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DYNAMICAL 3-D EVOLUTION OF NEARBY YOUNG MOVING GROUPS

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Using 3-D trajectories of probable members of previously photometrically and spectroscopically studied stellar moving groups β Pictoris, TW Hya, η Chamaeleontis, ϵ Chamaeleontis we confirmed the star memberships and determined dynamical ages. Only stars with complete kinematical data (Hipparcos astrometry and radial velocities) were taken into consideration. The observed temporal sequence of group formation is consistent with the existence of a wave of star formation in the Scorpio-Centaurus OB association region.

The aim of this work is the study of the temporal evolution of young, nearby stellar groups on the basis of the 3-D motions of their members. We define a moving group as a set of stars with currently similar kinematics and which were confined within a 3-D region at the epoch of formation. An important issue in the study of these groups is the establishment of their dynamical age defined as the first orbital confinement when the motion of each star is is considered in the past. This procedure also sets the size of the confinement region. An important point bearing on the group formation is whether the so determined dynamical age is consistent with the nuclear (H-R) age of the group.

In the present work we focus on the groups β Pictoris, TW Hydrae, η and ϵ Chamaeleontis, all related to the Scorpio-Centaurus OB Association. We consider the motion of the stars with complete (Hipparcos) kinematical data in the general gravitational field of the Galaxy. This is modeled as the total field generated by the structural componenets of the Galaxy: bulge, disk and halo (Ortega et al. 2002). Our results give the following dynamical ages: 11.2 $\pm$ 0.3 Myr for β Pictoris Association (Ortega et al. 2002, 2004), 8.3 $\pm$ 0.8 Myr for TW Hydrae Association (de la Reza et el. 2006) and 6.7 Myr for η and ϵ Chamaeleontis associations (Jilinski et al. 2005) showing a sequence of succesive episodes of group formation. Plausibly, this process may have been triggered by the joint action of expanding shells and supernovae events related with and occuring in the older Scorpio-Centaurus subgroups, Lower Centaurus Crux (LCC) and Upper Centaurus Lupus (UCL) both with a mean age of about 18 Myr. There is evidence for both of these mechanisms. In fact, shells are observed forming loops around UCL and LCC. Some pieces of direct and indirect evidence for supernovae triggering can be mentioned:

a) absence of O type stars in UCL and LCC;

b) existence of the local bubble within which the Sun is currently embedded;

c) absence of interstellar clouds in UCL and LCC, blown up by the action of stellar winds and by powerful supernovae events;

d) runaway stars of B type have been found with probable origin in the Sco-Cen Association.

It is also worth mentioning that the above found dynamical ages of the groups are not only consistent with their H-R determined ages but are more precise. The use of these dynamical ages introduces then a new and more detailed temporal scale which can be employed in studies of planetary formation and evolution of circumstellar disks in these associations (de la Reza et al. 2006).

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