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A First Look at the Disk Population in the Auriga-California Molecular Cloud

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Abstract. The Auriga-California Molecular Cloud (AMC) is one of two nearby (within 500 pc) giant molecular clouds, the other being the Orion A Molecular Cloud (OMC). We aim to study the properties of circumstellar disks in the AMC to compare the planet formation potential and processes within the AMC to those for other clouds. A first look with measurements from *Spitzer* observations suggests that AMC disk properties, such as the distribution of disk luminosities and the evolution of the mid-IR excesses, are not vastly different from those in other regions. Follow-up observations in the submm, mm and cm can be used to measure disk masses and the degree of grain growth from spectral slopes to more completely characterize the disk population.

Keywords. stars: formation, planetary systems: protoplanetary disks, ISM: clouds

1. Introduction

The AMC was only recently identified as being one contiguous cloud (Lada *et al.* 2009). Consequently, it is relatively unstudied compared to other star-forming regions in the Gould Belt. Although the AMC is similar in mass (10^5 $M_\odot$), size (80 pc) and distance (∼450 pc) to the OMC, its star formation properties are quite different (Lada *et al.* 2009). The AMC is forming 20x fewer stars than the OMC as well as forming less massive stars. The OMC has 20 OB stars whereas the AMC has only one B star, LkHα 101. This raises the question of how the reservoir of material in the cloud relates to that used for the formation of star systems.

Spitzer observations of the AMC have been used to identify 166 young stellar objects (YSOs) in the cloud (Broekhoven-Fiene *et al.,* submitted). A substantial number of these (91/166) are Class II sources, i.e. likely disk hosts with no remnant circumstellar envelope. The Class II sources define our target sample of potential protoplanetary disk hosts in the AMC.

2. First Look at Disk Properties with *Spitzer*

Some disk properties can be measured from the *Spitzer* observations by modelling the spectral energy distributions of Class II and Class III YSOs. This is done by fitting a model stellar spectrum to the observed short wavelength photometry (optical and near-infrared). The excess emission that is observed in the infrared is attributed to dust emission from the disk. By determining the wavelength range of excess emission, the ratio of the disk and stellar luminosities is estimated (see Fig. 1). The distribution of disk

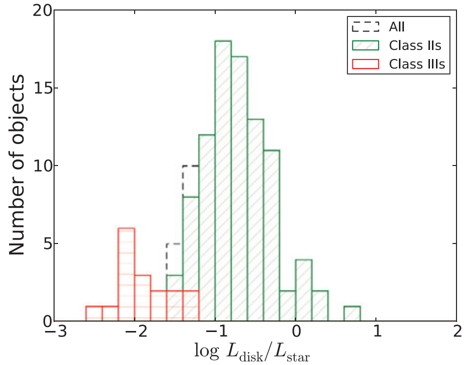

Figure 1. The ratio of the disk luminosity to the stellar luminosity for Class II and Class III sources in the AMC. (Figure adapted from Broekhoven-Fiene *et al.,* submitted.)

luminosities is similar for disk populations in other clouds observed by the *Spitzer* Gould Belt Survey suggesting, at first glance, the disk populations appear similar regardless of the cloud properties (Broekhoven-Fiene *et al.,* submitted).

3. Current questions/future work

We want to investigate how the disk population in the AMC compares to disk populations in other Gould Belt clouds and how the disks in the environment of LkHα 101 compare to those further away along the adjoining filament. Measuring the disk masses and the degree of grain growth by measuring the spectral slope is the best way to target the total amount of material in the disk available for planet formation. The disk mass distribution in the AMC can then be directly compared to other disk populations, such as Taurus (Andrews & Williams 2005), ρ Ophiucus (Andrews & Williams 2007) and Orion (Mann & Williams 2009).

The AMC was mapped by *Herschel* at 70, 160, 250, 350, and 500 μm (see Harvey *et al.* 2013) and part of the cloud is also being mapped with SCUBA-2 by the JCMT Gould Belt Legacy Survey (PI Jenny Hatchell) at 450 and 850 μm. Submillimeter fluxes from these observatories provide preliminary measurements of the disk masses for a handful of sources. Detections at the longer wavelengths by both *Herschel* and SCUBA-2 identify the targets that are likely the brightest sources for potential follow-up observations at longer wavelengths.

ALMA and the VLA are optimal observatories to use to both measure disk masses in the AMC and estimate the degree of grain growth, while constraining the contribution from free-free emission. Furthermore, the sensitivity of the these observatories is advantageous given the distance to the AMC ($\sim$ 450 pc). ALMA Cycle 0 observations of protoplanetary disks in the OMC (PI Rita Mann) demonstrate ALMA's ability to observe disks at the distance of the OMC and the AMC.

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