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ON THE "SEYFERT SEXTET," VV 115

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ABSTRACT

Radial velocities in a field east of the Seyfert Sextet indicate that the Seyfert's compact group is a condensation in an extended group of galaxies.

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The compact group of galaxies known as the Seyfert Sextet includes a galaxy with discrepant redshift. The group was discovered by Seyfert (1951), and the redshift of the components was determined by Burbidge and Sargent (1971) and by Chincarini and Rood (1972*b*). The radial velocity of one component, NGC 6027e, irregular and very distorted,[1] is still missing. Chincarini and Rood have been unable as yet to obtain a measurable spectrum. Arp (1973) associated the galaxy NGC 6052 with the group on the basis that the latter is a peculiar galaxy and has a redshift close to the majority of the members of the Sextet. The compact group, as pointed out by Arp, is also located on the outskirts of the Hercules cluster of galaxies which contains a rather large number of typically disrupted and peculiar galaxies.

Zwicky and Herzog (1963) do not include the Sextet in any of the larger groups or clusters present in that region of the sky. Whether the group is part of a larger complex of galaxies can perhaps be best decided by determining the redshifts of galaxies in fields surrounding the Sextet similar to what has been done for Stephan's group by Lynds (1972).

As part of a larger program of redshift of galaxies in the Hercules cluster region started by Chincarini and Rood, we obtained the redshift of some galaxies located to the east of the Sextet. The McDonald spectra were obtained using the UVITS Cassegrain spectrograph at the F/9 focus of the 107-inch (2.7 m) telescope. The spectrograph was designed and built by Optics for Industry and was substantially modified and upgraded by Chincarini for observations of faint extragalactic and quasi-stellar objects. We used an inverse dispersion of 110 Å mm^{-1} and a two-stage RCA image tube. The comparison source is a combination of two hollow-cathode lamps filled with argon and neon gas, respectively, and having iron electrodes (fig. 1). In our spectra, mercury at $\lambda 4353$ is barely detectable with a measured shift of -18 km s^{-1}. Details on the reduction procedure will be given elsewhere, but it was similar to the method used by Chincarini and Rood (1972*a*). The radial velocities obtained for the brightest galaxies in the west field are given in table 1. The morphological type, column (2), was kindly estimated by Harold Corwin on a glass-copy plate of the Palomar Sky Survey.

For NGC 6052, three redshift determinations are available in the literature: $V_S = 4671$ km s^{-1}, A. and G. de Vaucouleurs (1967); $V_S = 4731$ km s^{-1}, Du Puy and De Veny (1969); $V_S = 4600$ km s^{-1}, Arp (1973). The mean symbolic velocity for the Seyfert Sextet, excluding the discrepant redshift, is $V = 4405$ km s^{-1}, Burbidge and Sargent (1971); $V_S = 4326$ km s^{-1}, Chincarini and Rood (1972*b*).

The observations started only recently and with very limited telescope time. No very faint galaxy was observed (the possibility remains that the galaxy with discrepant redshift may be associated with other galaxies in the field with high symbolic velocity), so that our conclusion remains incomplete. The data so far obtained nevertheless indicate that the Seyfert compact group of galaxies is not only associated with NGC 6052, Arp's suggested parent galaxy, but is also part of a larger group of galaxies whose mean symbolic recession velocity is around 4480 km s^{-1}. In order to maintain the view that NGC 6052 is *the* associated galaxy of the Sextet we would then be compelled to define it as the closest peculiar galaxy having a similar redshift.

That the group of galaxies associated with the Seyfert Sextet may have a considerable extent in the sky is indicated by the published observations of Bautz (1972): NGC 6018, R.A.$_{1950} = 15^h55^m2$, decl.$_{1950} = +16°00'$, $V_S = 5121$ km s^{-1}; NGC 6021, R.A.$_{1950} = 15^h55^m2$, decl.$_{1950} = 16°05'$, $V_S = 4486$ km s^{-1}; by the symbolic velocity of Mark 296,

[1] As suggested by Burbidge and Sargent (1971), this may be due to matter tidally pulled from NGC 6027.

