The Study of the characteristics of the CMDs of M13 with the BVR CCD photometry

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The BVR CCD photometry was performed for the globular cluster M13 down to V ~ 19 over the region from the center to the west 13′ and the characteristics of CMD of M13 were investigated. The major photometric error for crowded field is due to the variation in the background sky, so the median filtering method is combined with the direct sky method for the correction of the sky variation.

The characteristics of the CMDs of M13 obtained in the present study are as follows: Firstly, the distribution of the stars on CMD is exactly consistent with the mean lines of Sandage(1970) along the RGB, HB, and AGB. Secondly, the gaps on RGB and BHB are clearly seen for the stars in the outer region(r > 100″). Thirdly, the UV-bright stars are more concentrated at the inner than the outer.

The gaps and bumps appearing in each branch on the CMD are examined in the aspect of stellar evolution. T\It is stressed in particular that the appearence of gap can be related to the nonuniform evolution of stars in the relevant branch but also to the observational completeness and a systematic photometric uncertainty.

Problems in Estimating Distances to Galaxies Using Variable Stars: The Pegasus Dwarf Galalxy

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Cepheid variables are known to be one of the most reliable distance indicators for nearby galaxies. However one has to be careful in using Cephied candidates discovered in one-band photometry for estimating the distances to galaxies. In this study we present an example showing how much wrong the distance estimate using Cepheid candidates can be.

Hoessel et al (1990, AJ, 100, 1151) searched for variable stars in the Pegasus dwarf galaxy (DDO 216) from CCD observations obtained using the Thuan-Gunn r filter at 1.5m to 5m telescopes for five years. They found 31 variable stars. They argued from the shapes of the light curves that seven of the variable stars are very likely Cepheids and three of them are probable Cepheids. They estimated the distance to the Pegasus dwarf galaxy using these Cepheid variable candidates. obtaining a value of 1750± 160 kpc ($(m - M)_o$ = 26.22± 0.2 mag).

On the other hand. We have estimated the distance to this galaxy using the tip of the red giant branch (TRGB) method (Lee, Freedman, & Madore 1993, ApJ, 417, 553) from the VI CCD photometry obtained using the Palomar 1.5m telescope. We obtained a value for the distance of 1060±50 kpc ($(m - M)_o$ = 25.13±0.11 mag). This value is significantly smaller

than the Cepheid distance estimated by Hoessel et al.

This large difference between the two distance estimates is due to the fact that the variable stars considered as Cepheids by Hoessel et al are not Cepheids but other kinds of variable stars. These variable stars are found to be located not in the Cepheid instability strip, but in the Asymptotic Giant Branch (AGB) in our color-magnitude diagrams. Hoessel et al did not have any information about the colors of these variable stars, because they used only one filter to search for variable stars. In addition, the period-luminosity relation of these variable stars given by Hoessel et al is much flatter than that of typical Cepheids. It is suspected that the periods of the variable stars determined by Hoessel et al might have suffered from aliasing problems in dealing with sparse data. Therefore the Cepheid distance estimated by Hoessel et al is meaningless.

Accretion Flows with Angular Momentum near a Point Mass

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The properties of axisymmetric accretion flows of cold adiabatic gas with zero total energy in the vicinity of a Newtonian point mass are characterized by a single dimensionless parameter, the thickness of incoming flow. In the limit of thin accretion flows with vanishing thickness, we show that the governing equations become self-similar, involving no free parameters. We study numerically thin accretion flows with finite thickness as well as those with vanishing thickness. The incoming flow enters the computational regime as a thin ring. In the case with finite thickness, after a transient period of initial adjustment, an almost steady-state accretion shock with a small oscillation amplitude forms, confirming the previous work by Molteni, Lanzafame, & Chakrabarti (1994). The gas in the vorticity roll between the funnel wall and the accretion shock follows closed streamlines, forming a torus. This torus, in turn, behaves as an effective barrier to the incoming flow and supports the accretion shock which reflects the incoming gas away from the equatorial plane. The postshock flow, which is further accelerated by the pressure gradient behind the shock, goes through a second shock which then reflects the flow away from the symmetry axis to form a conical outgoing wind. As the thickness of the inflowing layer decreases, the flow becomes unstable. In the case with vanishing thickness, the accretion shock formed to stop the incoming flow behind the funnel wall oscillates quasi-periodically with the amplitude comparable to the thickness. The structure between the funnel wall and the accretion shock is destroyed as the shock moves inwards toward the central mass and re-generated as it moves outwards. We suggest a possible explanation for the instability. The phenomenon may be related to the quasi-periodic oscillations observed in accreting galactic sources.