PHYSICAL CONDITIONS IN SEYFERT TYPE GALAXIES MARKARIAN 9, 10 AND 42

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I would like to present some new data concerning the Seyfert type galaxies Markarian 9, 10 and 42 (Khachikian, 1968; Arp *et al.*, 1968; Khachikian and Weedman, 1969).

A. MARK. 9

The large scale photograph of this galaxy shows that it consists of three parts: (a) A very bright and compact nucleus which is a little elongated and has a size 4″.5 by 5″; (b) A very bright ring the plane of which is perpendicular to the direction of elongation of the nucleus. The diameter of the ring is about 11″.6; (c) A faint diffuse envelope is elongated in the same direction as the nucleus and surrounds both (*a*) and (*b*) parts. The envelope diameter is approximately 20″.

B. MARK. 10

This is an Sb spiral with a very bright and star-like nucleus. The nucleus is a little elongated with size 5″.1 by 4″.4. Mark. 10 is a giant galaxy with diameter ~55 kpc.

C. MARK. 42

The galaxy has a condensed nucleus with nebulous envelope. We have no large scale photograph of this galaxy.

Figure 1 shows slit spectra tracings of Mark. 9, 10 and 42 (Cassegrain image-tube spectrograph of 200-in. Hale telescope, dispersion 85 Å/mm). The relative line-intensities and equivalent widths of identified lines of these galaxies are shown in Table I.

Photometric data for these galaxies are listed in Table II (Weedman and Khachikian, 1968 a, b).

Conclusion

As seen from Figure 1 the profiles of the Balmer lines in Mark. 9 and 10 are very smooth without sharp cores superposed as in NGC 4151 (Oke and Sargent, 1968). This fact is incompatible with a two-zone model of the nuclei of Seyfert galaxies (Dibai and Pronik, 1968). At the same time if the broadening mechanism of Balmer lines is due to Doppler effect it is difficult to imagine how both hydrogen and forbidden lines can arise in the same region because of large differences between their line-widths.

It is also seen from Figure 1 that the H-lines of Mark. 9 and 10 have components shifted toward short wave-lengths by 0.005 λ and 0.011 λ respectively, which means that in the nuclei of these galaxies there possibly took place an asymmetrical ejection

