



Studies in Galactic Clusters

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Introduction

Galactic star clusters are one of the important constituents of Milky Way. They form from dust and gas of the disc, so are considered to be key objects for studying star formation process. Fundamental parameters of these clusters such as age, distance and reddening allow us to understand many astrophysical problems related to the structure and evolution of the Galactic disc. Distribution of stellar masses at birth quantifies the conversion of gas into stars in galaxies. Therefore, measuring Initial mass function figures out star formation history and in-turn the evolution of star clusters and galaxies. Observations show that more massive stars preferentially populate the inner part of the cluster, resulting the evolution towards energy equipartition in stellar system. Based on CCD UBVRI observations from 104 cm Sampurnanand Telescope, ARIES, Nainital, we derived fundamental parameters, structural parameters, mass function and mass segregation of three young (age ~ 10 Myr) open star clusters NGC 2129, NGC 1502 and King 12.

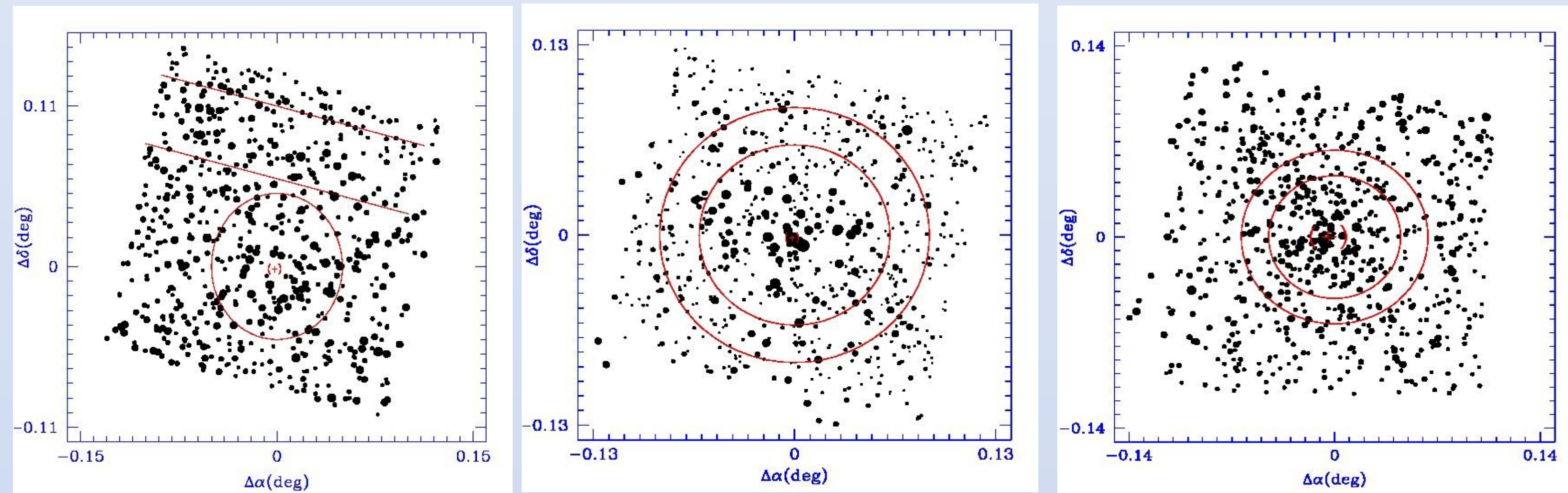
Observational Techniques

The 104-cm Sampurnanand Telescope celebrating its Golden Jubilee has been the main source of our observations. UBVRI Johnson Cousins CCD photometric images were obtained using thinned back-illuminated CCD camera mounted at f/13 Cassegrain focus of the 104 - cm Sampurnanand reflector telescope of Aryabhata research Institute of Observational Sciences (ARIES),



Nainital. Size of the CCD chip is 2048x 2048 corresponding to 0.36 arcsec covering 12.7 X 13 arcmin² on the sky. 2 X 2 binning mode is taken for improving the S/N ratio. High quality CCD data going down to V = 22.0 mag has been observed. Photometric error for standard field was obtained as ≤ 0.01 mag at V < 19.

