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THE PEGASUS I AND PEGASUS II CLUSTERS OF GALAXIES

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New radial velocities are presented for 35 galaxies in the fields of the Pegasus I and Pegasus II clusters.

Many background galaxies with apparent photographic magnitude brighter than 15^m6 are found to be superimposed upon the Pegasus I cluster.

Galaxies with radial velocities near the average for the Pegasus II cluster are detected well outside the boundary of the cluster as defined in the *Catalogue of Galaxies and Clusters of Galaxies* by Zwicky et al. This suggests that the Pegasus II cluster is part of a large cloud of galaxies.

Key words: clusters of galaxies — radial velocities

The Pegasus I cluster is centered near the bright elliptical galaxies NGC 7619 and NGC 7626 at $\alpha = 23^h18^m$, $\delta = 7°55'$ (epoch 1950). According to Zwicky, Karpowicz, and Kowal (1965), Pegasus I is a medium compact cluster with an angular diameter of 6.3 degrees. A more distant cluster, Pegasus II, is centered near three bright galaxies at $\alpha = 23^h08^m$, $\delta = 7°18'$. Pegasus II is a compact cluster with an angular diameter of 1.1 degrees (Zwicky et al. 1965). We have derived radial velocities for 35 galaxies in the fields of the Pegasus I and Pegasus II clusters from spectrograms obtained with the Carnegie image-tube spectrograph on the 2.1-meter telescope at the Kitt Peak National Observatory. Reduction procedures are identical to those described by Chincarini and Rood (1972). We combine these data with further data in the literature to briefly examine the structure of the Pegasus clusters.

Table I contains data for each galaxy with known radial velocity within the boundaries of the Pegasus I and Pegasus II clusters as illustrated by Zwicky et al. (1965; also Fig. 1). Columns 1–3, identification and coordinates; columns 4–5, radial-velocity relative to the Local Group from de Vaucouleurs and de Vaucouleurs (1964, 1967) and the present paper; columns 6–8, apparent photographic magnitude from Zwicky et al. (1965) and position angle of major axis and morphological type from Nilson (1973); column 9, radial distance from the adopted center of Pegasus I (midway between NGC 7619 and NGC 7626); column 10, cluster membership. The radial velocity range of Pegasus I is assumed to be 2500–5500 km s^{-1}, and the range for Pegasus II is assumed to be 12,000–13,500 km s^{-1}, inferred from the observed frequency distribution of radial velocities (Fig. 2). Column 11, notes from Nilson (1973).

A map of the Pegasus region (Zwicky et al. 1965) with indicated radial velocities of galaxies is presented in Figure 1. There may be a line of galaxies in the Pegasus I cluster extending from near its center to the southwest, but no correlation is evident in a plot of radial velocity vs. declination for galaxies along this line (Fig. 3). The galaxies in the Pegasus I cluster listed in Table I have an average radial velocity of 4031 km s^{-1} and a standard deviation of 672 km s^{-1}. Of the 21 Pegasus I galaxies with known morphological types, eleven are spirals, seven are S0's, and three are ellipticals. The position angles of major axes are randomly distributed (Table II). The plot of radial velocity vs. distance from the center of Pegasus I is confused by the superposition of background galaxies (Fig. 4). The surface distribution of galaxies in the Pegasus region is very clumpy (Zwicky 1957). A plot of radial velocity vs. apparent magnitude for the galaxies in Pegasus I has a nonzero correlation coefficient on the 5% significance level but not on the 1% level. This correlation may be caused by the superposition on Pegasus I of field galaxies with velocities near the average for Pegasus I, or by an expansion with time of the Pegasus I cluster.

Several galaxies with radial velocities in the Pegasus II range are located in the field of Pegasus I several

