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I want to call attention to the presence of [O I], which one sees characteristically in Seyfert nuclei. It is a very puzzling thing to have neutral oxygen present in regions where one can also have He II λ4686, and is strong evidence for very considerable inhomogeneity.

A distant Seyfert galaxy occurs in the group of galaxies that is VV 150 in Vorontzov-Velyaminov's catalogue. A photograph is given in Arp's (1966) Atlas (No. 322). The object has broad lines and a redshift of about 7800 km/sec and the broad lines led us to call it a Seyfert galaxy, but one must remember that there may be integration over a considerable extent of the galaxy even in an untrailed spectrum, and one may get velocity gradients that do not belong to the very center. We also have called VV 144 a Seyfert galaxy. It is reproduced in Arp's (1966) Atlas (No. 151). Notice the jet. I want to point out that the gas that is in the center has a large spread in velocity, shows Seyfert characteristics, and indicates a time scale of not more than about 10^4 yr. This gas must belong to an event that is going on right now or is fairly recent, whereas if the jet represents an ejection from this galaxy, it must indicate an earlier explosive event. Whatever gives rise to the Seyfert phenomenon has to be either continuing or recurrent. It is remarkable that the two sets of emission lines which can be seen in NGC 1275 and which indicate gas with a different redshift in the outer part of the galaxy can both be seen right into the nucleus. If one treats this as a Doppler shift of the gas then this gas has to be behind the galaxy itself; it is surprising that this should come up to the very nucleus. This has led me to believe that the ejection of gas in NGC 1275 (if this is the explanation of the two different redshifts) must be a continuing phenomenon that is going on with a rather constant direction in space. It is occurring right now and, from the extent of the gas that is giving displaced emission lines, must have been going on for 10^6 yr. In connection with the double lines discussed previously by Dr. Lynds, it should be noted that one might not spatially resolve the components giving rise to the doubling if this object were at a considerably greater distance.

31. Two New Seyfert Galaxies from Markarian's List of Galaxies with Strong uv Continua

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RECENTLY Markarian (1967) published a list of galaxies having strong uv continua. His observations were carried out with very low dispersion: about 1800 Å/mm near Hγ. Most of these objects, if not all, have sharp, starlike nuclei and are themselves very compact. The fact that these galaxies have strong uv continua indicates that unusual physical conditions exist in their nuclei and makes them very interesting objects for spectroscopic investigation. The first observations of some of these objects with better dispersion were made at McDonald Observatory with the 82-in. telescope (dispersion ≈240 Å/mm) by Dr. D. Weedman and myself in October–November 1967. The observations have been continued at the Kitt Peak National Observatory with Dr. R. Lynds using the 84-in. telescope with the image tube spectrograph (dispersion ≈120 Å/mm) and at Mount Palomar Observatory with Dr. H. C. Arp using the Cassegrain image tube spectrograph of the 200-in. telescope (dispersion ≈85 Å/mm).

The first conclusion from these observations is that among these objects, there are galaxies with quite different spectra, which may be placed in five groups with the following characteristics:

(1) Narrow lines both in emission and absorption (Markarian 2).

(2) Narrow, strong emission lines only (Markarian 5, 8, 13, 36).

(3) Strong and diffuse emission lines; N_1, N_2 much stronger than the hydrogen lines (Markarian 1, 3, 6).

(4) No strong emission lines (Markarian 4, 17).

(5) Very broad hydrogen emission lines, typical of Seyfert galaxies (Markarian 9, 10).

The redshifts ranged between 1000 and 12 000 km/sec.

It is of interest to present some data about two galaxies from this list, Markarian 9 and 10. The first evidence that these two objects show spectra characteristic of Seyfert galaxies was initially obtained at McDonald Observatory. In Plates S-XVIII and S-XIX spectrograms of Markarian 1, 9, and 10 obtained at Palomar and at Kitt Peak are shown. The following preliminary conclusions may be drawn from the spectra of these galaxies:

In Markarian 9, which has a redshift of 0.038, there are very broad hydrogen emission lines (Hα≈200 Å, Hβ≈110 Å); and relatively narrow forbidden lines of [O III] λλ5007, 4959. The [O II] line λ3727 is weak. There are also two broad lines or blends near 4686 Å, with centers about 4640 and 4560 Å.

