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INVESTIGATION OF THE COMA CLUSTER OF GALAXIES

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INTRODUCTION

The study of the morphological, kinematical and dynamical properties of the Coma cluster of galaxies is of great importance for a wide variety of questions. The Coma cluster of galaxies is according to Zwicky's classification [1—3] an example of regular cluster.

The distance modulus of this cluster is only $m\text{-}M=30^m.7$ (Stebbins and Whitford [4]), and there exists a possibility for the observation of faint cluster galaxies. The Coma cluster possesses a spherical symmetry, which permits the investigation of its space structure. On the other hand it is possible while studying the Coma cluster to obtain an answer about the tendency towards the clustering of galaxies. The investigation of the Coma cluster is in connection with the Universe age as well as with gravitational influences of large distances.

The position of the Coma cluster center is not determined with a great accuracy. According to Omer, Page and Wilson [5] the co-ordinates of this center are

$$\alpha_{1950}=12^h57^m.3 \quad \delta_{1950}=+28^\circ24', \tag{1}$$

while according to Zwicky [1, 2], Abell [6, 7], Shane [8] and Shane and Wirtanen [9] these co-ordinates are

$$\alpha_{1950}=12^h57^m.3 \quad \delta_{1950}=+28^\circ14'. \tag{2}$$

It seems that the inaccuracy of the center co-ordinates is not important, but as it was pointed out in our previous papers [10, 11], the differences in δ for the above mentioned two determinations are decisive for the study of the cluster rotation.

According to [5] the angular diameter of the Coma cluster is only 100′; while according to Zwicky [1—3, 7, 12] its angular diameter is at least 12°. Abell (f. e. [7]) indicates that the cluster is substantially contained within an oval region of dimensions 5.4 by 4.3 degrees. Sharov [13] and Noonan [14] after different interpretations of Zwicky's data (in [13] the material used is by Wallenquist [15]), do not support Zwicky's conclusions [1, 2].

Some questions in connection with the structural, kinematical and dynamical properties of the Coma cluster of galaxies are examined in the present paper.

RESULTS OF DIAMETER MEASUREMENTS

The observational material in this study is the print No. 1393 (blue and red) of the National Geographic Society — Palomar Observatory Sky Survey. The center co-ordinates of the print are $\alpha_{1950}=13^h04^m33^s$ and $\delta_{1950}=+29°29'25''$.

The co-ordinates of the Coma cluster center were determined with the help of 12 independent counts of galaxies (cross-sections, as in [16—18]) around the approximately known cluster center. The data from 10 cross-sections (in the squares $3'\times3'$) conform to the co-ordinates (2). Indeed, the Coma cluster center is located between the two brightest galaxies NGC 4874 and NGC 4889=NGC 4884 which have co-ordinates ([19] and [20]):

$$\text{NGC } 4874 \begin{cases} \alpha_{1950}=12^h57^m.2 \\ \delta_{1950}=+28°14' \end{cases}$$

$$\text{NGC } 4889=\text{NGC } 4884 \begin{cases} \alpha_{1950}=12^h57^m.7 \\ \delta_{1950}=+28°15'. \end{cases}$$

It appears that the cluster center is located at a distance of the separation between these two galaxies, reckoned from NGC 4874 to NGC 4889=NGC 4884. Thus determined the center complies with the condition [2]. In the very center of the cluster a galaxy ($m_0\approx18^m$) which is not registered in the Catalogues is located. This galaxy was adopted as the cluster center.

The purpose of our measuring was the determination of the major and minor diameters of all galaxies on the *O* and *E* prints, located in a field with a radius of 60′ around the central galaxy. The field was divided into 12 sectors (of 30°) and 10 rings of 6′ each. (The radial reseaux were made in the Workshop for scientific instruments at the Astronomical Section, Bulgarian Academy of Sciences.)

The diameter measuring is carried out with a binocular microscope (used in [21]) with 16× and 56× magnifications. As it is known the image scale of the prints is $67''.1$ mm^{-1}. The divisions on our eyepiece micrometer are $3''.355$ for 16× and $0''.959$ for 56×.

Major and minor diameters of the galaxies were measured for their peripherical (outer) parts on the *E* and *O* prints, as well as for the corresponding diameters of their nuclei. (A work about the measurement errors with respect to various magnifications is out by Karachentsev [22] but only for counts of the galaxies.)

Thus our measurements permit the obtaining of 16 properties from which one may calculate 8 properties more — quantities for the flattening of ga-

Table 1

Sectors (Zones)	D_1^0	D_2^0	$\varepsilon_{D_{12}}^0$	d_1^0	d_2^0	$\varepsilon_{d_{12}}^0$	D_3^0	D_4^0	$\varepsilon_{D_{34}}^0$	d_3^0	d_4^0	$\varepsilon_{d_{34}}^0$	n_i
1	2	3	4	5	6	7	8	9	10	11	12	13	14
I(No.1)	4.3	4.0	92	2.6	2.4	90	17.3	15.1	88	9.2	8.5	92	3, 4, 3, 4
II	5.9	4.7	80	3.1	2.3	76	19.9	16.0	85	9.5	7.2	78	9, 8, 9, 8
III	7.3	6.2	78	2.5	2.0	85	34.0	26.8	76	9.6	7.8	82	13
IV	6.7	5.0	74	3.1	2.3	77	22.1	17.8	80	9.7	6.9	75	8, 7, 8, 8
V	7.6	6.4	87	2.8	2.2	78	24.3	18.8	77	9.8	7.8	81	7
VI	6.5	4.9	76	3.6	2.6	74	24.6	18.6	74	10.8	8.8	81	7
VII	3.9	2.8	74	2.2	1.6	74	13.2	10.9	81	7.3	5.6	77	7, 7, 6, 7
VIII	12.0	8.0	67	3.5	2.2	60	40.0	25.0	62	10.8	6.5	58	1, 2, 1, 2
IX	4.5	2.9	68	2.4	1.7	79	18.6	15.6	86	6.7	5.3	83	7
X	18.6	14.5	81	4.7	3.6	78	62.8	56.4	85	17.0	12.9	80	5, 7, 5, 7
XI	3.1	2.5	80	1.5	1.3	89	9.0	7.2	81	4.0	3.5	88	4, 3, 4, 3
XII	8.2	7.2	90	3.5	3.0	87	27.2	22.2	82	10.2	9.0	87	4
I(No.2)	5.7	4.3	75	2.4	1.7	83	22.8	16.9	79	6.7	5.3	84	9
II	9.8	7.2	73	3.8	2.8	80	34.5	25.7	75	12.3	8.3	73	6
III	7.3	6.0	84	3.4	2.6	81	21.5	18.1	83	10.9	8.5	81	9; 10, 11, 10
IV	4.7	3.2	74	1.8	1.3	86	16.8	10.7	69	5.4	4.3	88	11, 8, 11, 9
V	5.3	4.2	81	2.8	2.2	86	19.9	15.2	76	9.8	8.2	83	9
VI	6.0	3.2	63	2.5	2.1	79	21.2	11.6	66	8.6	6.3	77	11
VII	6.6	3.8	61	3.3	2.1	62	23.6	16.3	72	11.6	7.5	71	7
VIII	5.5	4.2	75	3.3	2.7	78	19.7	14.7	75	10.0	8.0	80	6, 5, 6, 6
IX	7.0	5.0	72	3.1	2.2	75	23.3	18.8	79	9.9	6.9	71	10, 9, 10, 9
X	4.3	3.0	78	2.4	1.4	72	15.4	10.9	79	7.4	5.2	82	11
XI	8.1	6.0	73	3.6	2.8	78	32.6	23.4	72	11.2	8.5	77	11, 10, 11, 11
XII	5.4	4.6	80	2.8	2.3	81	17.8	15.0	83	7.7	6.2	79	8
I(No.3)	7.3	4.7	66	2.4	1.9	81	22.9	14.8	67	6.5	5.2	80	8
II	11.8	5.9	59	4.4	3.1	70	36.8	20.8	62	15.7	10.7	72	8, 6, 8, 6
III	6.2	5.1	80	2.6	2.0	72	22.6	18.7	78	7.7	6.1	77	7
IV	4.8	3.5	73	2.2	2.5	78	18.2	11.7	67	6.3	4.6	75	13
V	7.3	5.0	74	4.6	2.7	69	30.7	20.0	72	14.3	8.8	73	14, 13, 14, 14
VI	5.6	3.4	65	2.4	1.8	77	16.7	11.0	68	7.0	5.2	76	7
VII	8.2	4.6	64	4.0	2.1	67	27.8	18.0	70	12.0	7.3	74	12, 11, 12, 11
VIII	5.7	3.8	68	3.3	1.9	60	20.0	13.0	65	8.5	5.1	60	5
IX	7.6	4.8	65	3.3	2.1	66	22.2	15.2	68	10.5	7.0	72	10, 12, 12, 11
X	10.9	6.8	72	4.4	3.1	71	37.8	27.5	76	14.6	10.6	78	13
XI	8.3	4.1	59	4.4	2.0	63	28.2	15.8	67	13.6	6.5	62	5
XII	14.8	9.7	74	4.5	3.4	76	60.7	40.7	75	16.2	11.6	77	6
I(No.4)	8.1	3.8	62	3.8	2.4	72	25.3	15.1	69	8.2	5.6	71	9, 9, 9, 8
II	6.9	4.4	67	3.2	2.2	70	24.4	16.9	70	9.2	6.3	71	9
III	9.1	5.9	61	3.1	2.3	72	27.4	19.6	69	11.1	8.4	72	7
IV	6.4	4.0	72	2.4	2.0	77	21.5	14.9	74	8.2	6.4	82	10, 12, 12, 12
V	8.4	5.8	68	3.5	2.4	71	30.4	22.2	74	11.0	8.1	72	6
VI	7.4	5.6	77	4.4	3.4	81	26.8	22.2	83	13.4	11.0	85	5
VII	7.1	5.1	77	3.6	2.4	73	23.9	18.1	80	9.7	7.4	75	7, 6, 7, 7
VIII	8,1	5.6	69	4.2	3.2	73	28.6	24.3	79	14.2	10.7	67	7, 6, 7, 6
IX	14.3	10.9	78	4.3	3.0	75	47.9	41.7	84	14.1	9.8	74	9
X	4.6	3.0	63	2.5	1.8	71	17.8	13.4	75	7.7	5.0	64	7
XI	8.0	6.2	71	3.2	1.9	70	19.7	17.0	78	9.9	6.0	68	4, 6, 6, 6
XII	5.2	3.5	71	2.4	1.4	65	17.2	12.2	71	6.6	3.8	60	8, 6, 8, 6