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TABLE I

PROPERTIES OF GALAXIES IN THE REGION OF PEGASUS I + PEGASUS II

NGC	α (1950)	δ	CR V_0	de Vaucouleurs V_0	m_p	P.A. (°)	Type	R	Cluster Membership	Note
			km sec^{-1}							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	$23^h\ 7^m.4$	7° 15′	5094		$15^m.3$			2°.70	Peg I	
7499	23 7.8	7 18		12116	15.0	10	S0	2.59	Peg II	
7501	23 8.0	7 18		12914	15.3			2.54	Peg II	
	23 8.0	7 52	6607		15.5			2.46		
7503	23 8.2	7 17		13429	14.9			2.50	Peg II	
	23 9.3	9 14	6780		14.2	125	S	2.51		
1474*	23 10.3	5 31	3564		14.9	150	Sc	3.07	Peg I	
7518	23 10.6	6 03	3763		14.5		Sa	2.62	Peg I	
	23 10.6	6 08	5008		14.8	145	Sc	2.56	Peg I	
7529	23 11.5	8 42	4773		14.6		S	1.77	Peg I	
7537	23 12.0	4 13	2898	2860	13.8	79	Sb	3.99	Peg I	
7541	23 12.2	4 15		2859	12.7	102	Sc	3.94	Peg I	
	23 12.6	9 24	4963		15.0	152	S0	1.98	Peg I	a
	23 13.3	9 14	12717		15.5	31	Sb	1.74	Peg II	
7562	23 13.4	6 24		4000	13.0	83	E	1.90	Peg I	
	23 14.2	8 37	6714		14.8	(88)	S0?	1.16		
	23 14.8	5 23	10193		15.4			2.66		
	23 14.8	5 24	10255		15.0			2.64		
7579	23 15.1	9 09	12514		15.4			1.41	Peg II	
	23 15.3	7 05	12807		14.8			1.07	Peg II	
7583	23 15.3	7 08	3979		15.2			1.03	Peg I	
7584	23 15.4	9 09	13114		15.3			1.38	Peg II	
7587	23 15.5	9 24	9137		14.9	123	Sa	1.59		b
7591	23 15.8	6 18	5195		13.8	145	SBb	1.71	Peg I	
7601	23 16.2	8 57	8408		14.7	(90)	Sb-c	1.11		
	23 16.3	6 46	5142		14.9			1.23	Peg I	
	23 16.4	6 35	4431		15.0	35	Sc/SBc	1.40	Peg I	c
5309*	23 16.6	7 50	4463		15.0	23	Sb	0.35	Peg I	
7608	23 16.7	8 04	3759		15.2	20	S	0.34	Peg I	
7609	23 17.0	9 13	12130		15.3			1.31	Peg II	
7611	23 17.1	7 46	3500	3580	14.0	139	S0	0.26	Peg I	
7612	23 17.2	8 17	3388		14.3	2	S0	0.40	Peg I	
7617	23 17.6	7 53		4269	15.1			0.10	Peg I	
7619	23 17.7	7 55		3954	12.7	(30)	E	0.06	Peg I	
7623	23 17.9	8 06		3661	13.9	175:	S0	0.18	Peg I	
7626	23 18.2	7 56		3554	12.8		E	0.06	Peg I	
	23 18.6	7 05	3270		14.8			0.86	Peg I	
7631	23 18.8	7 56	3970		13.8	79	Sb	0.21	Peg I	
	23 19.1	8 42	3803			15.5		0.83	Peg I	
7634	23 19.1	8 36	3435		13.7	95	SB0	0.73	Peg I	d
7648	23 21.3	9 23	3793		13.5	85	S0	1.68	Peg I	
7671	23 24.8	12 12	4336		14.3	138	S0	4.60	Peg I	
7674	23 25.4	8 30	8904		13.6		SBb	1.93		
7675	$23^h25^m.5$	8° 29′	8861		$14^m.8$			1°.95		

Notes to Table I:
(a) nnp of 2.
(b) n of 2.
(c) s of 2.
(d) Brightest of 3.

