

ACCRETION RATES IN YOUNG LOW MASS STARS. A STELLAR CLUSTERS AND ASSOCIATIONS COMPARISON.

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ABSTRACT

We present accretion mass rates for a collection of stars belonging to young open clusters and associations with ages between 10 and 30 Myr. All measurements were made with the same methodology based on photometric excesses in the U band. Accretion rates in clusters are in agreement with similar others found in the literature, in the sense that a general trend shows the end of accretion in clusters at 10 Myr. Stellar associations present however, a different trend indicating that their accretion rates depend on the intrinsic histories of each association. In particular, for the TW Hya association with 8 Myr, the rates compare well with the clusters data. For the Beta Pic association (11 Myr) the accretion rates are very low, in the order of $3 \times 10^{-11} M_{\odot}/yr$. At 16 Myr we found however, a notable difference. A quarter of the low mass post-T Tauri stars of the two older subgroups of the Sco-Cen OB association present relatively large accretion rates of the order of $4 \times 10^{-9} M_{\odot}/yr$. This indicates that sufficient gas could exist in the disks of these stars to form giant planets even at an age of 16 Myr. The Horologium association (30 Myr) presents again low accretion rates of $\sim 8 \times 10^{-10} M_{\odot}/yr$, indicating a probable general end of accretion before or at this age. This end of accretion appears to be characterized by a sudden evaporation of the internal parts of the disks by the influence of the direct UV radiation of the central star when mass accretion is low. This rapid mass loss disk wind can be result of a gradually intensified stellar chromospheric radiation originated by the spin up of stellar rotation that is present at least up to ~ 30 Myr.

1. BACKGROUND

Circumstellar disks, a natural product of star formation, have a complex evolution due to their relative independent and different gas and dust evolutionary histories. Whereas the gas component appears to dissipate on a short time scale of the order of ~ 10 Myr, dust lifetimes can have practically no limits. Concerning the gas dissipation lifetimes of disks around low mass stars - the subject of this work - the main mechanism for the gas loss is the accretion onto the central star. Gas can also be ejected from the system via a disk wind provoked by direct UV radiation of the central star. This gas loss by a disk wind is however much less important than accretion. Only when accretion is in a final stage, the loss by a wind is the dominant source of gas loss for a short episode of $\sim 10^5$ yr (Wolk & Walter 1996). In any case, the gas can be also retained in giant planets formed in the disk. Thus, the measurement of the gas reservoir is not only important to determine the time scale of giant planets formation, but consequently the respective scale

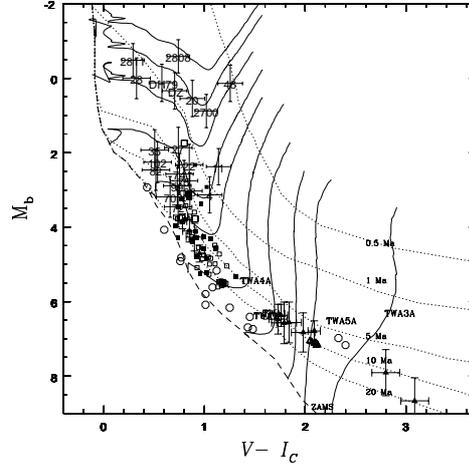


Figure 1: H-R Diagram for dereddened stars. Numerical symbols correspond to stars in the clusters Berk87, Biu2, NGC884 and NGC1502. The other symbols indicate post-T Tauri stars in the associations: TWA (~ 8 Myr), BPA (~ 11 Myr, triangles), UCL (15-22 Myr, filled squares), LCC (17-23 Myr, open squares) and Horologium (~ 30 Myr, open circles). The MS is indicated with a dashed line. Isochrones and evolutionary tracks correspond to the model of Siess et al. (2000). From the left to the right: 0.3, 0.4, 0.5, 0.7, 1.0, 1.5, 2.0, 3.0, 4.0 and 5.0 M_{\odot} for a metallicity of $Z=0.02$

for the formation of terrestrial planets as well.

2. OBSERVATIONS

A sample of 21 young stars belonging to four open clusters (Berkeley 87, Biurakan 2, NGC 884 and NGC 1502) in the Northern Hemisphere have been observed in August 2005 with the 0.8m telescope at the Wendenstein Observatory (Germany) using the CCD camera MONICA. Long and short exposures were taken in the respective regions covering a FOV of $\sim 8'$ in different optical filters. Data for stellar associations were acquired with the 0.6 m Zeiss telescope at the Pico dos Dias Observatory (Brazil) and its FOTRAP detector. These observations were made during the SACY survey (Search for Associations Containing Young stars) (Torres et al. 2007). The observed associations are: TWA, BPA, the low mass components of the older subgroups of the Sco-Cen OB association: Lower Centaurus Crux (LCC) and Upper Centaurus Lupus (UCL), both with an age of ~ 16 Myr and the Horologium Association with an age of ~ 30 Myr (Torres et al. 2006).

Reddening and distances for clusters and associations were

