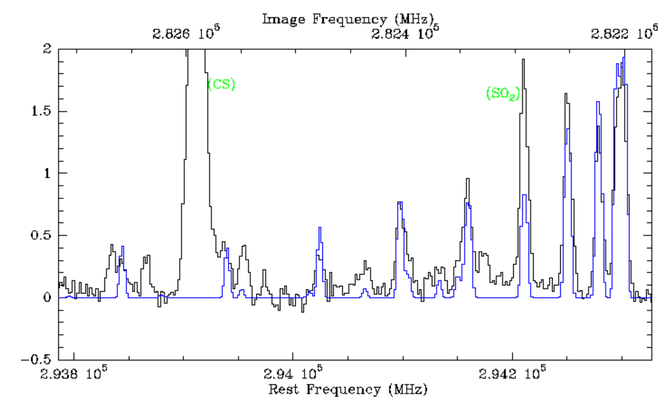


Figure and contours same as for 16060-5146 with σ=50mJy/beam. 16065-5158 is located in the middle of a large region where the extend of the 8 µm dust emission gives evidence that star formation has already happened in the surroundings of 16065-5158. As with 16060-5146, further overlaps between the Spitzer and LABOCA emission hint at clustered star formation.



Spectra are created the same as for 16060-5146. 16065-5158 shows two components, an extended envelope with temperature T_{ex}= 30 K and a compact hot core with T_{hc}= 220 K.

One can see in the spectrum how blends with lines from both sidebands influence the quality of the modelling.

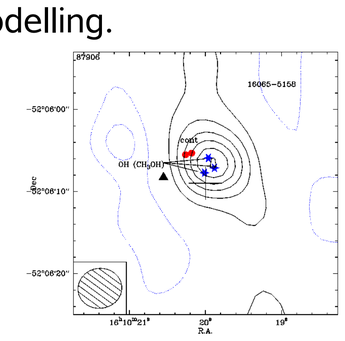


Figure and marks same as for 16060-5146 with σ=8mJy/beam. In the high resolution data of 16065-5158 one can see extended emission and an association with very strong OH masers (Caswell et al. 1998,MNRAS 297,215).

12326-6245:

d=4.0 kpc, L=2.7x10^{5}L$_\odot$, M=2.4x10^{3}M$_\odot$

(L, M from Faúndez et al. 2004)

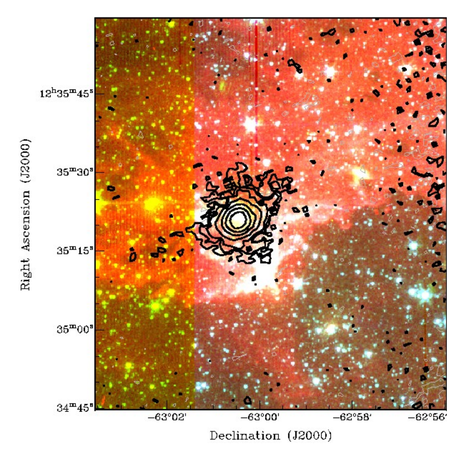
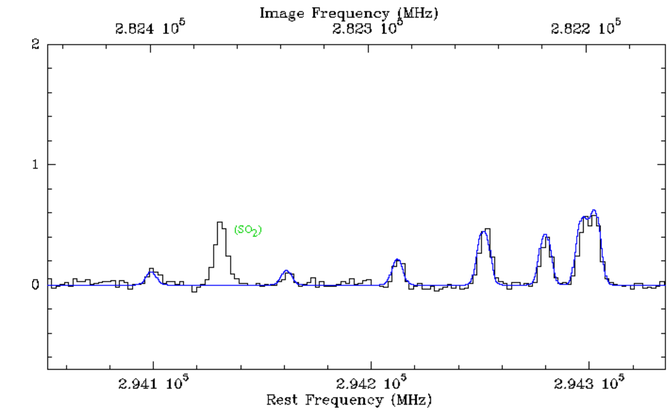


Figure and contours same as for 16060-5146 with σ=40mJy/beam. Unlike the previous two sources, 12326-6245 does not show any signs of cluster formation in the LABOCA data, but much like 16065-5158, it is located in an area that has seen a lot of star formation already.



Spectra are created the same as for 16060-5146.

12326-6245 shows two components, an extended envelope with T_{ex}= 20 K and a compact hot core with T_{hc}= 100 K.

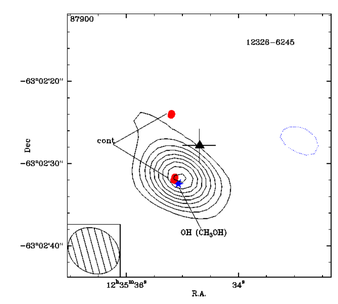


Figure and marks same as for 16060-5146 with σ=0.04Jy/beam. In this high resolution data of 12326-6245 one can see the rather compact 3mm continuum and an association with OH masers and cm continuum positions.

Outlook:

These three sources are part of a survey of 40 southern massive star forming regions. We are using APEX to study a large sample of sources in several frequency setups covering the whole ground accessible submm window with the aim to obtain their physical and chemical conditions and prepare a well studied sample of sources to be followed up with ALMA and Herschel/HIFI.

Discussion:

On this poster, we present the study of three high mass star forming regions, from their dust continuum environment down to high resolution spectroscopy and imaging of the hot cores. Comparing our sources with typical hot cores of the northern hemisphere, we find that 16060-5146 and 12326-6245 show comparable temperatures (cf. Hatchell et al. 1998,A&ASS 133,29; Olmi et al. 1996,A&A 307,599), while 16065-5158 seems to be significantly warmer. 16060-5146 with it's two cores in the 3mm data and the multiple peaks in the 345 GHz continuum data seems to be an example of triggered cluster formation, due to it's apparent location at the edge of a large shell.

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