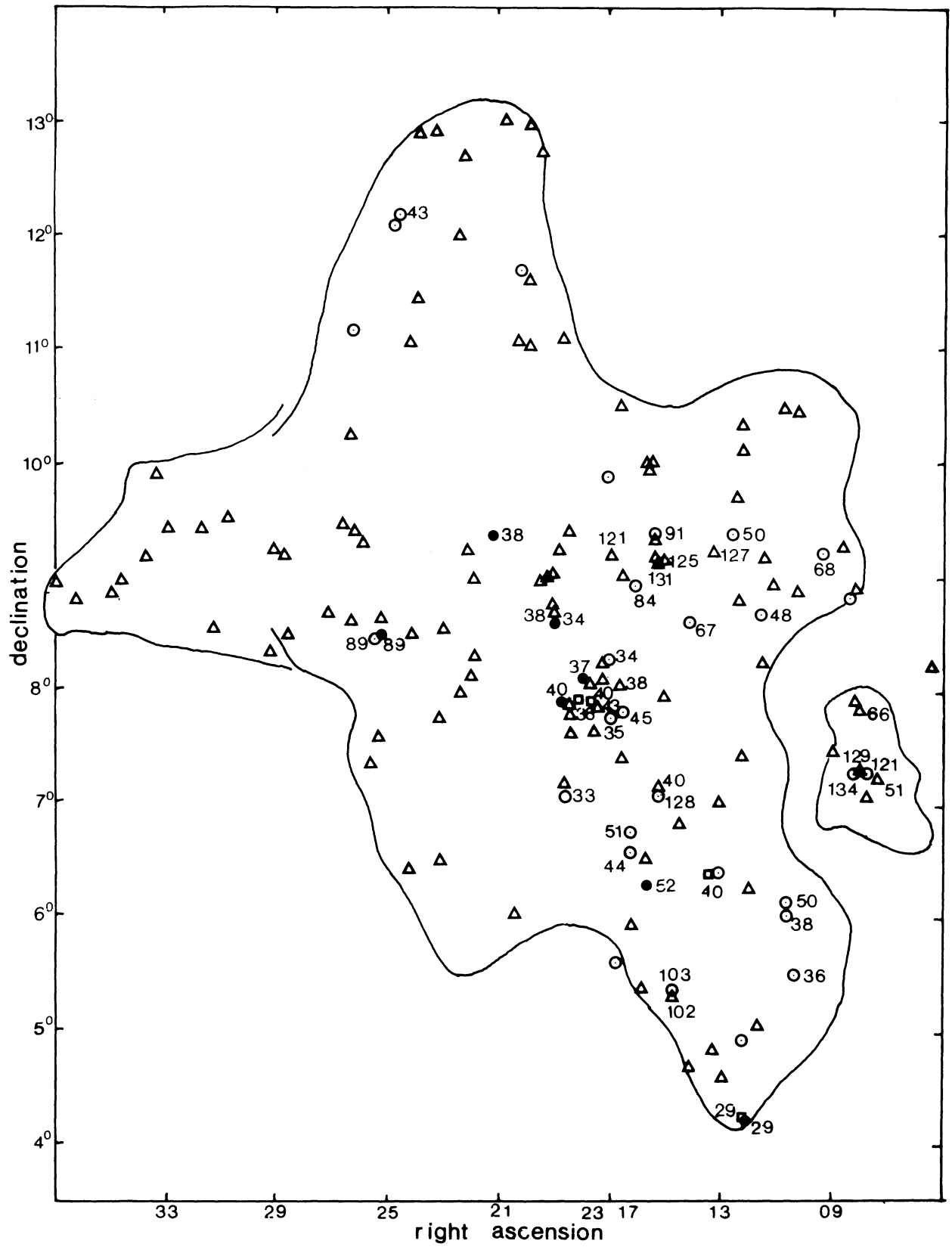

FIG 1 — Map of the Pegasus I and Pegasus II clusters from Zwicky et al. (1965). The symbol at the location of each galaxy indicates its apparent photographic magnitude, m_p — open square, $12^m1 \leq m_p \leq 13^m0$; closed circle, $13^m1 \leq m_p \leq 14^m0$; open circle $14^m1 \leq m_p \leq 15^m0$; open triangle, $15^m1 \leq m_p \leq 15^m7$. The number beside a symbol is the radial velocity of the galaxy in units of 100 km s^{-1}.

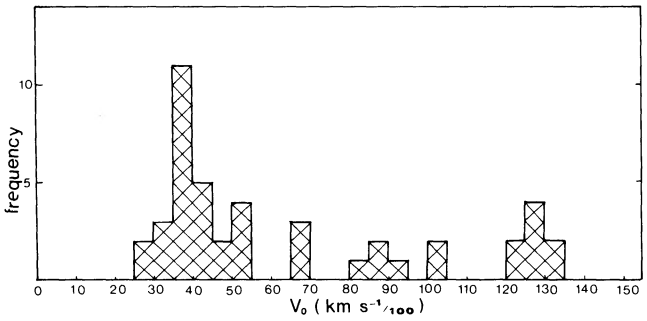

FIG. 2 — Frequency distribution of radial velocities of galaxies in the field of Pegasus I + Pegasus II listed in Table I.

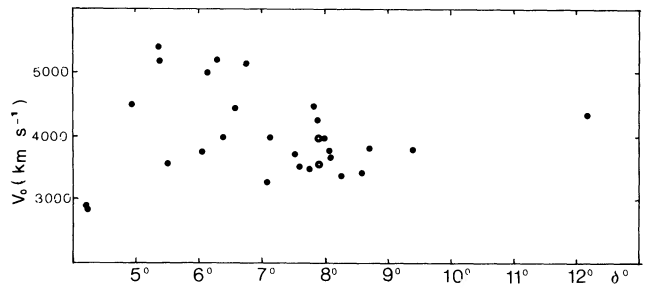

FIG. 3 — Radial velocity vs. declination for the line of galaxies extending from near the center of Pegasus I to the southwest. Open circles refer to NGC 7619 and NGC 7626.