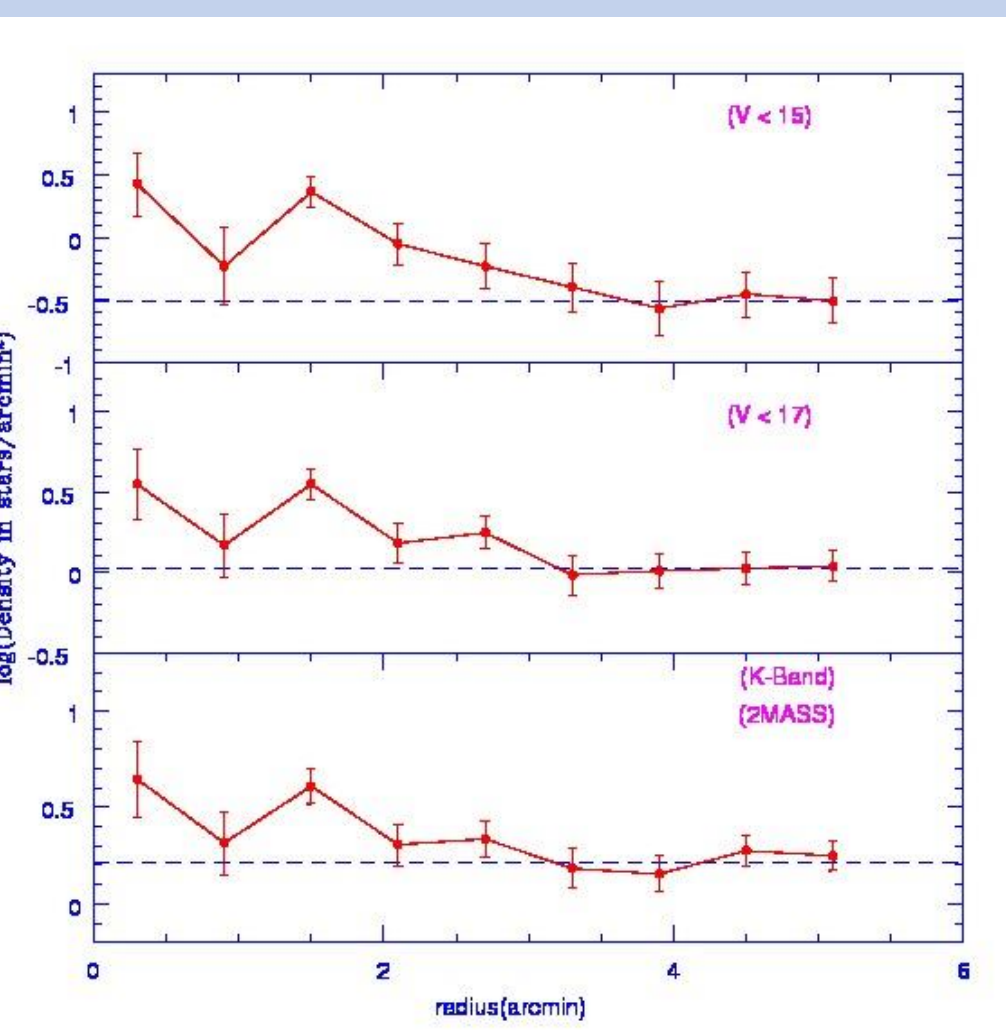
Selected Object, Location and ID chart



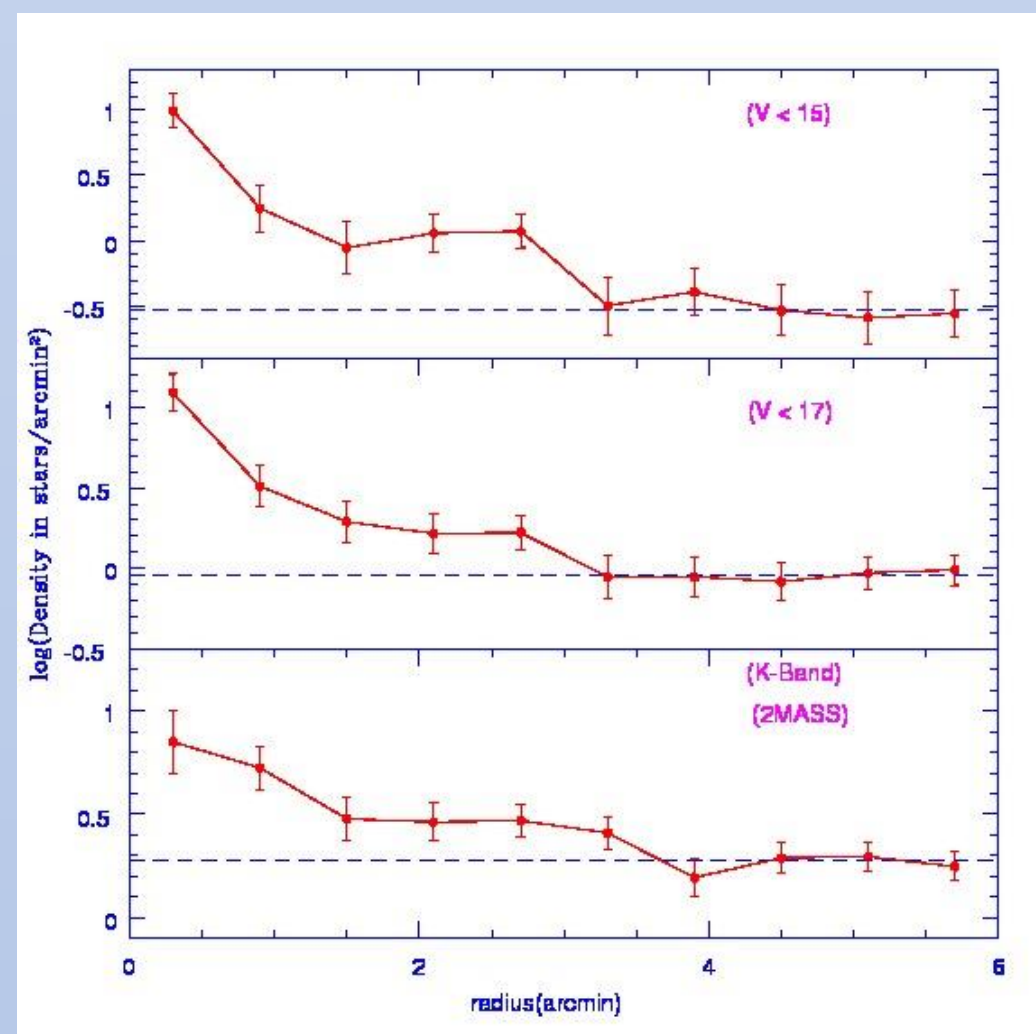
NGC 2129 located in the Gemini constellation inside the local spiral arm
NGC 1502 located in the northern constellation of Cassiopeia near the Perseus arm of the Galaxy.
King 12 is located in the northern hemisphere in the outer border of the Orion spiral arm.

