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The formation of high-mass binary systems by core/disk fragmentation: very early results

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Abstract. We are carrying out a survey of bright, known high-mass star-forming regions at 0.06″ (100-200 AU) at 230 GHz. All twenty fields have been observed in the compact configuration (~0.3″; 500-1000 AU). Interestingly, at 0.3″ resolution some dust cores fragment in smaller condensations and others do not. Some condensations inside a core have completely different chemistry, likely reveling different evolutionary stages. To address the main science goal (if high-mass binaries are formed by core/disk fragmentation) we require the long baseline observations (not observed yet). Here, we present the continuum emission for 6 sources and the example spectra for one source.

1. Introduction

Different mechanisms have been suggested to explain the binarity of high-mass stars: core fragmentation, disk fragmentation, and multiple-body interactions. So far, there is no observational constraints to assess their importance.

2. Sample selection

We have selected 20 targets containing >30 massive young stellar objects (MYSOs) with fluxes >0.1 Jy at 230 GHz. All targets have been previously observed with interferometers.

The selected sources are: NGC 6334 I(N), W33A, G35.03+0.35 A, G35.20-0.74 N, IRAS 18162-2048, IRAS 18151-1208, IRAS 16547-4247, IRAS 16562-3959, NGC6334 I, G034.43+00.24, G11.11-0.12, G335.579-0.272, IRDC 18223-1243, IRAS 18089-1732, G10.62-0.38, G5.89-0.37, IRAS 18182-1433, G29.96-0.02, G333.23-0.06, and G11.92-0.61

Half of the MYSOs have been associated with compact cm emission. We therefore can split the sample in ”young” (no cm emission) and ”old” (with cm emission). Bolometric luminosities ($L_\odot$) range from 10^3 to 4×10^5 $L_\odot$.

3. Preliminary results & conclusions

Cores nearby (<5,000 AU) shows very different chemistry (Figure1). This may suggest sequential star formation.

Some sources are highly fragmented while others are dominated mostly by a single source (Figure 2). Contrary to the lack of rotating structures recently found in IRAS 18566+0408 (at 0.4″; Silva et al. 2017), we do find velocity gradients, likely revealing disk-like structures at the MYSO positions (similar to Guzmán et al. 2014; Sánchez-Monge et al. 2014; Beltrán et al. 2014).

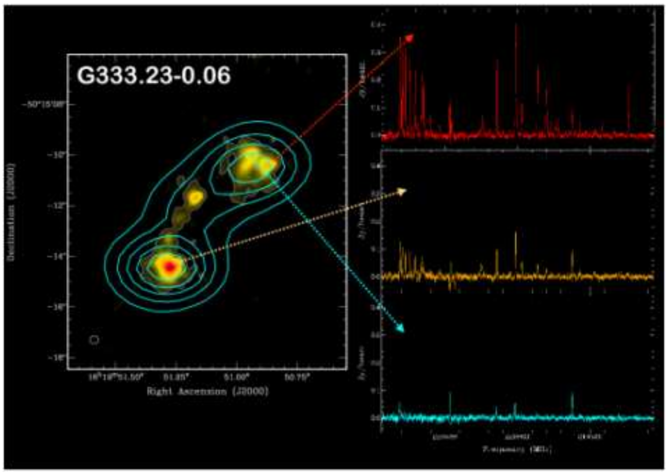

Fig. 1. Color image is the ALMA continuum emission at 230 GHz. Cyan contours are 3 mm continuum from ATCA (2.3″; Stephens et al. 2015). Spectra at different positions reveal different chemistry, likely due to different evolutionary stages.

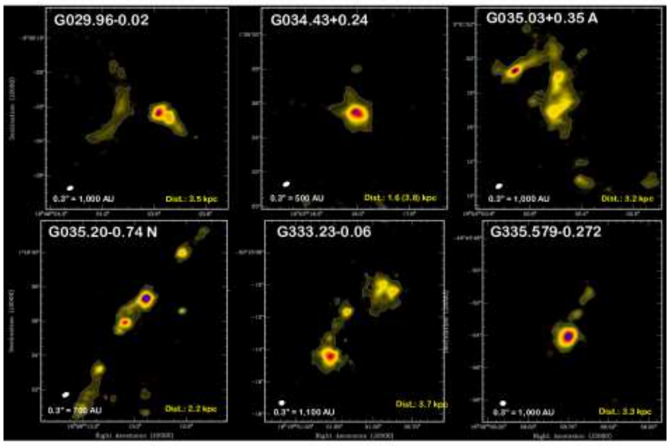

Fig. 2. Color image is the ALMA continuum emission at 230 GHz (~0.3″ angular resolution). The grey contours show the emission at 5σ. Self-calibration has not been performed yet. Images are dynamic range limited. G029.96-0.02: Beltrán et al. (2011). G034.43+0.24: Rathborne et al. (2011), Sanhueza et al. (2010). G035.03+0.35 A: Beltrán et al. (2014). G035.20-0.74 N: Sánchez-Monge et al. (2014). G333.23-0.06: Stephens et al. (2015). G335.579-0.272: Avison et al. (2015).

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