TABLE II

FREQUENCY DISTRIBUTION OF MAJOR AXIS POSITION ANGLES

P.A. (°)	Frequency
0–60	5
60–120	6
120–180	7
20–80	6
80–140	6
140–20	6
40–100	5
100–160	7
160–40	6

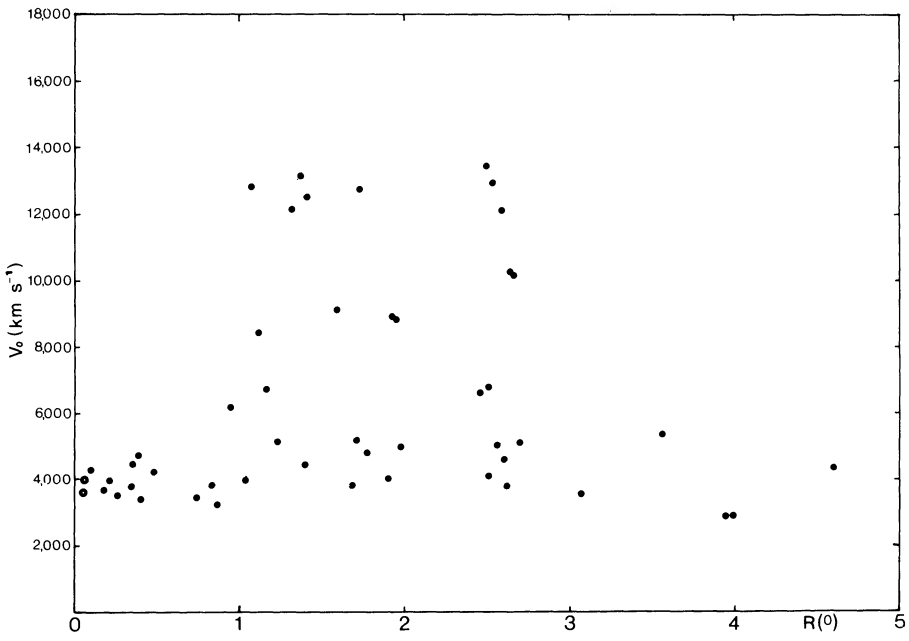

FIG. 4 — Radial velocity vs. distance from the center of Pegasus I for the galaxies listed in Table I. Open circles refer to NGC 7619 and NGC 7626.

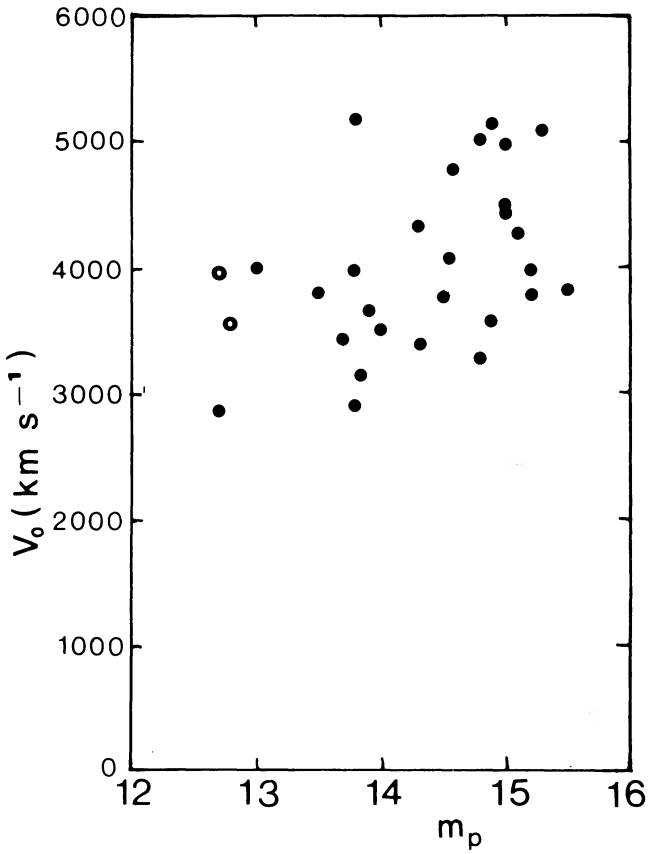

FIG. 5 — Radial velocity vs. apparent photographic magnitude for galaxies in Pegasus I. Open circles refer to NGC 7619 and NGC 7626.

degrees from Pegasus II. Evidently, Pegasus II is part of a large cloud of galaxies.

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