D. S. Evans (ed.), External Galaxies and Quasi Stellar Objects, 160–162.

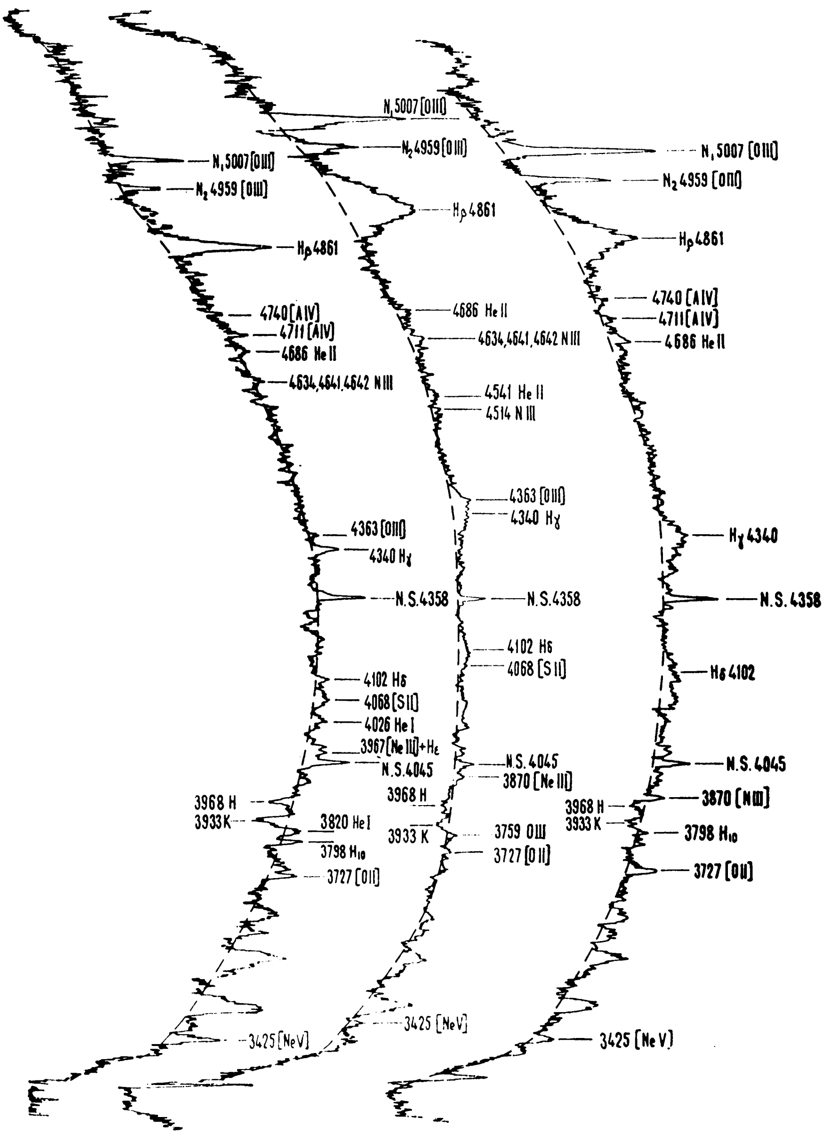

Fig. 1. Slit spectrum tracings of Mark. 10, 9 and 42 (Cassegrain image-tube spectrograph of 200-in. Hale telescope, dispersion 85 Å mm^{-1}) (from the right to the left).

of gas with radial veolocities of about 1500 km s^{-1} and 3000 km s^{-1} repectively.

As for Mark. 42 it seems that the Hβ line of this galaxy has broad wings with a very strong central peak.

There are no absorption line features in the spectra of these galaxies except the H and K lines of Ca II which are not shifted and have Galactic origin.

A more detailed discussion of these galaxies will be published elsewhere.

TABLE I

Ion	λ_0	Mark. 9 $I/I_{H\beta}$	Mark. 9 W_λ	Mark. 10 $I/I_{H\beta}$	Mark. 10 W_λ	Mark. 42 $I/I_{H\beta}$	Mark. 42 W_λ
[O III]	5007	6.1	18.3	10.3	25.2	3.5	3.7
[O III]	4959	2.1	6.0	3.0	7.0	1.4	1.6
H_β	4861	10.0	37.6	10.0	33.7	10.0	16.5
[A IV]	4740			0.5	1.4		
[A IV]	4711			0.4	1.2	1.0	1.1
He II	4686	0.6	2.2	1.3	3.8	1.5	1.8
C III	4668			1.0	3.5		
N III	4634, 4641, 4642	0.7	2.3				
He II	4541	0.5	1.8				
N III	4514	0.6	2.0				
[O III]	4363	0.8	2.8				
H_γ	4340	3.8	13.1	3.8	12.2	2.9	4.0
H_δ	4102	2.1	9.0	1.9	7.2	1.2	1.2
[S II]	4076					1.7	2.0
[S II]	4068	0.4	1.6				
He I	4026					1.4	1.7
H_ε	3970					1.2	1.6
[Ne III]	3968						
[Ne III]	3870	0.7	2.2	0.4	1.6		
He I	3820					1.8	2.2
H_{10}	3798			0.3	1.1		
H_{11}	3771			0.2	0.7		
O III	3759	0.4	1.3				
[O II]	3727	0.2	0.7	1.4	4.0	1.3	3.2
[Ne V]	3425	0.9	1.1	1.5	1.8		

TABLE II

Mark. No.	B	B − V	U − B	z	M_B	R_{Mpc}
9	14.77	+0.40	−0.68	0.039	−21.2	156
10	14.71	+0.47	−0.70	0.029	−20.7	116
42	16.24	+0.79	−0.19	0.024	−18.8	96

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