STRUCTURAL PARAMETERS OF YOUNG STAR CLUSTERS: FRACTAL ANALYSIS

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A unified view of star formation in the Universe demand detailed and in-depth studies of young star clusters. This work is related to our previous study of fractal statistics estimated for a sample of young stellar clusters (Gregorio-Hetem et al. 2015, MN-RAS 448, 2504). The structural properties can lead to significant conclusions about the early stages of cluster formation: 1) virial conditions can be used to distinguish warm collapsed; 2) bound or unbound behaviour can lead to conclusions about expansion; and 3) fractal statistics are correlated to the dynamical evolution and age. The technique of error bars estimation most used in the literature is to adopt inferential methods (like bootstrap) to estimate deviation and variance, which are valid only for an artificially generated cluster. In this paper, we expanded the number of studied clusters, in order to enhance the investigation of the cluster properties and dynamic evolution. The structural parameters were compared with fractal statistics and reveal that the clusters radial density profile show a tendency of the mean separation of the stars increase with the average surface density. The sample can be divided into two groups showing different dynamic behaviour, but they have the same dynamic evolution, since the entire sample was revealed as being expanding objects, for which the substructures do not seem to have been completely erased. These results are in agreement with the simulations adopting low surface densities and supervirial conditions.

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A SPECKLE SURVEY OF SOUTHERN HIPPARCOS VISUAL DOUBLES AND GENEVA-COPENHAGEN SPECTROSCOPIC BINARIES

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The prospect of exquisite-precision parallaxes that will be enabled by the Gaia satellite dramatically changes the landscape of observational stellar astrophysics: If one considers the Hipparcos double stars that lie within 250 pc of the Solar system, a parallax determined by Gaia would yield an uncertainty under 1% for all these objects. In this volume, there are 591 Hipparcos double star discoveries and 160 spectroscopic binaries from the Geneva-Copenhagen spectroscopic survey in the declination range of $-20°$ to $-90°$. These two samples are important as a source of new binaries from which we will derive masses, component luminosities, and effective temperatures in the coming years. The northern hemisphere counterpart of these objects have been systematically observed at the WIYN Telescope by Horch and collaborators (Horch, E. P., van Altena, W. F., Howell, S. B., Sherry, W. H., & Ciardi, D. R. 2011, AJ, 141, 180). On the other hand, Tokovinin has shown the ability of HRCam at the CTIO/SOAR 4m telescope for binary star research. In 2014 we started a speckle survey with SOAR+HRCam that will complement and significantly extend those previous efforts, allowing us to compile a unique all-sky, volume-limited speckle survey of these two primary samples. So far 12 nights (spread over 3 semesters) have been granted through the Chilean reserved time, with lots of binaries confirmed, many new binaries found, and with several multiple systems discovered (Tokovinin et al., 2015, AJ, 150, 50 and 2016, AJ, 151, 153). Our survey, when complete, will open the door to many sensitive tests of stellar evolution theory, and a large number of new points on the MLR. With this we will truly be able to investigate effects such as metallicity and age on the MLR for the first time. In cases where one component has evolved off the main sequence, age determinations will also be possible.

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