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The feedback of Herbig Ae/Be stars

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Abstract. To study the molecular environment and feedback of Herbig Ae/Be (HAB) stars, We mapped four HAB stars' nearby region with CO (1-0) and its isotopes by the 13.7m millimeter telescope of Purple Mountain Observatory. The results show that new stars are forming in the nearby molecular cores and HAB stars give them an extra pressure. On the other hand, HAB stars are the main heat source of their surrounding gas.

Keywords. ISM: molecules, ISM: jets and outflows, stars: pre–main-sequence.

1. Introduction and observation

Massive star formation is not a simple scaled-up version of low-mass star formation (Zinnecker *et al.* 2008). The detailed studies of their circumstellar environment and their feedback of young massive stars are espcially important for understanding their formation and evolution process. However, most massive stars are far away from us and deeply embedded in the clouds, which add to the difficulties of detailed study.

As intermediate-mass pre-main sequence stars, Herbig Ae/Be (HAB) stars are visible at optical and infrared band and share similar circumstellar properties with massive stars, which will bridge the transition between the different processes of low-mass and high-mass star formation. Could they also link the feedback of the two kinds of young stars? To investigate this question, we made an mapping observation towards four HAB stars with ^{12}CO, ^{13}CO and C^{18}O (J=1-0) lines by the 13.7m telescope of Purple Mountain Observatory from 2011 to 2013. The four HAB stars are BD46, LkHα208, LkHα215 and Par22, which are selected from the previous work of Liu *et al.* (2011).

2. Results and dicussion

Strong ^{12}CO and ^{13}CO emission can be detected in the four regions but very week or no C^{18}O signature can be found there. Fig. 1 shows the ^{13}CO velocity-integrated contours overlaid on the WISE 22μm (red), 12μm (green), 3.4μm (blue) composite colour image. Dense molecular cores can be found beside these HAB stars with column density $3\sim60\times10^{21}$ cm^{-2} and exciting temperature 10$\sim$30K. The WISE infrared emission is relatively weak near those molecular cores and IR point sources can be found in some cores. A bipolar outflow was found aroung the core beside BD46 3471. Those clues indicate that young stars are forming beside HAB stars whose evolution will be impacted by HAB stars. And it is obviously that HAB stars give an extra pressure to the surrounding gas from Fig. 1. Fig. 2 shows the distibution of exciting temperature witch can be regard as kinetic temperature in the LTE assumption (Garden *et al.* 1991). We can see that these young stars are the main heat source of the surrounding gas, which will increase the Jeans mass of molecular cores.

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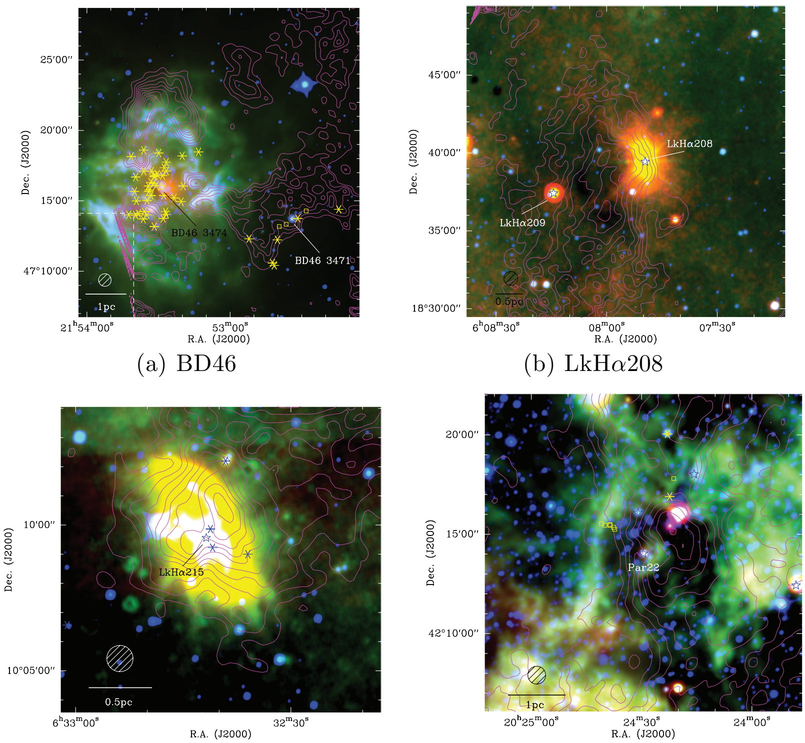
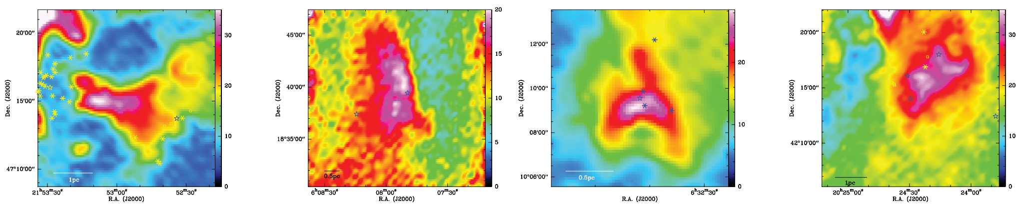


(a) BD46 (b) LkHα208

(c) LkHα215 (d) Par22

Figure 1. The ^{13}CO velocity-integrated contours overlaid on the WISE 22μm (red), 12μm (green), 3.4μm (blue) image. HAB stars are labelled with blue star symblos. The asterisks mark other emission-line stars and yellow squares stand for Herbig-Haro objects. The left-bottom corner of BD46 labelled by dash lines is out of our observation range.



(a) BD46 (b) LkHα208 (c) LkHα215 (d) Par22

Figure 2. The distibution of exciting temperature of CO. The labels are same as Fig 1. The unit of the colourbar is Kelvin.

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