TABLE 1

RADIAL VELOCITIES OF GALAXIES EAST OF THE SEYFERT SEXTET

Object (1)	Type (2)	Mag (3)	R.A.$_{1950}$ (4)	Dec.$_{1950}$ (5)	V_S (km s^{-1}) (6)	Lines for V_S (7)	Comments (8)
/.....	SA(*sr*)bc	14.2	15^{h}58^m.2	+21°00′	4753	H, K	Spectrum obtained at KPNO, CR
NGC 6032.....	SB(sr)b	15.0	16 00.8	+21 06	4284	[O II]	v F arms
NGC 6035.....	S*A*(*sr*)c	14.7	16 01.2	+21 02	2241	H, K	.....
NGC 6060.....	S*A*B(rs)bc	14.3	16 03.7	+21 38	4555	H, K	G Band, $V = 4510$
/.....	SA: (sr:) m pec	15.2	16 03.9	+20 55	4595	[O II], Hβ	South component,* see below

* Arp, private communication, noticed some peculiarities in this pair of galaxies. Corwin classifies the North component as SA: (s)dm. He notices some faint galaxies in this region, in particular southwest of the pair a faint galaxy of type I0? 0.9 sp south component with jet to eF red knot.

R.A.$_{1950}$ = 16^{h}01^m.2, decl.$_{1950}$ = 19°19′, V_S = 4800 km s^{-1} (Arakelian *et al.* 1971); and by NGC 6028,[2] R.A.$_{1950}$ = 15^{h}59^m.2, decl.$_{1950}$ = +19°29′, V_S = 4480 km s^{-1} (Zwicky 1971), and V_s = 4484 km s^{-1} (Chincarini, unpublished). In this region of the sky the velocities of galaxies down to m_{pg} = 15.5 may therefore be segregated in three main groups corresponding to the redshift of: (*a*) the Hercules cluster as commonly known, $\langle V \rangle \sim$ 10,775 km s^{-1}; (*b*) the group of which the Seyfert Sextet is part, $\langle V \rangle \sim$ 4480 km s^{-1}, (*c*) a third group at a redshift of about V_S = 2300 km s^{-1} as indicated by the velocity of NGC 6035 and Mark 294, V_S = 2400 km s^{-1}, R.A.$_{1950}$ = 15^{h}59^m.8, decl.$_{1950}$ = 18°57′ (Arakelian *et al.* 1971).

Segregation of redshifts is also encountered in the region of the Pegasus cluster of galaxies. Chincarini and Rood (1972) found that toward the west of the Coma cluster, in a region of 7° × 4° centered near R.A.$_{1950}$ = 12^{h}18^m and decl.$_{1950}$ = 29°, the velocities are also segregated in three groups.

The possibility that the Seyfert Sextet belongs to a more extended group was advanced also by Corwin (1967), based on the two velocities of the Sextet available at the time and on the velocity of NGC 6052.

[2] NGC 6028 is a peculiar galaxy, similar to Hoag's object (O'Connell, Scargle, and Sargent 1974), whose morphology is not understood. With H = 75 km s^{-1} Mpc^{-1} the ring has an outer diameter of about 20 kpc. The starlike object as seen on the Palomar Survey is composed of the proper nucleus, somewhat diffuse, and a foreground star somewhat bluer than the galaxy. Our velocity is based on the lines H, K. The G band gives $V_s \sim$ 4522 km s^{-1}, and [O II] has not been measured. For the star we obtain $V = -225$ km s^{-1} which is somewhat larger than expected for these observations and perhaps due to sky contaminations.