1	2	3	4	5	6	7	8	9	10	11	12	13	14
I(No.5)	5.8	3.0	56	2.4	1.8	73	14.4	9.5	68	6.9	4.5	67	7, 7, 8, 8
II	11.4	5.2	53	4.2	2.3	64	35.1	17.6	57	14.5	7.7	61	9
III	8.4	4.9	67	3.4	2.6	75	24.3	17.3	75	8.1	6.3	78	9
IV	9.1	4.8	61	3.8	2.2	64	32.6	15.7	56	11.5	6.4	65	11
V	7.9	5.2	64	4.4	2.7	62	32.0	21.7	66	14.1	8.4	59	7
VI	6.1	3.7	60	4.0	2.2	58	20.8	12.3	59	10.2	6.9	68	6, 4, 6, 4
VII	7.7	4.6	68	3.6	2.5	76	26.6	17.6	70	12.9	8.5	73	9, 8, 9, 8
VIII	9.0	4.2	49	3.6	2.2	61	28.7	15.0	52	10.4	6.2	64	6, 7, 6, 7
IX	11.4	7.2	59	4.1	2.7	65	35.4	30.8	80	11.6	9.3	74	5
X	7.6	4.9	71	4.3	2.6	64	29.9	20.4	69	14.6	9.0	62	7, 5, 7, 5
XI	9.1	5.9	61	4.2	2.4	69	28.1	19.4	67	13.1	8.1	68	7
XII	7.5	4.9	68	3.9	2.4	63	26.5	18.4	66	13.2	8.2	63	5, 6, 6, 6
I(No.6)	6.8	4.3	65	3.1	1.8	60	23.9	16.3	67	9.5	6.4	66	11, 10, 11, 10
II	6.0	3.3	54	1.9	1.0	53	19.5	10.7	54	6.6	3.8	58	5, 6, 6, 6
III	7.5	4.5	62	3.8	2.0	52	26.2	15.5	64	12.3	6.7	58	6, 5, 6, 6
IV	7.3	5.2	71	4.1	2.4	62	25.1	16.8	68	11.4	7.0	63	9
V	6.7	4.6	69	3.5	2.5	70	25.9	18.5	67	11.0	8.2	73	10
VI	8.3	4.8	67	4.7	2.2	52	27.7	17.3	67	15.7	7.2	55	3
VII	6.2	5.0	79	3.2	2.6	79	18.5	16.5	89	9.0	7.2	80	4
VIII	9.3	6.8	72	3.8	2.7	72	30.9	24.3	75	12.2	8.6	71	9, 8, 9, 8
IX	6.2	2.9	56	2.9	1.6	60	19.4	10.3	59	9.7	5.3	60	7, 7, 7, 6
X	8.2	6.0	76	4.1	2.6	68	26.4	18.8	70	12.1	8.5	72	8, 7, 8, 7
XI	4.8	3.2	69	2.3	1.6	69	15.8	9.7	66	6.5	4.6	70	9
XII	5.9	3.7	63	2.9	1.5	72	20.3	12.8	69	9.6	5.4	71	9, 8, 9, 8
I(No.7)	6.2	3.1	53	2.4	1.9	81	22.7	12.3	53	7.1	5.5	80	7
II	5.8	3.2	60	2.2	1.6	81	18.5	11.4	64	6.8	4.8	73	7, 8, 8, 8
III	6.2	4.9	75	2.4	1.9	76	20.9	17.6	82	8.6	6.3	73	9
IV	6.6	3.8	62	2.8	1.8	68	22.9	13.9	63	8.8	5.5	66	10
V	10.8	6.2	66	4.8	3.0	66	43.6	26.9	64	16.1	9.6	61	16
VI	5.2	3.2	65	3.0	1.8	60	19.2	13.0	67	8.8	5.9	67	6, 6, 6, 5
VII	10.4	6.4	62	3.6	2.4	74	35.3	23.6	67	11.9	8.2	73	7
VIII	9.2	6.2	64	3.6	2.5	74	28.2	18.8	63	11.0	8.0	74	4
IX	6.4	4.1	66	3.9	2.2	58	23.3	15.7	70	11.9	7.2	62	7, 5, 7, 5
X	8.7	6.1	70	4.2	2.8	74	28.1	22.3	79	12.3	9.4	79	11, 10, 11, 10
XI	7.1	4.8	69	3.3	2.3	70	25.5	15.2	61	10.3	6.7	63	10, 9, 10, 9
XII	5.4	4.3	78	1.9	1.4	77	17.2	12.6	71	6.7	4.7	72	9
I(No.8)	9.2	4.6	59	3.0	1.8	73	26.2	14.0	60	7.3	4.5	69	4, 3, 4, 3
II	8.9	5.3	58	3.7	2.5	61	33.1	21.2	57	12.1	7.9	57	9, 8, 9, 8
III	6.2	4.6	73	2.8	1.8	63	23.0	16.7	74	12.8	8.6	63	5
IV	7.2	4.9	63	3.4	2.2	61	29.7	19.2	60	11.5	7.5	62	10
V	9.4	4.7	54	3.3	2.3	69	35.8	19.6	55	11.1	7.4	62	9
VI	7.0	4.0	55	4.0	2.5	59	25.0	14.0	54	12.2	7.0	53	4
VII	7.4	5.1	76	3.2	2.2	73	21.0	15.3	73	8.8	6.8	77	6, 6, 7, 6
VIII	6.0	4.2	71	2.5	1.6	66	20.8	14.6	74	7.1	4.9	68	5, 4, 5, 4
IX	4.6	3.2	76	2.6	1.5	60	16.7	11.6	72	9.4	5.8	63	8, 8, 8, 7
X	13.0	6.2	56	4.8	2.2	57	45.6	19.1	49	15.5	7.5	61	9
XI	8.5	4.7	63	4.3	2.2	61	29.8	17.8	66	13.5	7.0	63	5
XII	5.5	3.8	72	2.8	1.7	60	18.2	13.3	76	7.2	4.6	65	6
I(No.9)	9.0	4.4	60	4.9	2.5	67	34.0	17.6	64	15.1	8.1	70	7
II	5.0	2.5	52	1.4	1.2	88	19.0	9.8	52	5.4	4.1	74	5
III	7.9	4.7	61	3.4	2.4	66	27.1	18.0	67	9.9	5.7	59	7
IV	12.1	7.2	64	4.4	3.1	71	41.8	32.6	75	14.6	10.6	74	9
V	9.3	3.8	46	3.8	2.3	71	32.3	15.3	49	13.3	7.3	61	3
VI	10.1	6.6	68	6.5	2.8	60	35.0	25.6	74	15.5	9.4	63	8
VII	5.8	3.8	64	2.6	1.8	68	20.5	13.5	68	7.1	5.0	70	4

1	2	3	4	5	6	7	8	9	10	11	12	13	14
VIII	6.0	3.5	61	3.2	1.9	60	22.4	13.8	63	7.4	5.6	76	8, 10, 9, 10
IX	5.6	3.4	59	2.8	1.6	59	16.8	12.5	73	9.1	6.0	66	4
X	7.6	5.2	68	3.7	2.3	64	29.2	20.9	70	11.3	7.7	68	16, 15, 16, 15
XI	5.4	3.3	65	2.6	1.6	64	18.4	10.9	63	7.7	4.6	63	6, 7, 7, 7
XII	9.2	7.1	74	4.2	3.3	84	32.8	19.9	63	12.7	10.2	85	6, 5, 6, 5
(No.10)	5.9	5.0	79	2.4	1.8	78	22.7	17.1	73	8.2	6.1	76	7
II	9.2	6.0	65	4.4	2.2	57	26.2	17.5	70	13.0	7.0	56	4
III	8.6	4.0	58	3.8	2.1	61	32.2	14.8	58	10.0	6.4	66	4
IV	11.0	6.5	55	3.6	2.5	78	37.2	22.1	61	13.6	8.4	72	8
V	10.0	6.6	68	3.7	2.7	73	32.5	22.2	73	11.3	7.2	67	4, 3, 4, 3
VI	6.8	3.5	62	2.7	1.9	69	17.8	11.3	70	6.7	5.2	78	6
VII	6.4	4.7	76	3.2	2.4	76	22.6	17.4	78	10.0	7.4	77	7
VIII	8.0	4.7	66	3.3	2.3	71	28.2	17.4	67	10.4	6.4	63	7, 7, 5, 7
IX	6.1	3.9	64	2.8	1.7	61	21.0	14.2	68	9.4	5.9	63	5
X	8.4	5.6	72	3.9	2.0	70	30.1	18.4	69	12.9	7.1	66	14, 13, 14, 13
XI	5.8	2.9	55	3.0	1.6	61	20.4	11.2	62	10.0	5.2	71	7, 7, 8, 6
XII	6.9	3.1	63	2.8	1.6	57	23.0	13.4	59	8.7	5.3	62	9