For NGC 1502 and King 12 field region refers to be the annulus around the cluster region and that for NGC 2129, the rectangle above the cluster region.

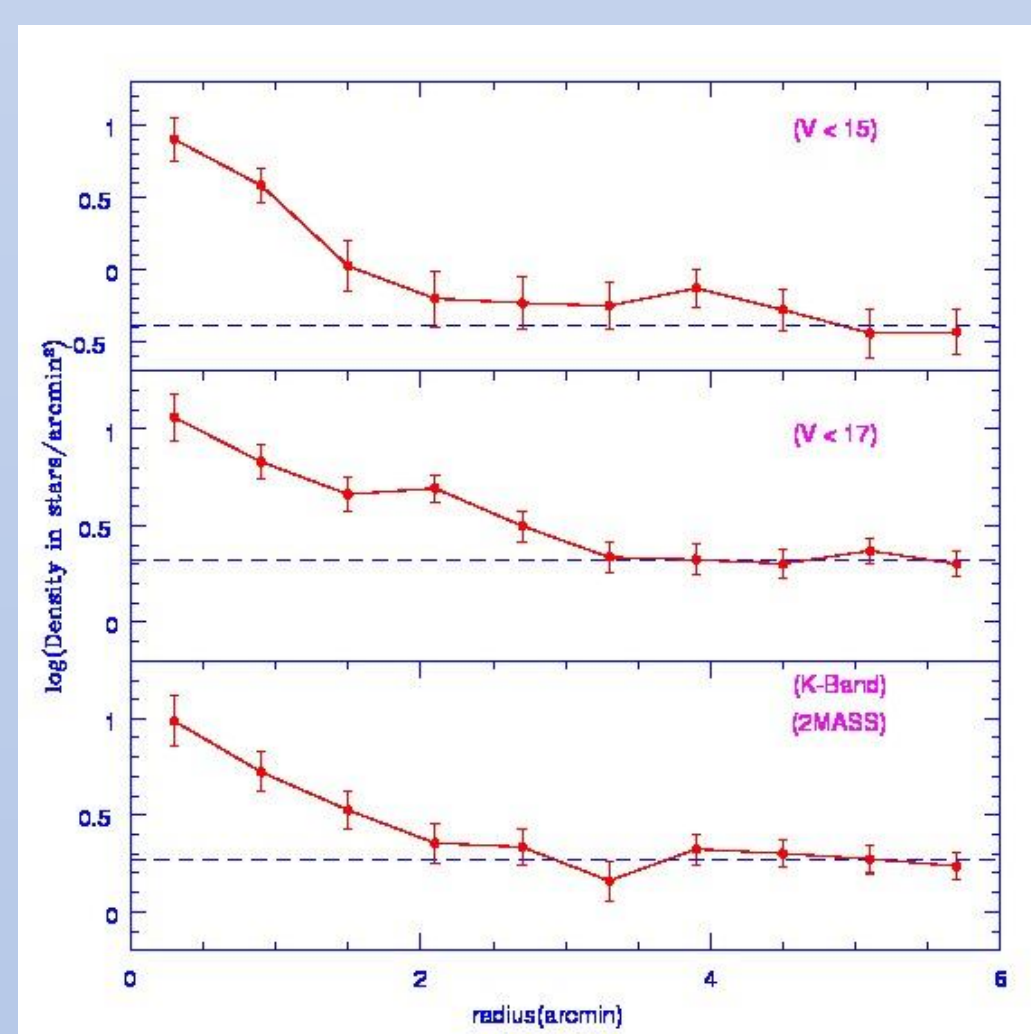
Results



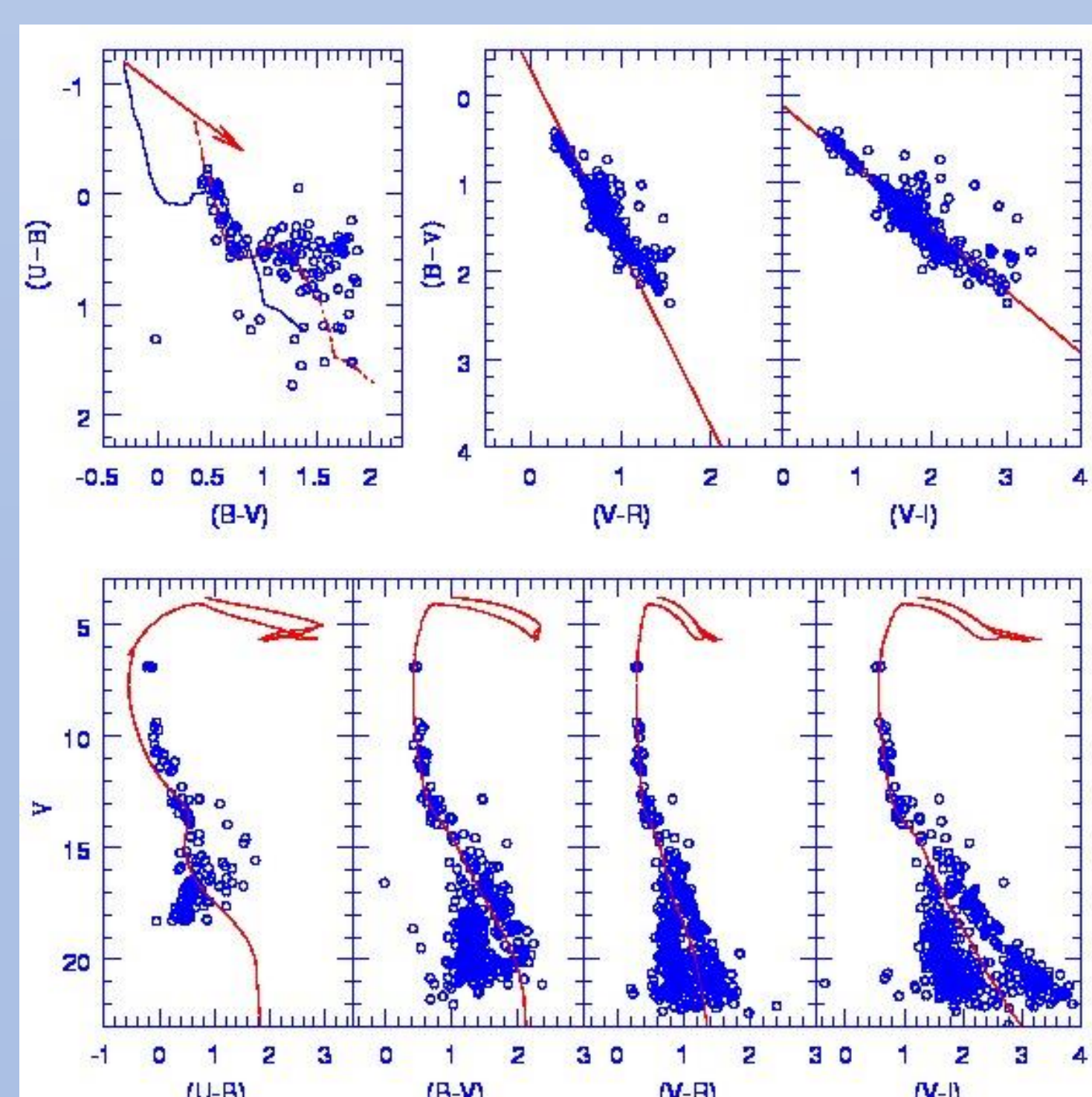
Radius = 3.9 pc