In Markarian 10, which has a redshift of 0.029, there are very broad hydrogen emission lines (Hβ≈95 Å) and relatively narrow forbidden lines. The two other broad lines observed in Markarian 9 are absent or very weak.

Direct photographs of these galaxies taken with the

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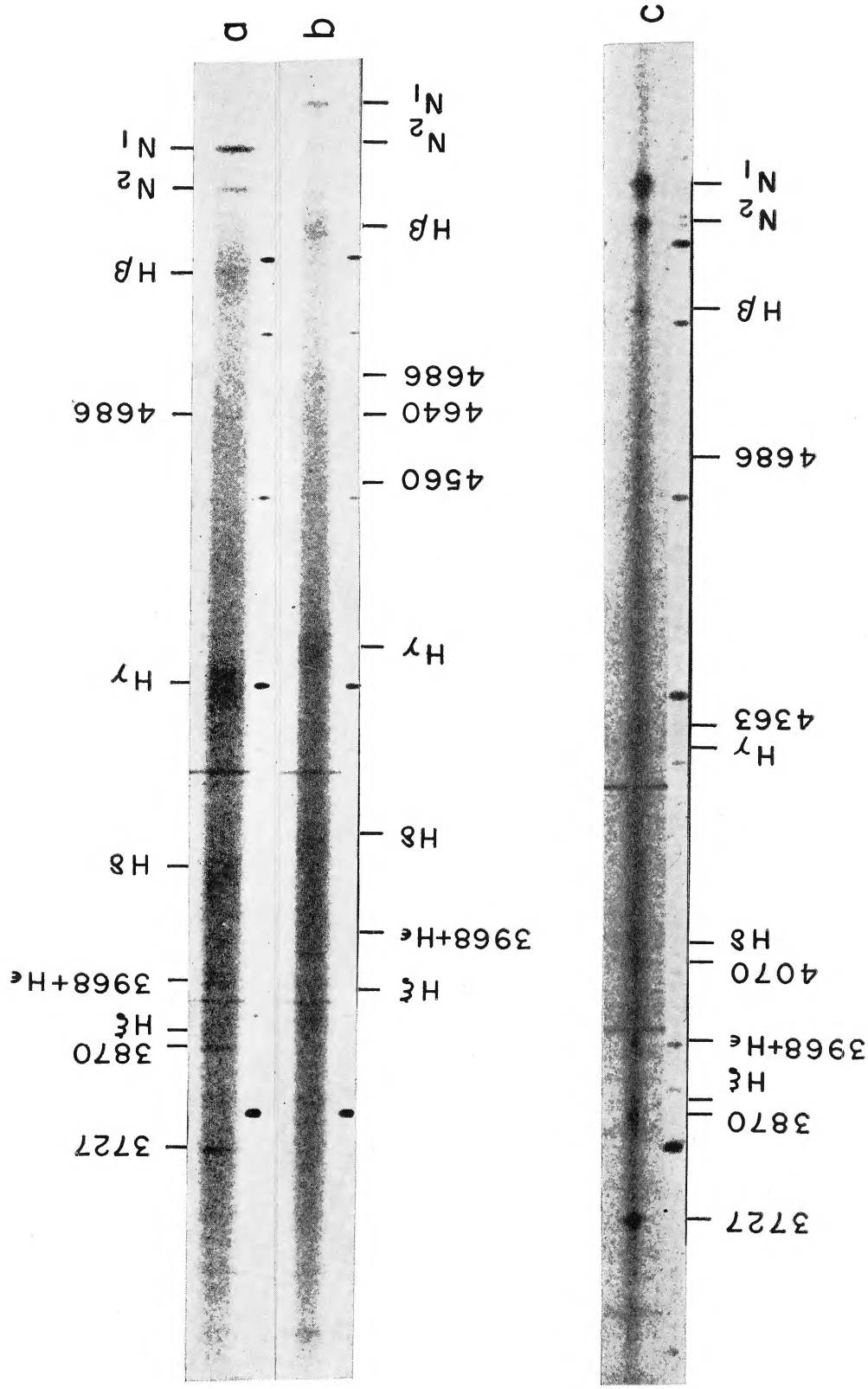

PLATE S-XVIII (No. 1, Khachikian). Spectrograms of Markarian (a) 10, (b) 9, and (c) 1, taken with the Cassegrain image tube of the 200-in. telescope.