	D_1^E	D_2^E	$\varepsilon^E_{D_{12}}$	d_1^E	d_2^E	$\varepsilon^E_{d_{12}}$	D_3^E	D_4^E	$\varepsilon^E_{D_{34}}$	d_3^E	d_4^E	$\varepsilon^E_{d_{34}}$	n_i
1	2	3	4	5	6	7	8	9	10	11	12	13	14
I(No.1)	5.0	4.3	86	2.6	2.1	81	16.0	14.5	89	8.5	7.8	90	3, 4, 4, 4
II	6.1	4.6	79	3.1	2.3	76	19.7	16.2	86	9.1	7.9	87	7, 9, 9, 9
III	12.9	10.7	80	2.7	2.3	86	45.9	38.6	78	9.6	8.0	85	8, 13, 8, 13
IV	8.2	6.1	76	3.4	2.6	82	25.3	20.4	84	11.6	8.3	82	6, 7, 7, 7
V	8.7	6.8	81	3.1	2.5	83	22.7	18.6	79	9.6	8.2	86	6, 7, 7, 7
VI	6.8	4.8	72	3.6	2.8	79	23.0	18.8	81	11.2	8.8	78	6
VII	4.1	2.9	70	2.3	1.8	80	15.5	12.0	79	7.2	5.4	81	5, 6, 3, 6
VIII	12.0	5.0	33	3.2	2.2	71	42.0	26.0	62	11.5	7.5	52	1, 2, 1, 2
IX	3.7	3.0	81	2.0	1.6	82	15.5	12.8	84	6.5	5.2	79	6
X	16.4	12.8	85	4.9	3.9	88	58.6	50.2	94	16.9	13.8	88	5, 7, 5, 7
XI	3.0	2.8	93	1.6	1.5	94	10.0	9.0	90	4.2	3.4	80	4, 4, 5, 4
XII	7.6	6.0	78	3.6	2.8	82	28.0	21.2	78	13.1	10.8	84	4
I(No.2)	5.1	4.1	88	2.2	1.8	90	18.6	14.7	84	6.3	5.2	94	8, 9, 9, 9
II	9.8	6.9	74	3.7	2.2	64	28.5	22.7	79	12.7	8.1	71	6
III	6.9	6.1	91	3.7	2.9	81	23.3	19.5	84	11.7	9.4	82	8, 9, 10, 9
IV	3.8	2.7	76	1.7	1.2	85	14.4	9.5	71	5.5	4.2	82	11, 10, 11, 11
V	5.2	4.3	85	2.4	2.1	84	16.7	13.9	85	8.1	6.9	89	7, 9, 9, 9
VI	6.1	3.2	62	2.7	2.2	85	19.1	10.9	67	8.0	6.4	82	10, 11, 11, 11
VII	5.6	3.1	61	2.6	1.8	70	17.9	11.3	66	10.2	7.7	75	10, 9, 10, 7
VIII	5.8	4.9	84	3.4	2.4	69	19.2	14.6	76	10.6	7.4	71	5
IX	6.5	4.7	72	3.3	2.3	73	21.1	18.0	81	10.6	6.5	74	9
X	5.3	3.4	82	2.3	1.5	72	16.8	11.7	80	9.2	5.9	81	6, 7, 7, 6
XI	8.2	5.0	63	3.3	2.4	75	28.1	19.7	70	11.1	8.5	74	11
XII	4.7	3.8	82	2.8	2.2	77	16.8	14.2	86	8.0	7.2	88	8, 6, 8, 6
I(No.3)	6.2	4.1	66	2.3	1.8	80	20.1	14.6	67	6.4	5.2	83	8
II	10.4	6.1	62	4.6	3.0	68	36.6	21.9	61	16.7	11.0	70	8, 6, 8, 6
III	6.2	4.7	74	2.2	1.7	68	18.5	14.8	76	7.3	5.8	76	5, 6, 6, 6
IV	4.2	3.2	80	1.9	1.6	85	14.7	11.4	79	6.0	4.5	78	12
V	8.9	5.2	69	4.2	2.4	76	29.0	17.4	66	15.7	9.5	72	13, 14, 14, 13
VI	4.0	2.7	73	2.1	1.6	90	14.0	10.3	76	6.0	4.6	77	7
VII	7.2	4.3	68	3.5	2.2	72	25.4	14.4	62	11.4	7.4	76	12, 11, 12, 11

Continued — table 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
VIII	5.5	3.5	66	2.6	1.8	69	18.0	11.2	66	8.0	5.6	74	5
IX	7.2	4.8	71	3.9	2.4	74	23.3	15.9	71	11.2	7.5	72	10, 11, 11, 11
X	9.4	6.5	73	4.4	3.3	84	32.3	22.5	74	14.9	10.2	74	13
XI	7.2	3.7	61	4.4	1.9	57	23.4	14.0	69	13.1	6.0	58	5
XII	12.2	7.6	68	5.1	3.2	74	51.0	29.3	70	17.2	11.2	73	6
I(No.4)	6.2	3.7	71	2.7	1.7	66	23.1	12.7	69	7.9	4.8	70	9
II	6.4	4.6	75	2.9	1.8	64	20.8	15.4	76	8.3	5.5	69	9
III	7.4	4.7	63	3.2	2.1	60	24.7	15.0	59	10.7	6.7	60	6, 7, 7, 7
IV	5.3	3.3	69	2.3	1.8	80	20.3	12.3	61	7.8	5.6	77	11, 12, 12, 12
V	8.6	6.0	74	3.2	2.5	77	29.8	23.4	74	11.4	8.0	70	5
VI	7.6	6.3	81	3.5	2.9	82	23.6	20.2	83	10.0	8.9	82	5
VII	5.8	3.9	70	3.0	2.3	80	19.7	13.1	69	10.2	7.5	74	7, 6, 7, 6
VIII	8.0	5.2	63	3.8	2.8	77	26.0	19.6	70	15.2	10.7	66	7, 6, 7, 6
IX	12.6	9.3	79	4.3	2.9	71	40.4	34.0	83	14.7	10.4	78	9
X	4.4	3.1	72	2.5	1.9	77	17.5	12.2	70	7.4	5.8	79	6
XI	6.2	4.9	78	3.2	1.9	74	20.7	16.2	77	12.0	6.8	71	6, 5, 6, 5
XII	4.3	2.9	67	1.9	1.2	64	16.2	10.5	66	6.1	3.8	64	8
I(No.5)	4.9	2.9	60	2.4	1.1	52	15.4	9.4	63	6.5	3.9	65	7, 8, 8, 8
II	10.7	4.8	57	4.6	2.3	63	32.2	14.9	57	14.4	7.6	63	8, 7, 8, 7
III	7.1	4.5	68	2.3	1.7	73	21.4	14.8	70	7.8	6.3	80	9
IV	8.1	4.4	64	3.5	2.7	68	24.8	14.4	64	11.1	6.5	64	11
V	7.6	5.3	72	4.5	2.9	66	29.1	20.0	66	15.5	9.5	62	7, 6, 7, 6
VI	5.8	3.4	58	2.4	1.5	61	18.5	9.5	54	9.5	5.6	60	6, 6, 6, 4
VII	7.1	4.3	65	3.6	2.2	64	22.7	16.2	75	11.8	7.6	71	9
VIII	7.2	3.8	52	3.2	1.9	65	24.4	14.0	58	9.6	5.7	64	6, 7, 7, 7
IX	12.5	8.9	68	5.1	3.2	64	36.2	27.8	74	16.2	11.2	66	4
X	7.2	4.5	69	4.4	2.3	62	27.3	17.7	74	12.3	7.5	66	7, 5, 7, 6
XI	8.4	5.1	62	4.0	2.6	69	29.7	18.6	61	13.1	8.3	66	7
XII	7.3	5.1	72	4.8	3.2	72	25.3	18.9	71	16.5	10.0	66	5, 4, 6, 4
I(No.6)	5.8	3.4	59	2.6	1.8	66	22.0	12.5	58	9.6	6.7	67	11, 10, 11, 8
II	5.1	3.0	61	2.1	1.1	57	16.0	9.3	60	5.5	3.1	58	6
III	8.1	4.2	58	4.5	2.1	50	27.0	15.8	62	14.0	7.6	63	5, 4, 5, 5
IV	7.1	4.1	58	3.2	1.8	58	22.7	15.3	67	9.0	5.7	61	9
V	5.8	4.8	81	3.3	2.6	76	23.3	17.3	72	9.9	8.0	80	10
VI	8.2	3.8	49	4.0	2.2	59	27.8	15.7	57	13.0	7.7	61	3
VII	4.8	3.8	73	2.1	1.9	91	17.7	17.7	100	8.2	7.1	87	4, 4, 3, 4
VIII	9.3	6.2	61	3.6	2.6	68	30.9	22.2	66	11.9	8.2	66	9, 8, 9, 8
IX	5.8	3.1	63	3.0	1.4	49	18.2	10.2	61	8.2	5.1	67	6
X	7.2	5.2	69	3.5	2.2	66	23.5	16.5	71	9.0	6.5	72	8
XI	5.6	3.7	70	2.0	1.2	68	15.6	11.1	72	6.7	5.1	77	5, 8, 8, 6
XII	6.0	3.6	64	2.6	1.8	77	18.7	11.6	69	8.2	5.1	76	8, 8, 9, 8
I(No.7)	5.1	3.4	70	2.2	1.6	70	21.4	13.6	64	6.6	4.1	75	7, 7, 7, 6
II	5.0	3.2	64	1.8	1.5	84	16.1	9.8	62	5.9	4.2	70	8, 7, 8, 7
III	5.8	4.7	76	2.1	1.7	72	20.6	17.1	80	7.4	5.5	71	9
IV	5.5	3.0	59	3.0	1.7	57	19.4	11.0	58	8.6	5.0	60	10
V	9.5	6.4	70	4.2	2.6	62	34.6	22.1	66	13.1	8.8	63	16
VI	5.8	3.2	57	2.9	1.8	60	18.5	11.4	66	8.5	6.2	74	6
VII	10.4	5.5	58	3.7	2.3	67	31.7	18.5	63	12.1	7.8	69	6
VIII	7.5	5.0	67	3.0	2.0	69	27.0	17.0	59	9.0	6.0	70	4
IX	7.2	5.0	63	4.6	2.5	62	26.0	16.8	71	11.9	6.5	57	6, 5, 6, 6
X	8.3	6.3	74	3.8	2.4	62	26.8	17.2	69	11.4	7.9	70	13, 12, 13, 12
XI	7.9	5.1	71	2.9	1.8	72	23.3	16.4	76	9.3	6.4	71	9
XII	5.3	4.3	80	1.9	1.5	79	18.7	15.6	84	6.2	5.2	86	7, 8, 7, 8