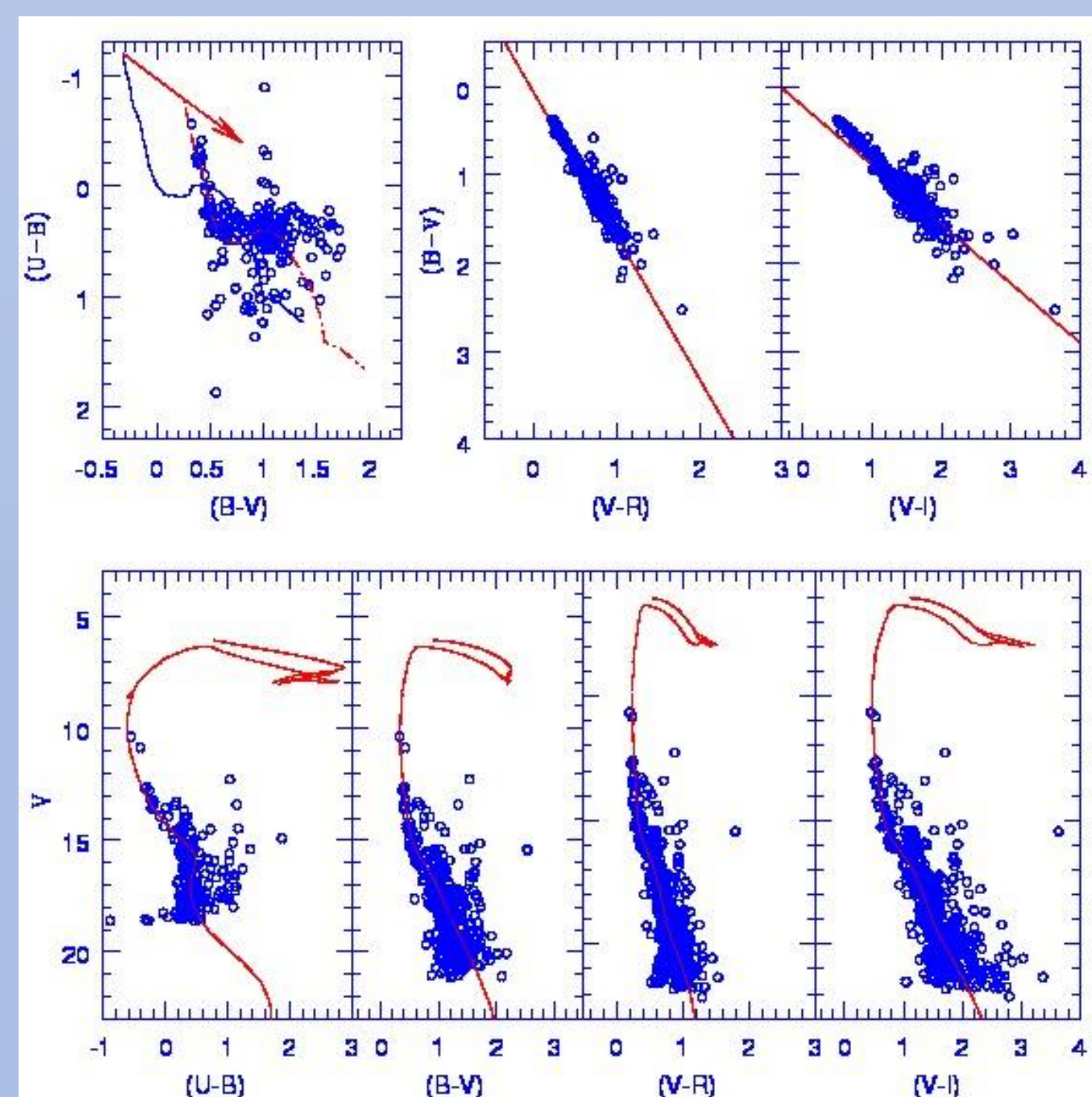
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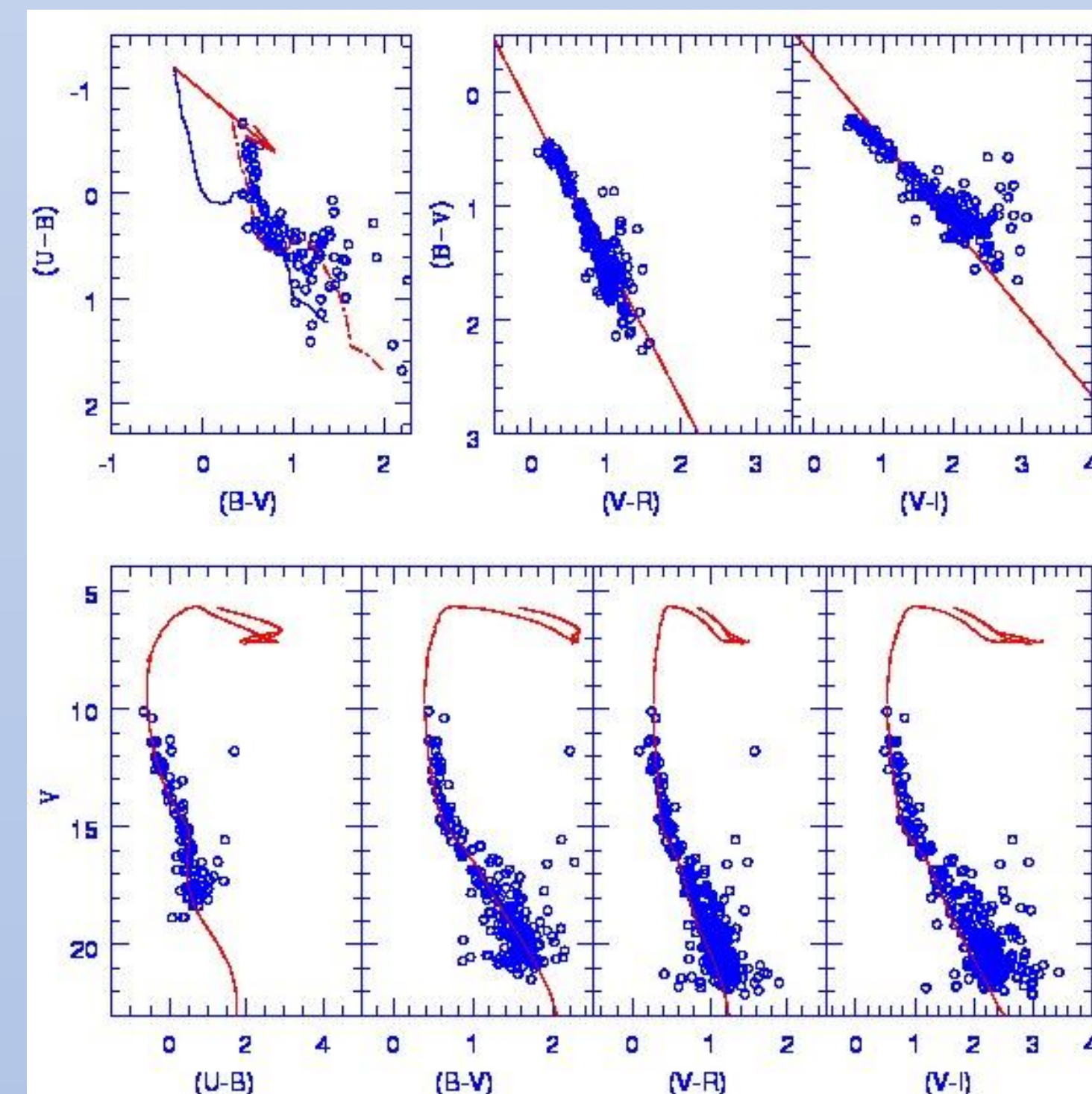
Radius = 1.7 pc