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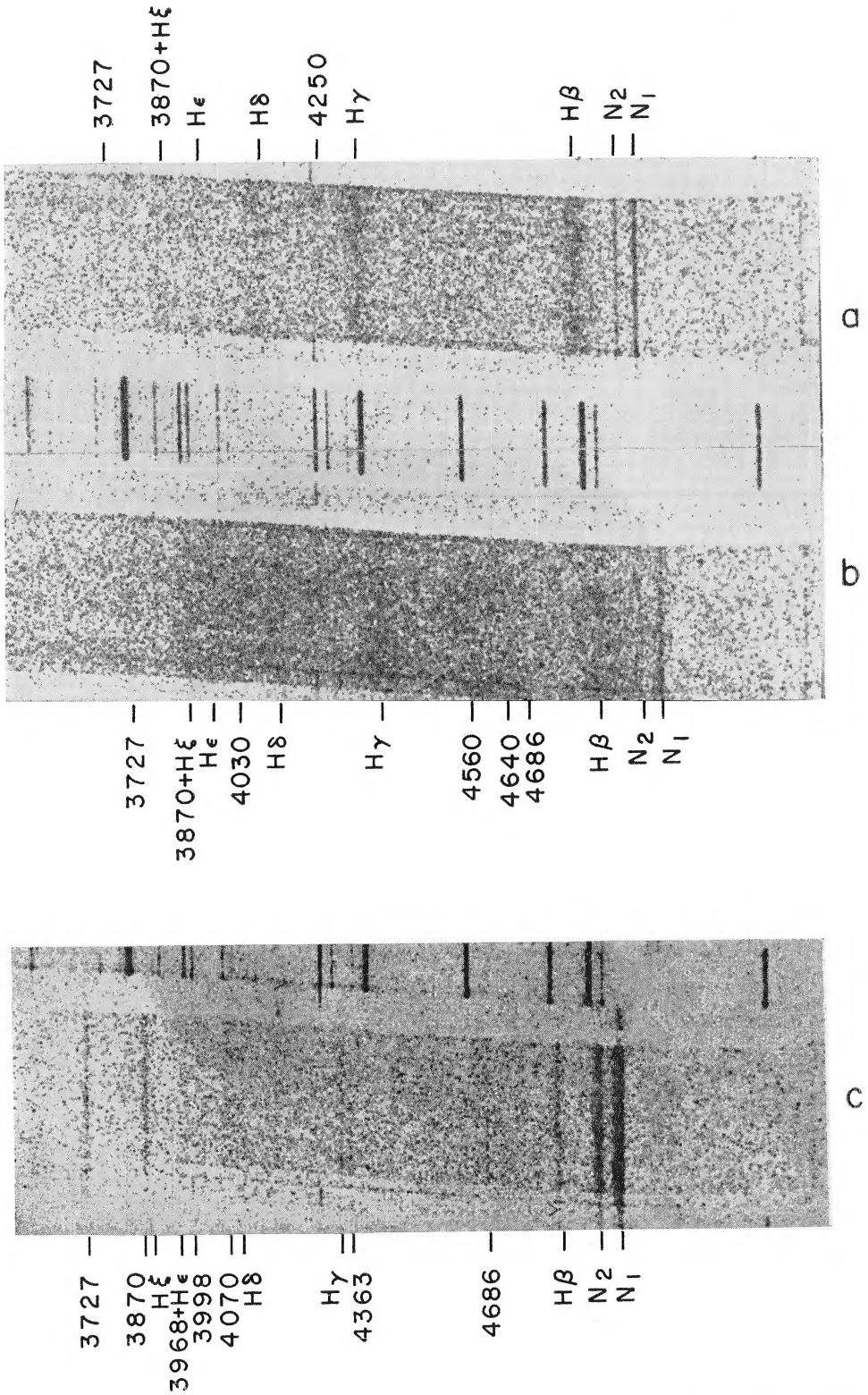

PLATE S-XIX (No. 2, Khachikian). Spectrograms of Markarian (a) 10, (b) 9, and (c) 1, taken with the Cassegrain image tube of the 84-in. Kitt Peak telescope.