Continued — table 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
I(No.8)	9.2	5.1	65	2.8	1.8	72	19.8	13.0	74	7.3	4.7	70	4, 3, 4, 3
II	7.6	4.9	59	3.3	2.3	64	27.1	17.4	58	11.3	7.6	64	9
III	5.2	3.7	60	2.9	2.0	70	19.8	14.4	72	9.6	6.8	62	5
IV	8.0	5.2	58	3.6	2.2	58	25.9	17.9	63	11.9	7.8	63	10
V	8.1	4.0	60	3.6	2.3	69	25.6	13.9	64	10.6	7.2	67	9
VI	5.4	3.5	64	2.5	1.8	77	14.8	10.5	72	8.0	5.5	65	4
VII	5.8	3.7	62	2.8	2.0	69	17.0	11.4	68	8.6	6.0	67	6, 5, 5, 5
VIII	6.1	3.0	54	2.2	1.6	71	16.2	9.0	57	7.0	5.0	70	4, 4, 5, 4
IX	4.4	2.9	65	2.4	1.5	60	14.1	9.4	70	7.1	5.3	77	7, 8, 8, 8
X	14.0	6.0	57	5.1	2.3	59	44.7	20.6	57	16.4	9.1	59	9, 9, 9, 8
XI	9.4	5.4	69	4.1	1.9	58	27.6	15.1	64	14.4	7.2	62	4, 5, 5, 4
XII	5.4	4.4	86	2.4	1.5	66	19.0	13.2	71	7.3	4.3	61	5
I(No.9)	8.9	3.6	55	3.8	1.6	54	27.3	13.0	59	12.0	5.7	59	7, 6, 7, 7
II	4.4	2.4	55	1.7	1.2	73	15.0	7.6	50	5.5	3.8	66	5
III	6.9	4.6	65	3.5	2.1	62	21.4	13.8	63	9.4	5.6	58	7
IV	10.6	6.6	67	4.1	2.8	71	36.2	25.0	71	14.8	14.1	72	9
V	7.0	3.0	46	3.5	2.0	57	25.0	8.7	37	12.3	6.3	54	3
VI	9.3	6.2	70	4.5	3.0	72	31.2	20.4	65	15.1	10.0	72	8
VII	5.3	3.5	65	2.3	1.7	72	19.0	13.3	69	7.7	6.2	79	3
VIII	4.9	3.4	57	2.8	1.7	64	20.4	12.6	66	8.6	5.5	67	8, 10, 9, 10
IX	6.7	4.0	55	2.5	1.5	63	17.3	12.3	74	9.7	5.7	64	3
X	6.4	4.1	64	3.4	2.1	63	22.7	14.9	66	11.0	7.0	66	16, 14, 16, 14
XI	4.9	2.6	56	2.2	1.3	64	18.2	10.7	63	9.0	5.2	64	6
XII	8.7	5.5	69	3.5	2.0	65	26.6	19.2	72	10.4	7.3	72	5
I(No.10)	5.2	3.6	68	2.4	1.8	68	16.7	12.2	74	6.5	4.8	76	6
II	11.0	5.3	51	4.8	2.6	59	32.2	18.8	59	13.5	7.8	60	3, 4, 4, 4
III	7.4	3.4	61	2.9	1.9	65	28.5	11.5	54	8.5	5.2	64	4
IV	13.8	7.2	50	3.9	2.6	65	45.8	23.2	49	13.0	8.6	66	5
V	9.2	5.2	55	3.4	2.5	80	33.2	19.5	56	10.1	7.2	75	4
VI	5.8	2.6	52	2.8	1.9	70	17.3	8.8	60	6.2	3.8	60	6
VII	7.5	5.0	69	2.9	2.0	71	20.4	15.1	76	8.4	6.8	84	6, 7, 7, 7
VIII	5.2	3.2	64	2.7	1.8	72	20.3	11.8	63	8.6	5.7	69	7
IX	6.2	3.4	56	2.8	1.7	61	21.0	14.0	67	8.8	6.1	73	5
X	7.9	4.8	69	4.1	2.3	62	27.6	16.6	69	13.5	7.9	4	13, 11, 14, 12
XI	5.0	2.8	64	2.7	1.6	77	17.0	9.4	60	8.2	5.2	75	8, 7, 8, 8
XII	7.6	4.8	63	2.7	1.7	67	21.9	12.9	58	8.6	5.4	68	6, 7, 7, 7

Table 2

Zones	$\bar{D}_1^0$	$\bar{D}_2^0$	$\bar{\varepsilon}_{D_{12}}^0$	$\bar{d}_1^0$	$\bar{d}_2^0$	$\bar{\varepsilon}_{d_{12}}^0$	$\bar{D}_3^0$	$\bar{D}_4^0$	$\bar{\varepsilon}_{D_{34}}^0$	$\bar{d}_3^0$	$\bar{d}_4^0$	$\bar{\varepsilon}_{d_{34}}^0$	n_k
1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. 1	6.4	5.4	806	2.7	2.2	828	26.9	21.6	810	9.5	7.7	822	25
	6.9	5.4	785	3.2	2.4	763	23.6	18.4	770	10.1	7.8	788	22, 21, 22, 22
	4.7	3.2	705	2.5	1.8	744	17.8	14.3	822	7.5	5.6	773	15, 16, 14, 16
	10.7	8.6	832	3.7	3.0	832	35.3	30.8	830	12.3	9.8	838	13, 14, 13, 14
No. 2	7.3	5.7	778	3.1	2.3	816	25.0	19.4	796	9.7	7.3	802	24, 25, 26, 25
	5.3	3.5	721	2.4	1.9	831	19.3	12.4	699	8.0	6.3	824	31, 28, 31, 29
	6.5	4.4	694	3.2	2.3	711	22.4	17.0	760	10.5	7.4	733	23, 21, 23, 22
	6.0	4.5	765	2.9	2.2	770	22.4	16.6	773	8.9	6.7	794	30, 29, 30, 30
No. 3	8.5	5.2	678	3.0	2.3	750	27.6	18.0	690	9.5	7.1	771	23, 21, 23, 21
	6.0	4.1	718	3.2	2.4	742	23.0	15.0	691	9.7	6.5	746	34, 33, 34, 34
	7.5	4.5	651	3.6	2.1	654	24.2	16.0	684	10.8	6.8	708	27, 28, 29, 27
	11.3	7.0	697	4.4	2.9	708	41.5	28.3	737	14.8	10.0	742	24

Continued — table 2

1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. 4	10.2	7.5	749	4.1	2.9	740	34.7	29.2	813	12.7	9.3	724	23, 21, 23, 22
	5.6	3.9	679	2.7	1.7	685	18.1	14.0	742	8.1	4.9	642	19, 19, 21, 19
	7.9	4.6	632	3.4	2.3	710	25.6	17.0	693	9.4	6.7	711	25, 25, 25, 24
	7.2	4.9	723	3.1	2.4	763	25.0	18.4	758	10.1	7.8	800	21, 23, 23, 23
No. 5	9.0	5.2	599	3.7	2.4	680	29.4	20.1	675	11.7	7.9	702	20
	8.1	5.3	667	4.1	2.5	656	28.3	19.5	675	13.5	8.4	647	19, 18, 20, 18
	8.8	4.5	588	3.4	2.2	706	25.0	15.0	666	9.9	6.3	688	25, 25, 26, 26
	8.0	4.6	615	4.0	2.4	621	29.5	16.6	595	12.1	7.2	637	24, 22, 24, 22
No. 6	7.6	5.1	676	3.3	2.3	692	24.4	17.9	724	10.7	7.2	692	20, 19, 20, 18
	6.2	4.3	690	3.1	1.9	698	20.6	13.5	683	9.2	6.0	713	26, 24, 26, 24
	7.2	4.9	694	3.9	2.4	640	25.8	17.6	674	11.8	7.6	665	22
No. 7	8.6	5.5	641	3.7	2.6	690	29.1	19.4	674	11.7	7.8	698	18, 16, 18, 16
	7.2	5.2	722	3.1	2.2	736	24.0	17.0	709	9.9	7.0	716	30, 28, 30, 28
	6.1	3.9	637	2.4	1.8	795	20.6	14.0	674	7.6	5.6	752	23, 24, 24, 24
	8.4	4.9	646	3.8	2.4	655	32.5	20.1	644	12.5	7.7	682	32, 32, 32, 31
No. 8	5.9	4.1	745	2.8	1.8	656	19.5	13.7	729	8.6	5.9	691	19, 18, 20, 17
	9.6	5.1	625	4.1	2.0	589	33.4	17.1	612	12.5	6.5	626	20
	8.2	4.9	623	3.3	2.2	637	28.8	18.3	623	11.4	7.5	610	18, 16, 18, 16
	8.0	4.7	583	3.5	2.3	638	31.3	18.4	567	11.5	7.4	606	23
No. 9	5.8	3.9	615	3.0	1.8	617	20.6	13.4	667	7.8	5.5	724	16, 18, 17, 18
	7.5	5.2	685	3.2	2.3	678	27.4	18.3	671	10.6	7.4	700	28, 27, 29, 27
	7.5	4.0	582	3.4	2.1	721	27.5	15.7	619	10.6	6.2	672	19
	10.9	6.6	627	4.5	2.9	669	37.7	27.2	706	14.8	9.6	678	20
No. 10	6.9	4.5	693	3.1	2.2	699	23.8	16.5	718	10.0	6.6	684	19, 19, 17, 19
	7.4	4.2	652	3.3	1.8	640	25.5	15.1	641	10.9	6.1	660	30, 29, 31, 28
	7.5	5.0	696	3.3	2.0	690	26.2	16.6	681	10.0	6.4	683	15
	9.4	5.5	600	3.3	2.3	741	29.7	18.6	667	10.8	7.0	735	18, 17, 18, 17