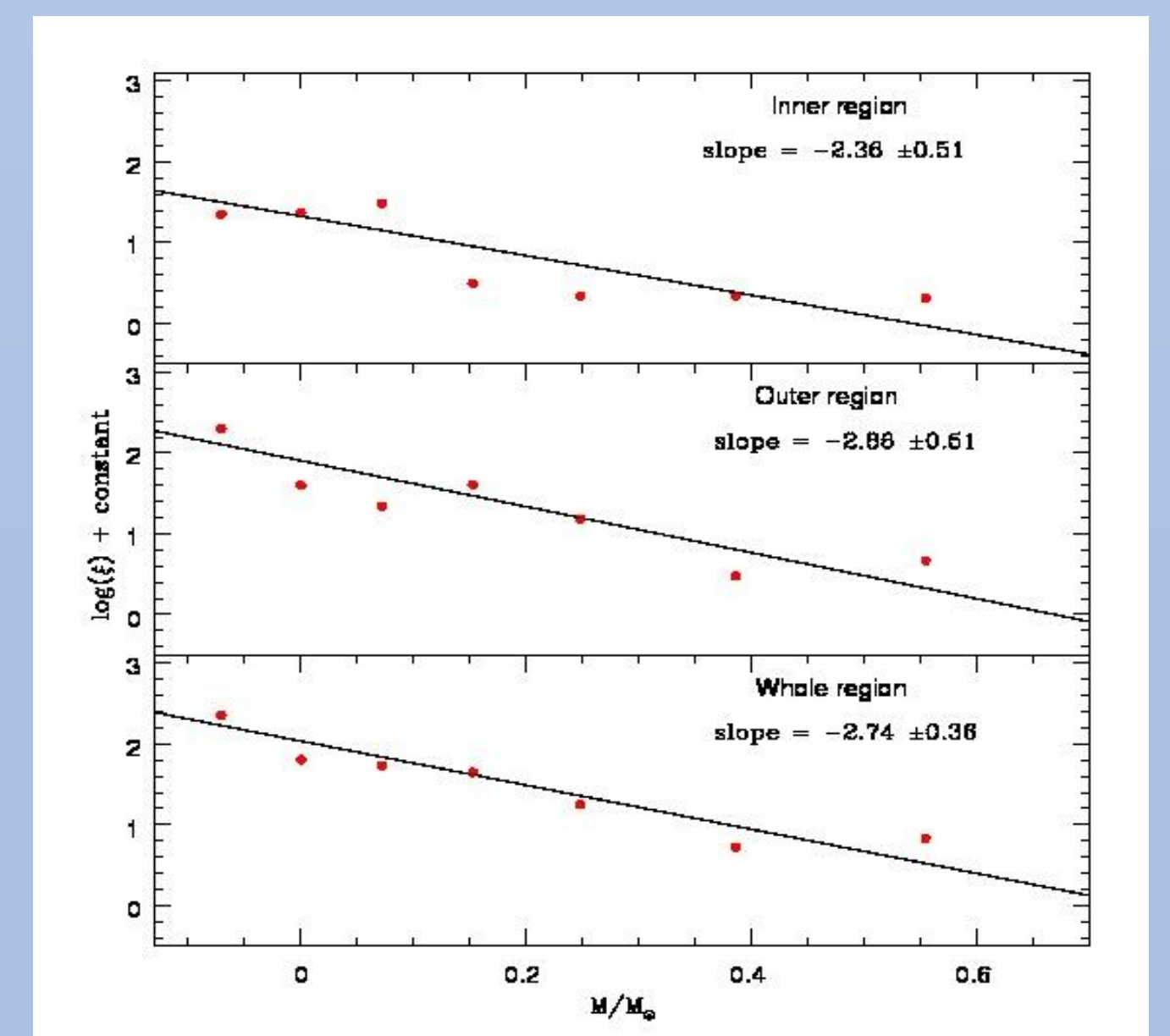
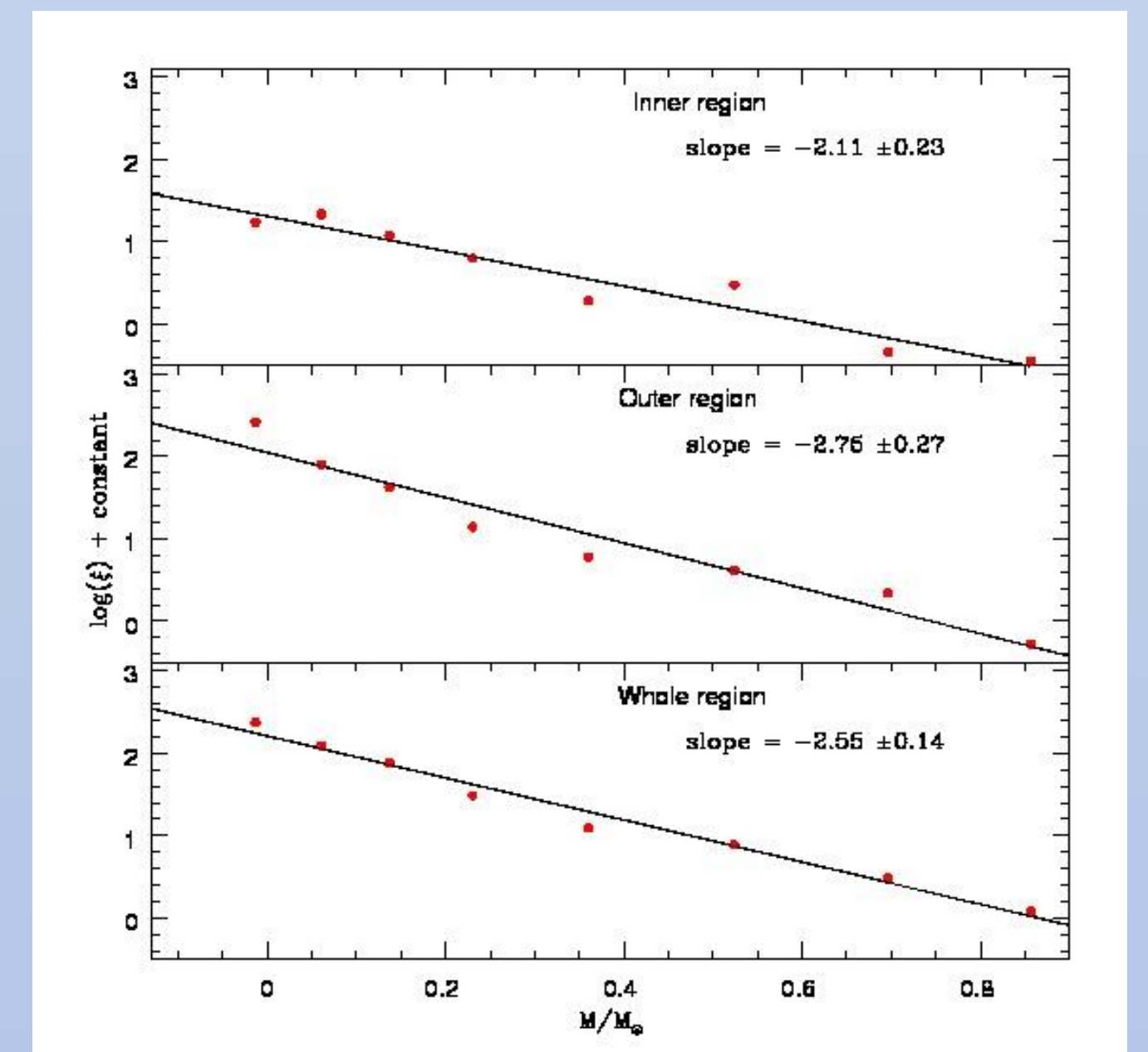
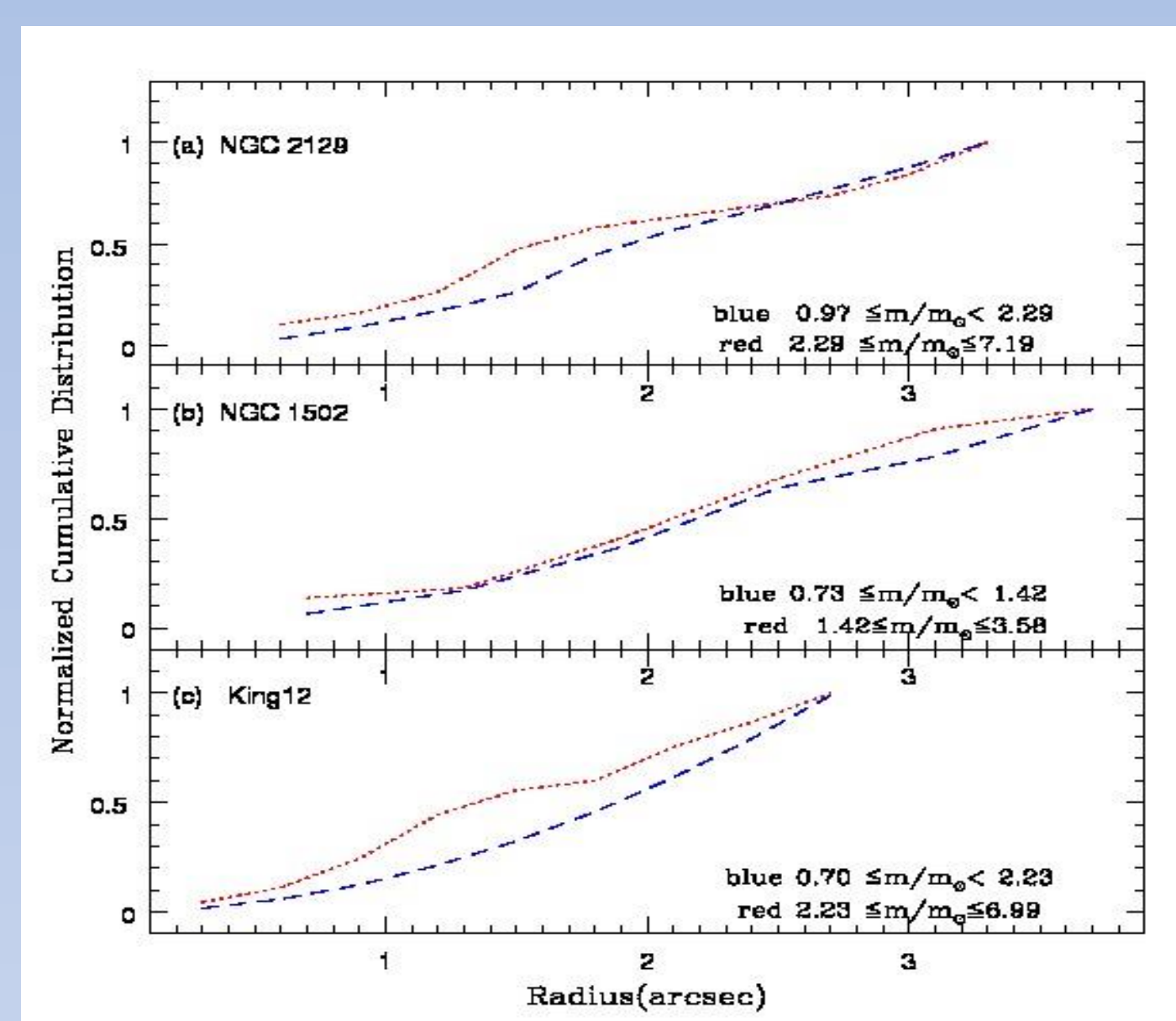
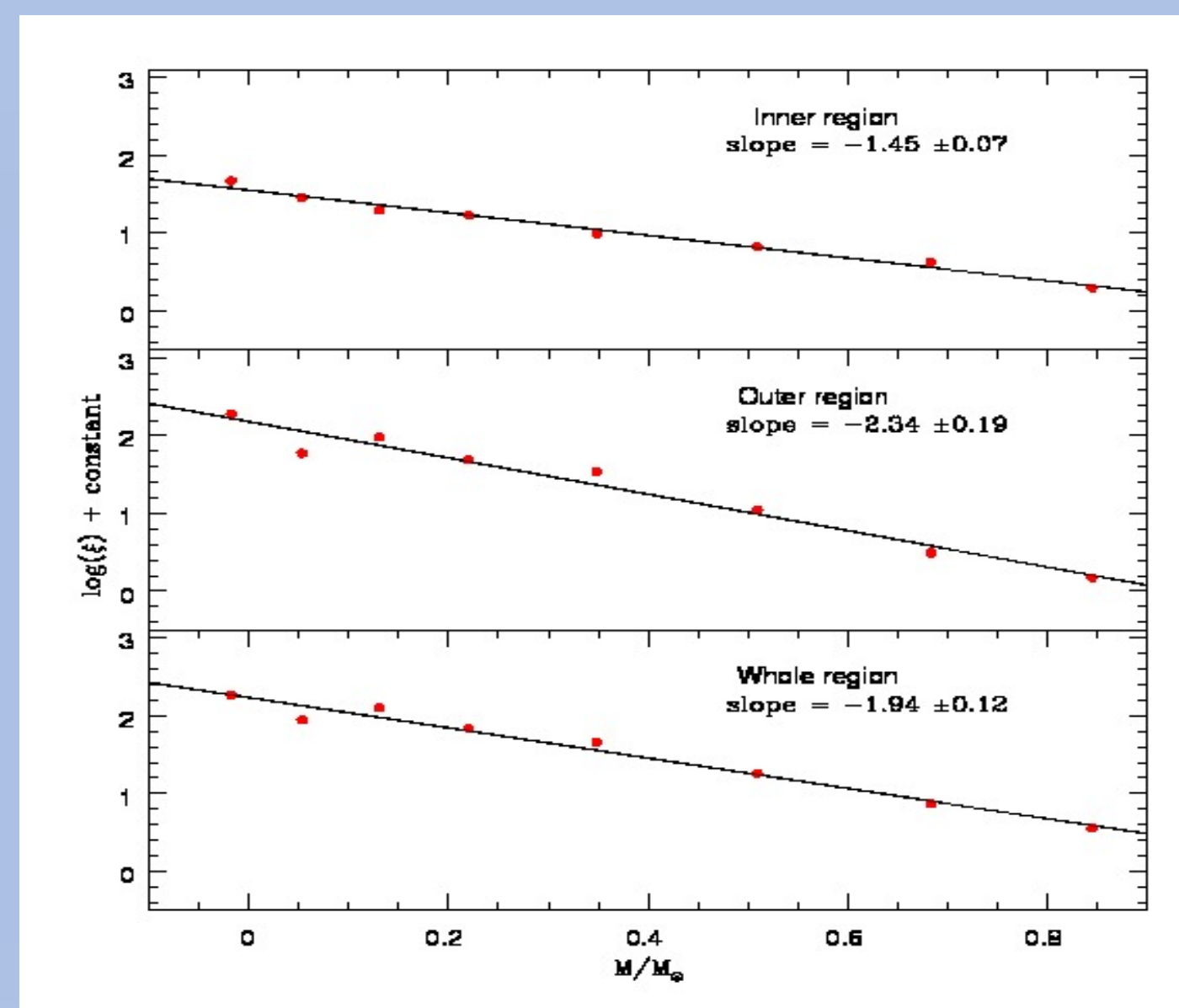
NGC 1502
E(B-V) = 0.64 mag
Distance = 1.7 kpc
Age = 10 Myr



King 12
E(B-V) = 0.72 mag
Distance = 0.8 kpc
Age = 10 Myr



NGC 2129
E(B-V) = 0.58 mag
Distance = 0.8 kpc
Age = 10 Myr



We obtain MF slopes of three clusters as -2.55 ± 0.14 , -2.73 ± 0.36 and -1.94 ± 0.12 respectively for the entire cluster region. Shallower MF slopes is observed in the inner regions of these clusters as compared to outer regions. This spatial variation of MF establishes presence of mass segregation in all of them.

NGC 1502 and King 12 are observed to show passing off of stars during the course of evolution. In NGC 2129 and King 12, equipartition of energy is still in progress. However for NGC 1502, significant amount of mass segregation has already taken place. Dynamical evolution time for NGC 2129 is found to be 9.8 Myr for NGC 1502 it is 4.8 Myr and for King 12 it is 9.0 Myr. Dynamical relaxation time for all the three clusters are found to be smaller than their ages, indicating that all of them are dynamically relaxed.