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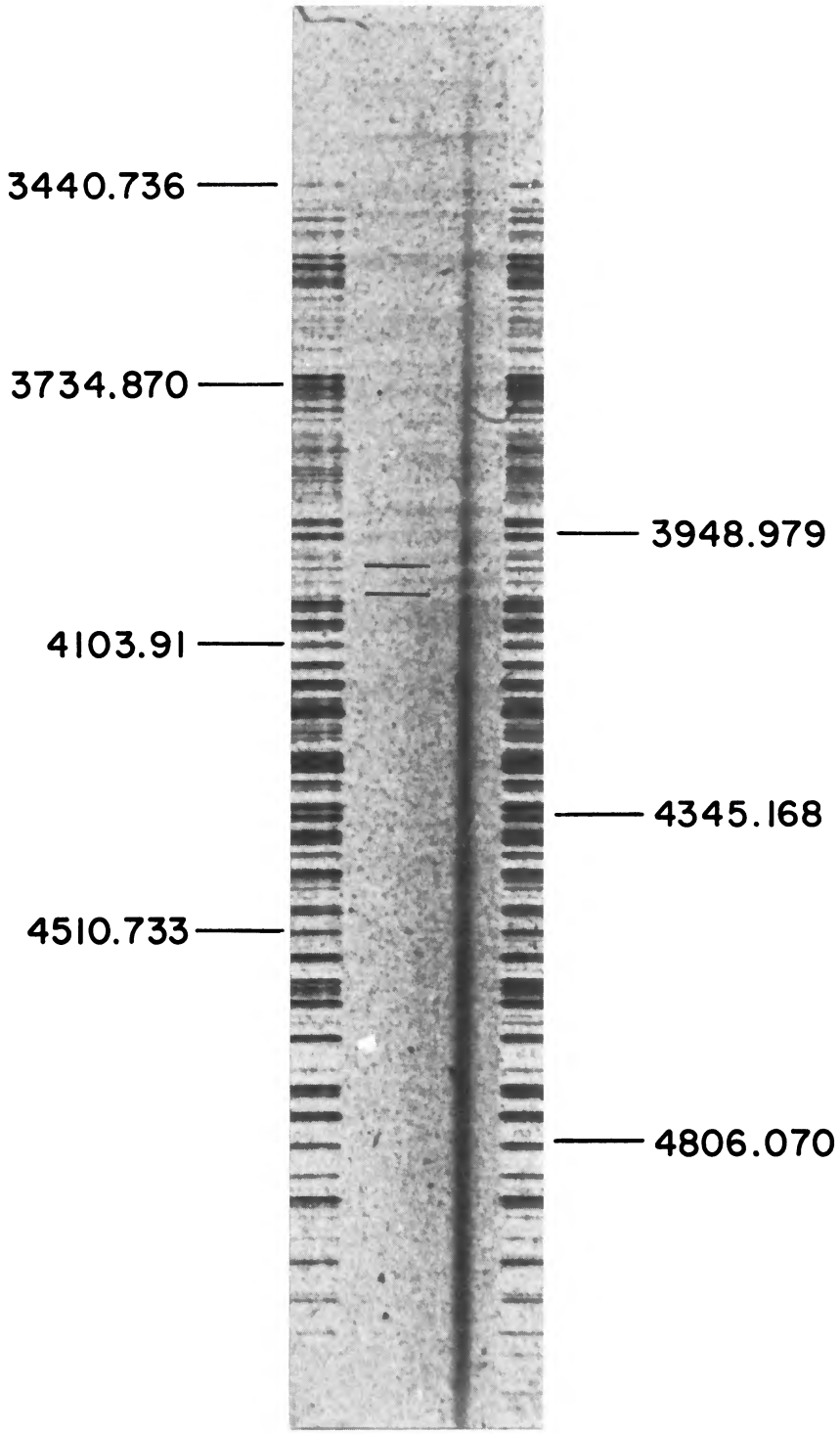

FIG. 1.—Spectrum of the galaxy NGC 6060 obtained with the UVITS at the F/9 Cassegrain focus of the 107-inch telescope. Comparison hollow cathode lamps filled with neon and argon, iron electrodes.