	$\overline{D}_1^E$	$\overline{D}_2^E$	$\bar{\varepsilon}_{0_{12}}^E$	$\overline{d}_1^E$	$\overline{d}_2^E$	$\bar{\varepsilon}_{d_{12}}^E$	$\overline{D}_3^E$	$\overline{D}_4^E$	$\bar{\varepsilon}_{D_{31}}^E$	$\overline{d}_3^E$	$\overline{d}_4^E$	$\bar{\varepsilon}_{d_{31}}^E$	n_k
1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. 1	8.9	7.3	807	2.8	2.3	817	29.0	24.4	835	9.3	7.9	863	18, 26, 21, 26
	7.9	5.9	762	3.4	2.6	815	23.7	19.3	813	10.8	8.4	819	18, 20, 20, 20
	4.5	3.1	725	2.3	1.8	795	18.2	13.9	801	7.5	5.6	762	12, 14, 10, 15
	9.6	7.6	855	3.7	2.9	877	32.5	27.2	881	12.5	10.2	845	13, 15, 14, 15
No. 2	7.0	5.6	853	3.1	2.4	802	22.8	18.5	827	9.9	7.5	838	22, 24, 25, 24
	5.0	3.3	734	2.3	1.9	847	16.7	11.3	736	7.1	5.8	842	28, 30, 31, 31
	6.0	4.1	702	3.0	2.1	713	19.4	14.5	739	10.5	7.1	737	24, 23, 24, 21
	6.4	4.2	736	2.9	2.1	749	21.6	15.9	775	9.8	7.5	794	25, 24, 26, 23
No. 3	6.1	3.9	743	2.9	2.0	825	20.6	13.7	731	19.9	6.5	754	32, 33, 33, 32
	7.8	5.0	666	3.0	2.1	727	25.5	17.3	671	9.8	7.1	769	21, 20, 22, 20
	6.9	4.3	685	3.5	2.2	723	23 3	14.4	665	10.7	7.1	741	27, 27, 28, 27
	9.6	6.2	697	4.6	3.0	760	35.1	22.4	720	15.1	9.6	705	24
No. 4	6.6	4.7	731	2.8	2.2	801	23.2	16.6	708	9.1	6.9	765	21, 22, 22, 22
	6.6	4.3	705	2.9	1.8	637	22.7	14.3	687	8.8	5.6	669	24, 25, 25, 25
	9.1	6.4	716	3.8	2.7	751	29.7	23.3	750	13.5	9.7	734	23, 21, 23, 21
	7.4	4.4	645	3.5	2.2	656	24.5	14.8	621	12.0	7.2	628	24, 23, 24, 21
No. 5	7.6	4.1	620	3.0	1.7	628	23.0	13.1	636	9.3	5.9	700	24, 24, 25, 24
	8.3	5.1	618	3.8	2.3	646	26.0	17.8	687	11.9	8.7	676	19, 20, 20, 20
	6.7	4.4	670	3.4	2.2	663	23.6	16.3	680	10.0	7.0	697	22
	6.1	3.5	594	2.9	1.7	598	21.5	12.4	593	9.4	5.8	633	22, 20, 22, 19
No. 6	7.2	4.7	639	3.1	2.1	669	24.4	17.4	698	9.8	6.9	712	19, 18, 18, 18
	6.4	4.2	671	2.7	1.8	704	19.2	13.0	706	8.1	5.6	750	21, 24, 25, 22
	7.5	4.8	640	3.6	2.2	602	26.8	16.6	636	10.8	7.1	644	32
	5.3	3.8	704	2.0	1.6	751	19.3	13.6	696	6.7	4.9	752	24, 23, 24, 22

1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. 7	8.5	5.2	620	3.8	2.3	657	28.4	17.5	649	11.3	6.8	645	16, 15, 16, 16
	7.5	5.4	746	3.0	1.9	697	23.8	16.6	752	9.3	6.7	747	29
	7.5	4.4	597	3.5	2.2	659	23.8	15.0	651	10.7	7.2	650	23
	7.3	4.6	608	3.1	2.1	673	23.4	15.6	657	10.1	6.9	646	18, 17, 18, 17
No. 8	5.3	3.2	616	2.5	1.7	654	17.4	11.1	656	7.5	5.4	726	17, 17, 18, 17
	10.6	5.4	678	4.1	2.0	606	33.4	17.2	622	13.3	7.3	602	18, 19, 19, 17
	9.5	5.9	652	4.2	2.8	697	32.6	20.7	645	14.6	11.3	694	20
	7.0	3.7	585	3.1	1.7	623	21.9	11.9	582	9.3	5.2	604	19, 18, 19, 19
No. 9	6.5	4.0	630	3.2	1.9	635	22.4	14.8	665	10.4	6.7	664	27, 25, 27, 25
	5.4	3.6	582	2.6	1.7	653	19.5	12.7	681	8.6	5.7	685	14, 16, 15, 16
	9.4	4.8	522	3.3	2.3	711	31.1	16.5	555	9.5	6.3	662	15
	7.2	3.9	622	3.2	2.0	645	24.5	13.9	639	9.1	5.8	679	13, 14, 14, 14

laxies and their nuclei. Let us denote the above mentioned characteristics as follows:

$$
\begin{array}{llll}
D_1^O & \multirow{2}{*}{$\varepsilon^O_{D_{12}}$} & D_1^E & \multirow{2}{*}{$\varepsilon^E_{D_{12}}$} \\
D_2^O & & D_2^E & \\
d_1^O & \varepsilon^O_{d_{12}} & d_1^E & \varepsilon^E_{d_{12}} \\
d_2^O & & d_2^E & \\
D_3^O & \varepsilon^O_{D_{34}} & D_3^E & \varepsilon^E_{D_{34}} \\
D_4^O & & D_4^E & \\
d_3^O & \varepsilon^O_{d_{34}} & d_3^E & \varepsilon^E_{d_{34}} \\
d_4^O . & & d_4^E & .
\end{array}
$$

The indices O and E are reserved for both prints, 1 and 2 — for major and minor diameters measured with 16×, 3 and 4 — for major and minor diameters with 56×. The diameters of the outer parts of the galaxies are labelled with D, and those of the nuclei with d. The ratios of the minor diameters to the major ones give the quantities $\varepsilon = D_2/D_1$; d_2/d_1.

All average characteristics (with respect to n — the number of galaxies measured) are given on Table 1. The numbers of the measured galaxies are given on the right side of the Table and represent each group of 3 characteristics, since in some cases the nuclei or the outer parts of the galaxies either do not exist or cannot be measured.

Errors in all characteristics will be discussed in the following paper. The D_1, D_2 and d_2 values (O and E) have small errors. For example when $1 < D$; $d < 25$ the mean-root-square error is of about 0.3 divisions. It is clear that the error depends on the type of the galaxies measured. This question is examined by Vorontsov-Velyaminov [23], Agekian and Soomsina [24] and discussed in [25].

In order to avoid the defects in Vorontsov-Velyaminov's method, dimensions of outer parts of the galaxies were determined up to an almost blend-

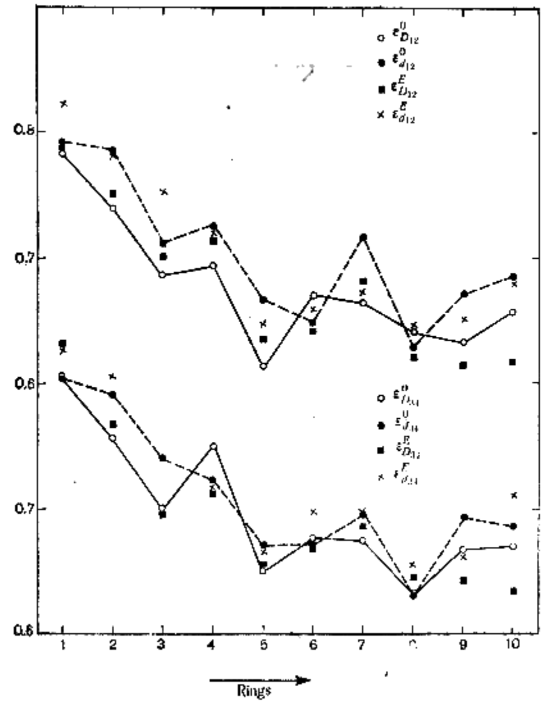

Fig. 1

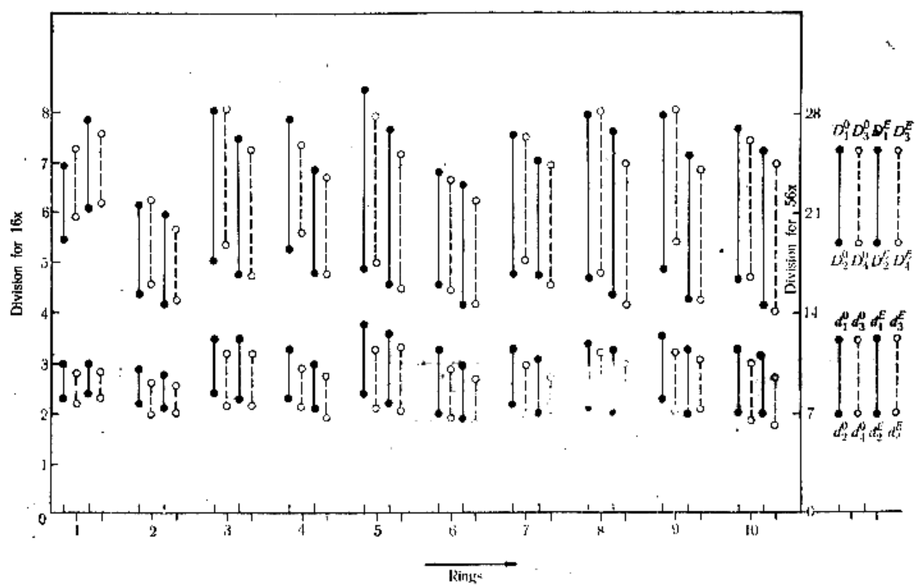

Fig. 2

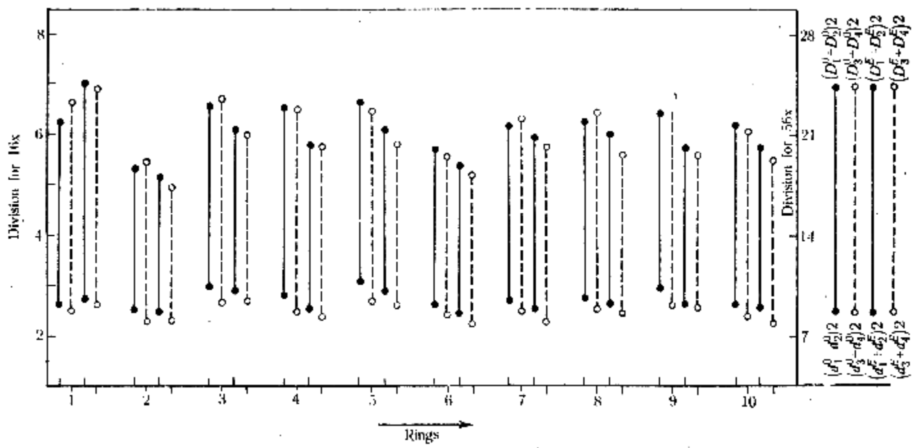

Fig. 3

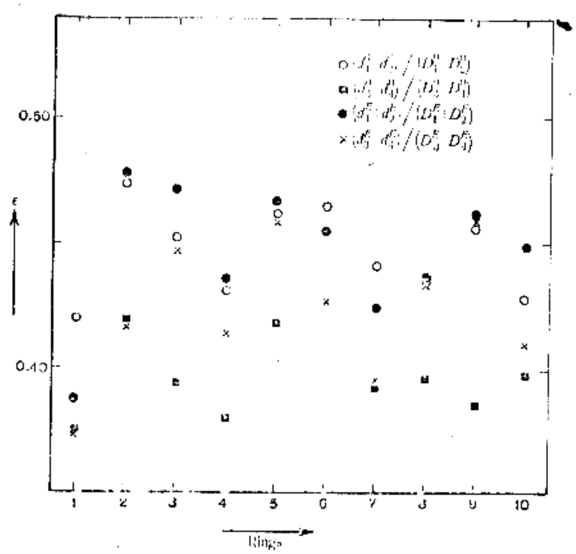

Fig. 4

ing into the background. The dimensions of the nuclei were determined from the greatest gradient of blackening (which gives a large uncertainty for elliptical galaxies)

The values of ε are in connection with the type of the galaxies (for elliptical systems only) according to Hubble, since $\varepsilon = D_2/D_1$; $e = 10.(D_1 - D_2)/D_1 = 10(1 - D_2/D_1) = 10(1 - \varepsilon)$.

