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PHOTOELECTRIC PHOTOMETRY OF SOME GALAXIES IN THE REGION OF THE VIRGO CLUSTER

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ABSTRACT

Four color photometry of 26 galaxies, mostly in the region of the Virgo Cluster, is presented.

INTRODUCTION

In a previous paper (Tifft, 1969), henceforth referred to as MPGIII, multicolor, multiaperture, photoelectric photometry of the brightest galaxies in the region of the Virgo Cluster of galaxies was given. The purpose of this brief communication is to present supplementary observations of fainter galaxies in the Virgo Cluster region which has been obtained as part of a long term investigation of galaxy clusters.

THE OBSERVATIONS

The observations were obtained during March and May, 1968, at the Newtonian focus of the Steward Observatory 36-inch (90 cm) telescope at Kitt Peak. The same four color systems previously used in galaxy photometry, and described in MPGIII and earlier references, was employed. The same notation is used here. Bands 1, 2, 3, and 4 were utilized at effective wavelengths of 1=3750, 2=4180, 3=4835, 4=5945, and bandwidths of about 400, 800, 800, and 500 Angstroms. All observations were taken with respect to the standard star pair "C" given in MPGIII. Individual night extinction was calculated and the transfer accuracy is believed to be within 0.02 magnitudes at all wavelengths. Three apertures were used--64, 45, and 32 arc seconds in diameter; smaller apertures were not considered practical at the scale of the 36-inch Newtonian focus. Since very small aperture data are not available, the photometry contains little information on color gradients and provides primarily a measure of the total or integrated color. Much of the color variation shown within a given galaxy is due to observational scatter on the relatively faint galaxies observed.

Table I contains the observations given as the band 3 magnitude and three color indices. The number of deflections in each band is also listed in 1, 2, 3, 4 order to indicate that fainter objects were generally observed with multiple deflections to improve accuracy. For convenience the observations have also been given transformed to the UBV system according to transformation coefficients given by deVaucouleurs (1961) and deVaucouleurs and deVaucouleurs (1964).

The preferred equations for the transformation are as follows:

$$V = [3] + 0.082 - 0.397\,[2\text{-}3], \quad (1)$$

$$(B\text{-}V) = 0.141 + 1.064\,[2\text{-}3], \quad (2)$$

$$(U\text{-}B) = -0.715 + 0.778\,[1\text{-}3]. \quad (3)$$

These equations give (B-V) and (U-B) colors comparable in accuracy to (2-3) and (1-3) and V magnitudes only slightly less accurate than 3. In the original equations given by deVaucouleurs, a dependence on band 4 was

usually included. This dependence has been eliminated in the set of equations given above. Band 4 is considerably less accurately observed owing to small deflections in the narrow band which is located on the red tail of the photoelectric detector. In general transformations to the UBV systems should avoid use of band 4 to achieve maximum precision. It should be further noted that the Seyfert galaxy NGC 4151 has not been transformed to the UBV system at all since it is doubtful if the ordinary transformations apply to such an object.

Some discussion of the data in Table I appears in MPGIII. The fainter E galaxies show a smooth extension of the dependence of galaxy color on luminosity as reported in MPGIII for the brightest Virgo Cluster galaxies. There is also some evidence for color variation in the ultraviolet for NGC 4486. One piece of information not previously discussed is that the color of IC 3481 is consistent with its high redshift which may be taken to imply that it is a luminous object well beyond the Virgo Cluster and is not a dwarf member of Virgo. This galaxy is closely associated with IC 3483 which shows a very low redshift.

REFERENCES

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Vaucouleurs, G. de 1961, Ap. J. Suppl. 5, 233, (No. 45).

Vaucouleurs, G. de and Vaucouleurs, A. de 1964, Reference Catalogue of Bright Galaxies (Austin: Univ. of Texas Press).

Table I. Galaxy Observations

OBJECT	APERTURE	3	1-3	2-3	3-4	n	V	B-V	U-B
NGC 3227	32	12.70	1.40	.70	.64	2121	12.50	.89	.37
NGC 4151	32	11.40	.67	.62	.30	1121	-	-	-
BD+40°2507	-	9.83	1.00	.48	.35	1121	-	-	-
NGC 4352	64	13.15	1.49	.73	.70	2121	12.94	.92	.44
	32	13.57	1.49	.72	.63	2121	13.37	.91	.44
NGC 4360	32	13.57	1.82	.82	.66	2232	13.33	1.01	.70
NGC 4387	45	12.75	1.71	.79	.65	2121	12.52	.98	.62
	32	12.93	1.66	.78	.68	2132	12.70	.97	.58
NGC 4417	64	11.78	1.64	.72	.63	2121	11.58	.91	.56
	45	11.96	1.60	.76	.60	2122	11.74	.95	.53
	32	12.13	1.71	.82	.62	2122	11.89	1.01	.62
NGC 4431	45	13.83	1.58	.69	.67	4232	13.64	.88	.51
NGC 4436	45	13.94	1.39	.73	.60	3242	13.78	.92	.37
NGC 4452	64	12.57	1.43	.73	.61	2242	12.36	.92	.40
	45	12.79	1.64	.74	.63	2242	12.58	.93	.56
NGC 4458	45	12.90	1.58	.79	.65	3232	12.67	.98	.51
	32	13.17	1.58	.80	.60	3242	12.93	.99	.51
NGC 4476	45	12.98	1.35	.67	.64	2122	12.80	.85	.34
	32	13.15	1.50	.70	.59	2122	12.95	.89	.45
IC 3427	45	13.73	1.26	.58	.53	3122	13.58	.76	.27
	32	14.02	-	-	-	0030	13.87	-	-
NGC 4478	64	11.77	1.58	.76	.62	4252	11.55	.95	.51
	45	11.91	1.55	.71	.61	2121	11.71	.90	.49
	32	12.14	1.54	.77	.61	2121	11.92	.96	.48
NGC 4479	64	13.15	1.59	.78	.75	2121	12.92	.97	.52
	45	13.42	1.56	.69	.72	2222	13.22	.88	.50
NGC 4486	32	11.15	1.81	.84	.67	1141	10.90	1.03	.69
A1228.4+1233	45	11.66	1.07	.49	.45	1121	11.55	.66	.12
	32	11.71	1.08	.51	.40	1121	11.59	.68	.13
NGC 4497	64	13.04	1.36	.64	.57	3242	12.87	.82	.34
	45	13.35	-	-	-	0030	13.18	-	-
NGC 4503	64	11.89	1.73	.81	.69	2121	11.65	1.00	.63
	45	12.10	1.81	.84	.67	2121	11.85	1.03	.69
	32	12.40	1.78	.81	.71	2121	12.16	1.00	.67
IC 3468	45	14.01	1.21	.62	.57	4242	13.85	.80	.23
	32	14.25	-	-	-	0030	14.09	-	-