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A Molecular Disk Survey of Low-Mass Stars in the TW Hya Association

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Abstract. We have carried out an ALMA Cycle 2 survey of 15 confirmed or candidate low-mass ($< 0.2M_{\odot}$) members of the TW Hya Association (TWA) with the goal of detecting line emission from CO molecular gas and continuum emission from cold dust. Our targets have spectral types of M4-L0 and hence represent the extreme low end of the TWA's mass function. The survey has yielded a detection of ^{12}CO(2–1) emission around TWA 34. This newly discovered ∼10 Myr-old molecular gas disk lies just ∼50pc from Earth.

Keywords. open clusters and associations: individual (TWA) — protoplanetary disks — stars: evolution — stars: pre-main sequence

1. Introduction

Beginning with the identification of the TW Hya Association (TWA) several stellar associations with ages ∼8–200 Myr have been identified in close proximity to the Earth (Zuckerman & Song 2004, Torres *et al.* 2008). These young moving groups serve as excellent laboratories to explore the evolution of stellar and planetary properties. Of particular interest is the growing number of M dwarfs identified as members of these groups and how the lifetimes of protoplanetary disks orbiting such low-mass stars compare with those of higher mass members.

To this end, we have carried out an Atacama Large Millimeter Array (ALMA) survey of 15 recently identified very low-mass members or candidate members of the TWA. Our sample is drawn from Looper *et al.* (2007, 2010a,b), Looper (2011), Shkolnik *et al.* (2011), Rodriguez *et al.* (2011), Schneider *et al.* (2012), and Gagné *et al.* (2004). Several are known to host dusty, circumstellar disks as inferred from WISE and Herschel infrared excesses, but none had yet been observed with ALMA.

Our ALMA Cycle 2 program (2013.1.00457.S) consisted of observations of continuum dust emission at 230 GHz and observations of the ^{12}CO(2–1) and ^{13}CO(2–1) emission lines with a velocity resolution of 0.6 km/s. The requested angular resolution was 1.6″ as we did not aim to resolve any emission. We reached a sensitivity of 0.05 mJy/beam in the continuum and 5 mJy/beam per 0.6 km/s channel in ^{12}CO and ^{13}CO. Calibration and cleaning was performed by the ALMA staff with CASA version 4.2.2.

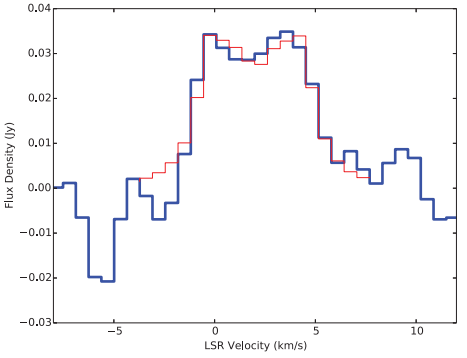

Figure 1. ^{12}CO(2–1) emission line profile of the gas around TWA 34, the only target in our sample with detected CO gas. The red, thin line is a best-fit Keplerian profile.

2. Results

We report unambigious 1.3mm continuum detections of four objects (TWA 30B, 32, 33, 34). We only detected ^{12}CO emission toward TWA 34. In Fig. 1, we show the integrated line profile of the CO emission, Hanning smoothed with a kernel size of 3 channels. To characterize this emission, we fit a parametrized Keplerian model as described in Kastner *et al.* (2008). We obtain an integrated intensity of 0.34 ± 0.03 Jy km/s. Combined with our 3-σ upper limit on ^{13}CO emission of $\sim$0.03 Jy km/s, we estimate a gas mass of $\sim$0.2 M_E, following the methods of Kastner *et al.* (2008) and assuming T_{ex}=40 K, a ^{12}C:^{13}C ratio of 89, and a CO:H_2 ratio of 10^{-4}.

With our best-fit Keplerian profile, we can estimate a systemic velocity for the CO emission. In the barycentric frame of reference, this corresponds to 13.3 ± 0.1 km/s. This is consistent with membership in TWA.

3. Conclusions

We have carried out an ALMA survey of 15 low-mass TWA members and candidates to search for molecular gas in the form of ^{12}CO and ^{13}CO as well as continuum dust emission. We detect continuum emission from four objects. Only one system, TWA 34, shows signatures of molecular gas in its disk in the form of ^{12}CO (2–1) emission. TWA 34 is a new low-mass star hosting a molecular gas disk at just 50 pc from Earth. The systemic velocity we measure for the circumstellar CO around TWA 34 is consistent with membership in the TWA.

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