The Table 1 data are necessary for a study ot the Coma cluster microstructures, but for macrostructures one needs results, which are obtained as a weighted average from the above mentioned values.

Table 2 presents data for z Zones which are grouped in 3 sectors for given radial distances from the center (No 1—3, 4—6, 7—9, 10—12 — four quadrants). The radial variations of all characteristics related to the ten rings are given on Fig. 1 — for ε, Fig. 2 — for diameters of outer parts and nuclei of the galaxies and on Fig. 3 — for the mean diameters. The radial variations of ratios between the mean diameters of nuclei and outer parts are shown on Fig. 4.

The above mentioned results give the following important quality information about the Coma cluster structure:

1. The values of ε_d are larger than those of ε_D — Tables 1 and 2 and mostly — Fig 1. Consequently, the nuclei of the galaxies possesses a smaller flattening than the outer parts of the galaxies.

2. The radial variation of ε (for all cases) show that in the central part of the Coma cluster there are galaxies with a smaller flattening — real spheroidal systems. This fact is connected to the dynamical stability of the cluster, as well as to its rotation.

COUNTS OF GALAXIES

Numerous attempts have been made to investigate the surface distribution of galaxies in the Coma cluster — as in large investigations (i. e. Lick counts [8, 9]) and also in special ones [1, 2, 5] and others.

In the present paper a count of galaxies is made too. The basic material is given on Table 3 — by means of sectors and rings. All counts are obtained with a 16× magnifications. As it may be seen an effect exists according to which the counts on the E print are larger than the counts on the *O* print, since for larger radial distances from the cluster center it is more probable to indicate the faintest background galaxies (as a result of the reddening for larger z).

Table 3

Sector *O*	Rings 1	2	3	4	5	6	7	8	9	10	Sector *E*	Rings 1	2	3	4	5	6	7	8	9
I	5	12	12	14	17	18	12	15	11	16	5	15	10	15	16	21	15	20	15	15
II	11	11	11	15	12	10	11	10	11	16	10	13	17	16	13	9	13	13	12	20
III	15	12	11	12	15	8	18	12	14	10	15	13	12	9	13	7	16	12	13	9
IV	11	13	29	16	15	12	14	26	20	14	10	13	27	18	18	13	15	28	18	15
V	8	12	23	10	10	13	23	20	11	7	9	12	18	8	8	14	19	18	12	9
VI	9	20	7	9	9	7	10	15	16	10	8	15	7	11	9	7	15	19	16	9
VII	7	13	18	10	11	7	13	12	10	11	8	14	17	8	10	7	11	12	12	12
VIII	2	11	9	11	10	12	5	9	13	14	2	8	11	9	10	11	6	8	13	18
IX	8	12	15	15	12	18	11	14	15	11	8	13	15	15	13	19	13	13	15	13
X	8	13	18	11	11	17	16	21	27	22	8	13	17	9	14	14	19	21	26	22
XI	4	15	9	10	13	17	16	18	11	15	5	16	10	12	17	14	18	16	15	17
XII	5	8	9	12	10	15	11	15	15	17	4	9	10	12	9	17	14	22	18	22

The function $\lg N(m)$ for all radial sectors, reduced to 1 sq. degree are given on Fig. 5, together with the results from [2] and [5]. Our count is in compliance with these results.

A more complete picture of the galaxie's surface distribution in direction to the Coma cluster is presented on Fig. 6 and Fig. 7, where the values of $\lg N(m)$ are given for the separate zones.

The observational material gives a possibility to study in detail the surface distribution of the galaxies. For this purpose it is necessary to construct the curves of radial surface densities — Fig. 8 and Fig. 9. The separate values, plotted on the latter two Figures, are obtained as a moving arithmetic mean from 4 neighbouring surface densities. After this method polar diagrams may be constructed — Fig. 10 and Fig. 11.

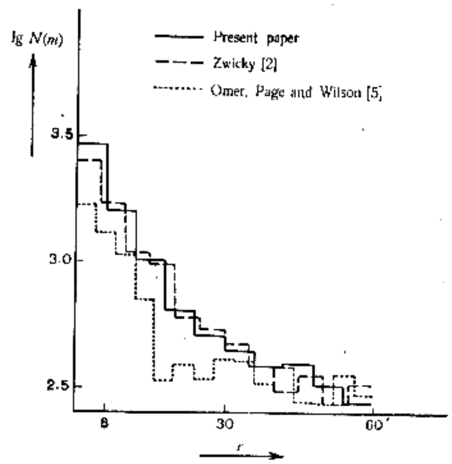

Fig. 5

Let us suppose that the polar diagrams may be approximated with ellipses. Let us choose the origin of the co-ordinate system in the cluster center and let the directions of the axes X and Y be N and E, respectively. a and b are the major and minor semiaxes of the approximated ellipses, ψ — the polar angle of the major semiaxis a and φ — the polar angle of the radius-vector.

The equation of an ellipse in the polar co-ordinate system will be

(3) $$\frac{1}{r^2}=\alpha+\beta\sin 2\varphi+\gamma\cos 2\varphi.$$

We have $n=12$ sectors, which permit the determination of the coefficients α, β and γ after the least-mean-square method

(4)
$$\alpha=\frac{1}{12}\sum_{i=1}^{12}\frac{1}{r_i^2},$$
$$\beta=\frac{1}{6}\sum_{i=1}^{12}\frac{\sin 2\varphi_i}{r_i^2},$$
$$\gamma=\frac{1}{6}\sum_{i=1}^{12}\frac{\cos 2\varphi_i}{r_i^2}.$$