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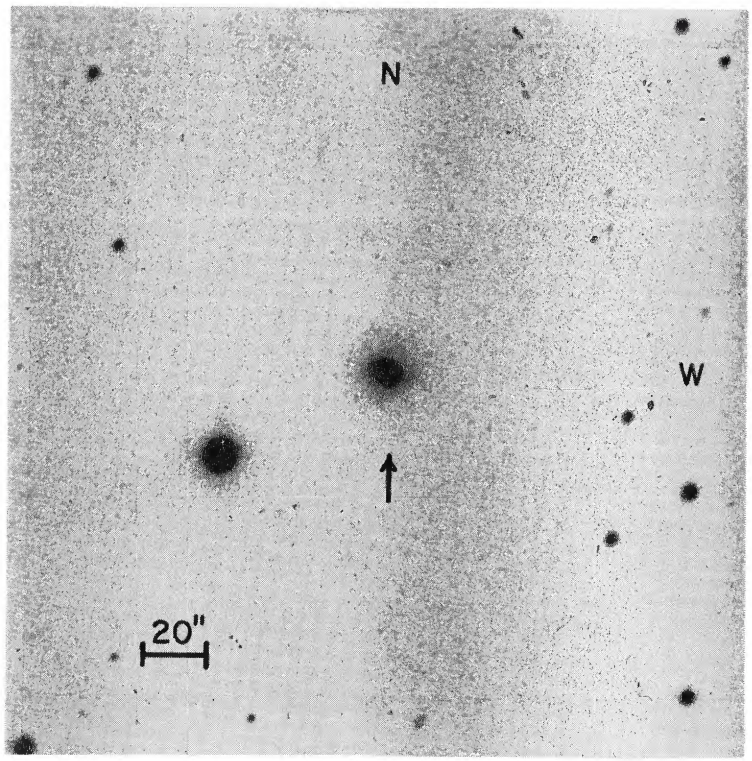

PLATE S-XX (No. 3, Khachikian). Photograph of Markarian 9 taken with the 200-in. telescope on Kodak 103a-J emulsion without filter. Exposure 15 min.

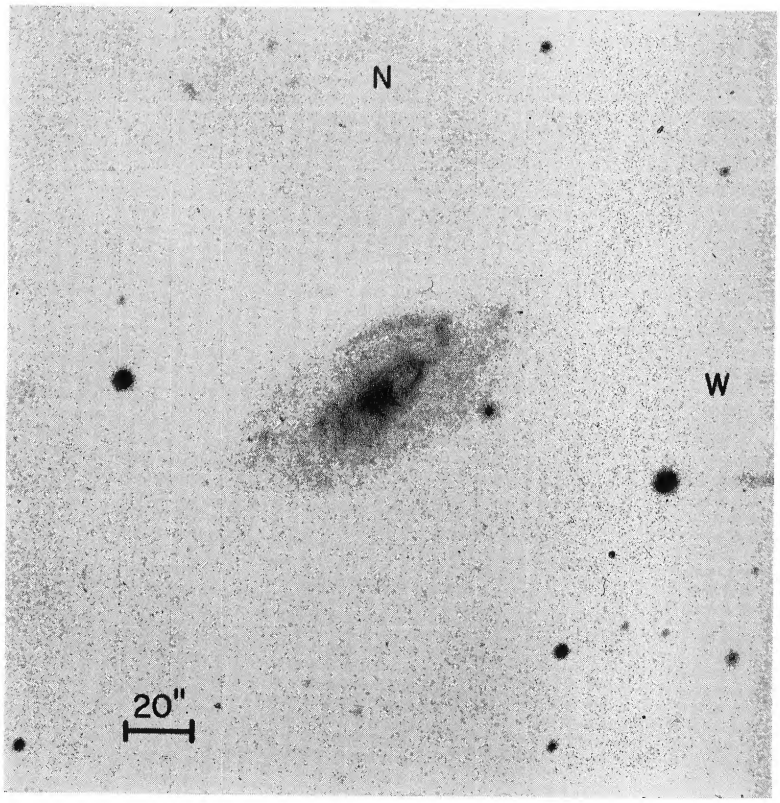

PLATE S-XXI (No. 4, Khachikian). Photograph of Markarian 10 taken with the 200-in. telescope on Kodak 103a-J emulsion without filter. Exposure 15 min.

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