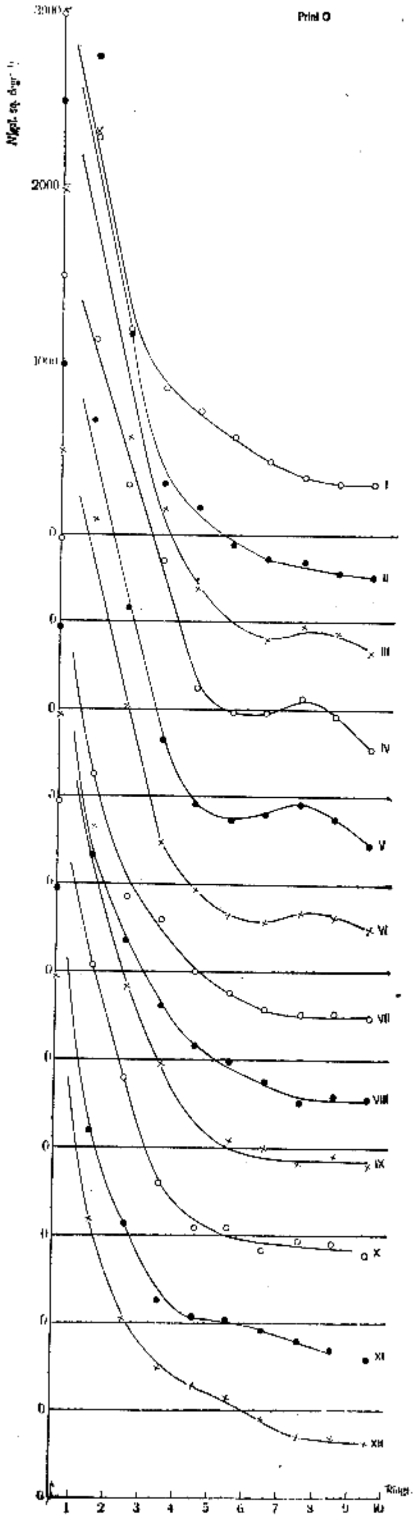

Fig. 8

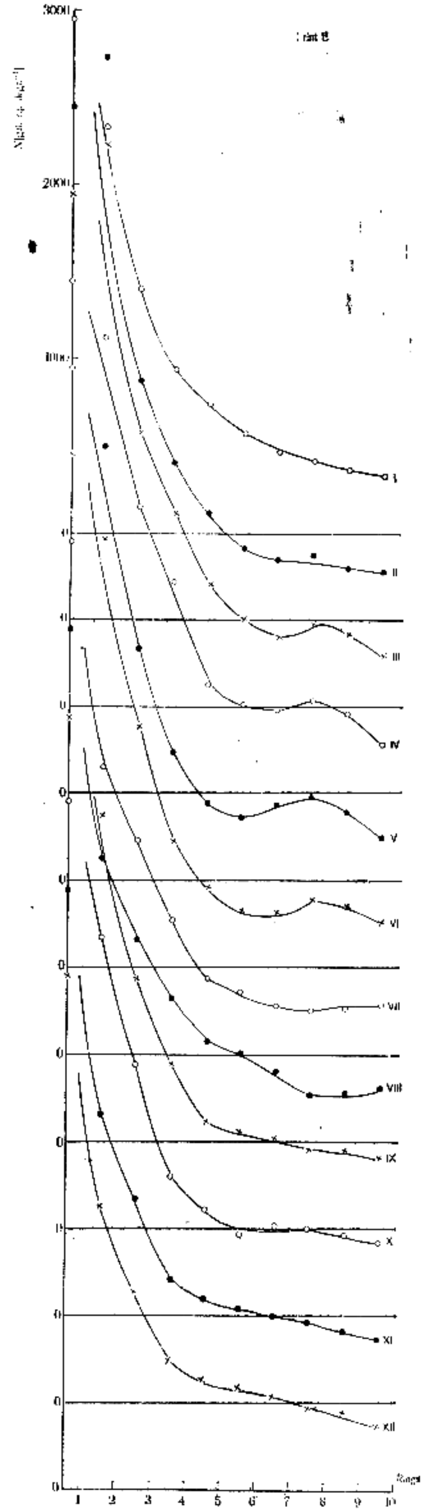

Fig. 9

Print O

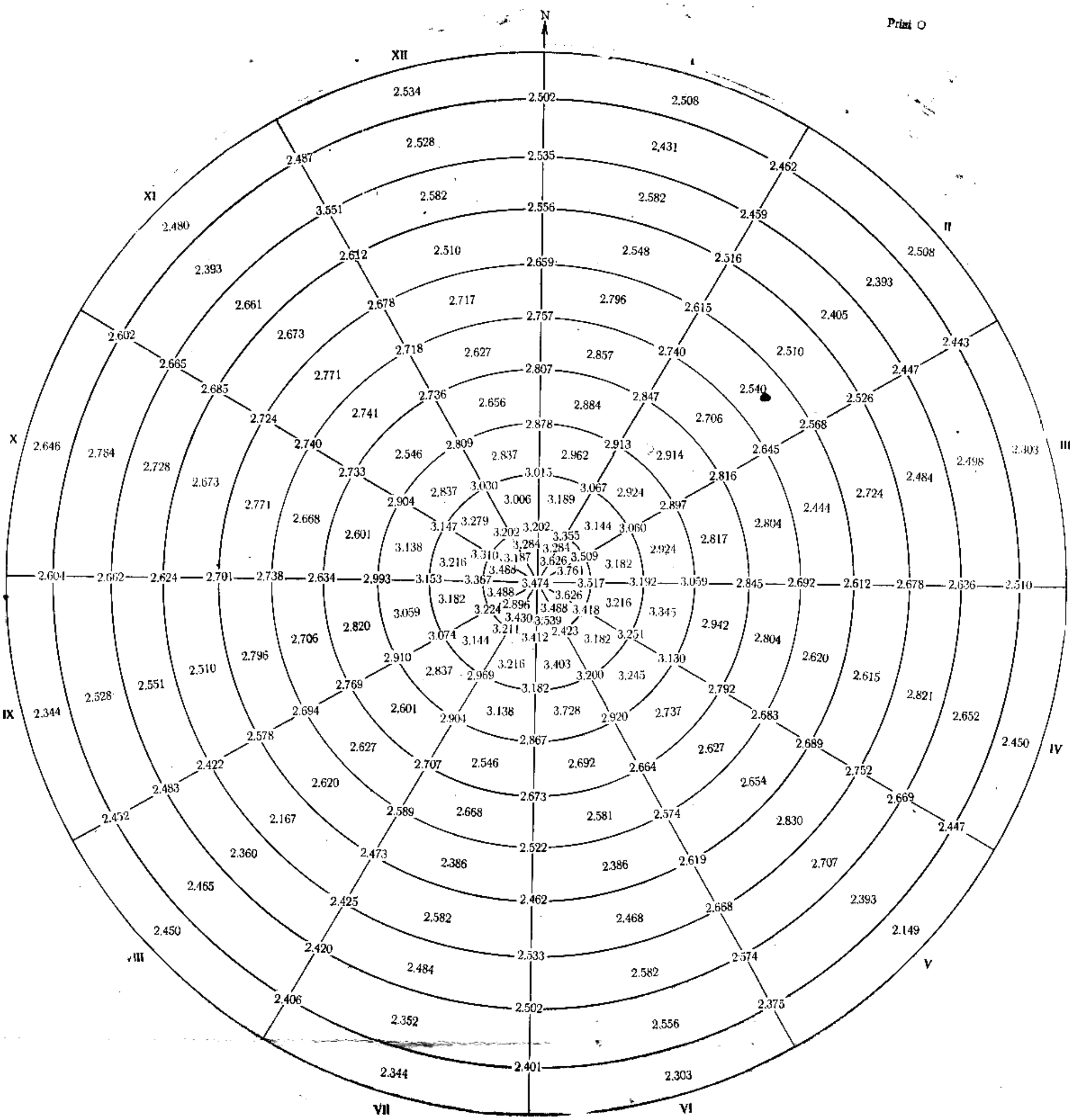

Fig. 6

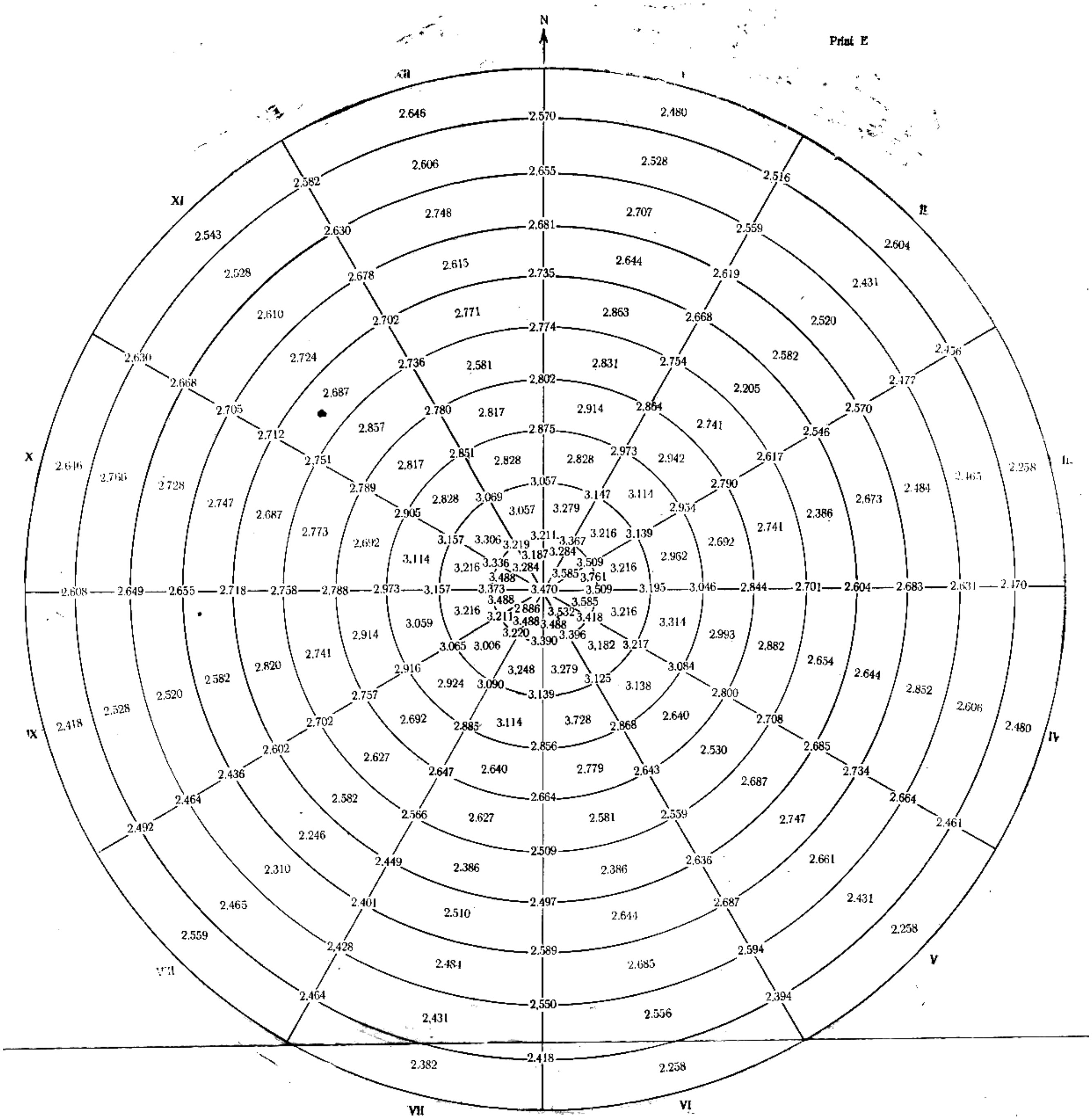

Fig. 7

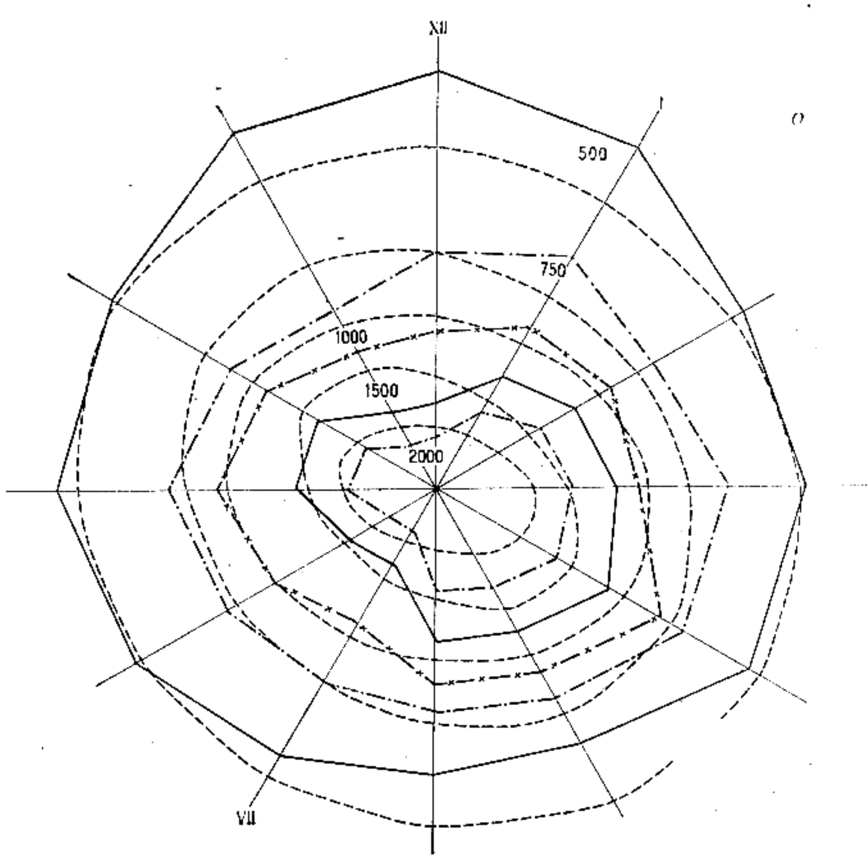

Fig. 10

with root-mean-square errors

$$(5) \qquad \Delta\alpha = \left[\frac{\sum \left(\frac{1}{r^2_{i,\,\mathrm{obs}}} - \frac{1}{r^2_{i,\,\mathrm{calc}}} \right)^2}{n(n-3)} \right]^{1/2},$$

$$\Delta\beta = \Delta\gamma = \Delta\alpha\sqrt{2}$$

and

$$(6) \qquad \mathrm{tg}\, 2\varphi = \frac{\beta}{\gamma}$$

with

$$\Delta\varphi = \Delta\alpha\,[2(\beta^2+\gamma^2)]^{-1/2}$$

and

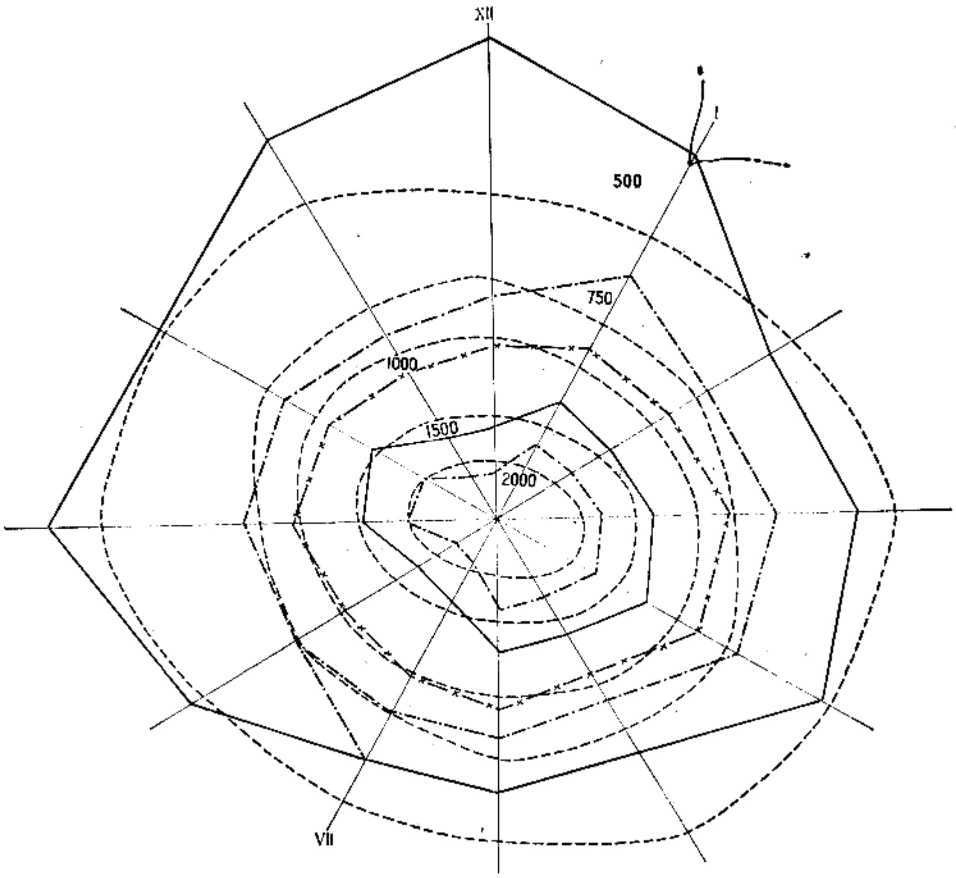

Fig. 11

(7) $$\eta = \frac{b}{a} = \left[\frac{a - (\beta^2 + \gamma^2)^{1/2}}{a + (\beta^2 + \gamma^2)^{1/2}} \right]^{1/2}$$

with

(8) $$\Delta\eta = \frac{1}{2} a^2 \eta \, \Delta a \, (3 + 2\eta^2 + 3\eta^4)^{1/2}$$

according to [26, 27].

The application of the least-mean-square method for apparent surface densities 2 000, 1 500, 1 000, 750 and 500 gal/sq. degr. permits the determination of the following approximated ellipses present on Fig. 10 and Fig. 11 (r_i is in units of mm, as 20 mm correspond to 6 minutes of arc; P is the positional angle of the minor axes — is this the position angle of the cluster rotation axis? — in direction NESW):

$$O,2\,000: \frac{1}{r_i^2} = 0.0026\,3557 - 0.0006\,8158 \,.\, \sin 2\psi_i + 0.0010\,6091 \,.\, \cos 2\psi_i$$
$$\pm 5\,7293 \qquad \pm 8\,1012 \qquad \pm 8\,1012$$

$$\eta = 0.594 \pm 0.250; \quad \varphi = 74^\circ \pm 18^\circ; \quad P = 344^\circ.$$

$$E,2\,000: \frac{1}{r_i^2} = 0.0028\,8207 - 0.0007\,2352 \,.\, \sin 2\psi_i - 0.0010\,4720 \,.\, \cos 2\psi_i$$
$$\pm 5\,5300 \qquad \pm 7\,8207 \qquad \pm 7\,8207$$

$$\eta = 0.622 \pm 0.215; \quad \varphi = 72^\circ \pm 18^\circ; \quad P = 343^\circ.$$

$$O,1\,500\, \frac{1}{r_i^2} = 0.0009\,6621 - 0.0001\,8127 \,.\, \sin 2\psi_i + 0.0003\,9183 \,.\, \cos 2\psi_i$$
$$\pm 1\,5680 \qquad \pm 2\,2172 \qquad \pm 2\,2172$$

$$\eta = 0.618 \pm 0.186; \quad \varphi = 78^\circ \pm 15^\circ; \quad P = 347^\circ.$$

$$E,1\,500\, \frac{1}{r_i^2} = 0.0009\,6201 - 0.0001\,8801 \,.\, \sin 2\psi_i + 0.0002\,5810 \,.\, \cos 2\psi_i$$
$$\pm 1\,3438 \qquad \pm 1\,9005 \qquad \pm 1\,9005$$

$$\eta = 0.708 \pm 0.162; \quad \varphi = 72^\circ \pm 17^\circ; \quad P = 342^\circ.$$

$$O,1\,000: \frac{1}{r_i^2} = 0.0003\,9072 - 0.000\,4100 \,.\, \sin 2\psi_i + 0.0000\,9192 \,.\, \cos 2\psi_i$$
$$\pm 2712 \qquad \pm 3836 \qquad \pm 3836$$

$$\eta = 0.768 \pm 0.082; \quad \varphi = 78^\circ \pm 11^\circ; \quad P = 347^\circ.$$

$$E,1\,000: \frac{1}{r_i^2} = 0.0003\,6316 - 0.0000\,0963 \,.\, \sin 2\psi_i + 0.0000\,6641 \,.\, \cos 2\psi_i$$
$$\pm 1597 \qquad \pm 2258 \qquad \pm 2258$$

$$\eta = 0.688 \pm 0.040; \quad \varphi = 86^\circ \pm 10^\circ; \quad P = 356^\circ.$$

$$O,\ 750: \frac{1}{r_i^2} = 0.0002\,3312 + 0.0000\,0724 \,.\, \sin 2\psi_i + 0.0000\,4183 \,.\, \cos 2\psi_i$$
$$\pm 1091 \qquad \pm 1543 \qquad \pm 1543$$

$$\eta = 0.692 \pm 0.043; \quad \varphi = 95^\circ \pm 10^\circ; \quad P = 5^\circ.$$

$$E,\ 750: \frac{1}{r_i^2} = 0.0002\,3280 + 0.0000\,0961 \,.\, \sin 2\psi_i + 0.0000\,4368 \,.\, \cos 2\psi_i$$
$$\pm 1044 \qquad \pm 1476 \qquad \pm 1476$$

$$\eta = 0.823 \pm 0.055; \quad \varphi = 96^\circ \pm 9^\circ; \quad P = 6^\circ.$$

$$O,\ 500: \frac{1}{r_i^2} = 0.0001\,1320 - 0.0000\,0134 \,.\, \sin 2\psi_i + 0.0000\,1257 \,.\, \cos 2\psi_i$$
$$\pm 917 \qquad \pm 1296 \qquad \pm 1296$$

$$\eta = 0.894 \pm 0.104; \quad \varphi = 87^\circ \pm 29^\circ; \quad P = 357^\circ.$$

$$E,\ 500:\frac{1}{r_i^2}=0.0001\,0939-0.0000\,0856\,.\sin 2\psi_i+0.0000\,1894\,.\cos 2\psi_i$$
$$\pm 1367 \qquad \pm 1933 \qquad \pm 1933$$

$$\eta=0.825\pm 0.153; \quad \varphi=78^\circ\pm 27^\circ; \qquad P=348^\circ.$$

In [10, 11] an attempt for the determination of the Coma cluster of galaxies rotation was made. There are two possible hypotheses for the direction of the rotational axis. The present count permits a rejection of the first hypothesis for reasons, which are independent of those in [10, 11] — the basic results are obtained there by means of an analysis of the radial velocities. The determined position of the axis according to the previous paper (sector 1-2 — 7-8, or $P=330°$) must be corrected, since the mean value of P here is $=348°$ (as we exclude the counts for 750 gal./sq. degr.), i. e. the axis is located in sector 1.

Note. In a following paper [28] a comparison will be made among the diameters in the Coma cluster of galaxies according to several sources [12, 19, 20, 29, 30, 31].

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23. IX. 1968

ИССЛЕДОВАНИЕ СКОПЛЕНИЯ ГАЛАКТИК COMA

М. Калинков

(Резюме)

Сделано исследование вращения скопления галактик Coma при использовании измерений и подсчета галактик по Паломарскому атласу.

Важнейшие выводы следующие:

1. Ядра галактик этого скопления имеют меньшее сжатие, чем сами галактики.

2. В центральной части скопления расположены галактики с меньшим сжатием — сфероидальные системы.