

## DISTANCE AND METALLICITY OF HVCS

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Table 1 summarizes results of programs to determine distances and metallicities of high-velocity clouds (HVCs, see Wakker 1991, IAU Symp 144, 27 for a general review). Reliable absorption is reported for one stellar probe (BD+38 2182), giving a distance  $D < 5$  kpc for complex M. Other results are controversial (BT Dra), uncertain (HD 135485) or atypical (4 Lac). Non-detections reported by e.g. Lilienthal et al. (1990, A&A 240, 287), Danly et al. (1992, ApJS 81, 125) and de Boer et al. (1994, A&A 286, 925), yield lower limits up to 2 kpc for complexes A, C and M. Absorption by heavy elements in HVCs is reported for twelve extra-galactic probes. All absorptions reported in HVCs with  $|v_{LSR}| > 90$  km/s are given in the table (abundances are from low-resolution HI data and thus uncertain).

With the UES on the WHT at La Palma we observed PG 1351+640. This QSO ( $V=14.5$ ) lies projected between HVCs C III B and C III C. Absorption in the Ca H- and K-lines is detected at the HVC's HI velocity of  $v_{LSR} \sim -150$  km/s. Data on elements other than Ca will be necessary to measure the actual heavy element content. Also, high-resolution HI data are required to reduce the uncertainties.

Mg II  $\lambda\lambda 2796$  and  $2803 \text{ \AA}$  spectra were taken with the GHRS on HST for two probes of complex A. Absorption was not found in PG 0859+596 (BHB star;  $B=15.9$ ; distance  $\sim 5.5$  kpc), nor in PG 0906+597 (sdB star;  $B=15.2$ ; distance  $\sim 2.5$  kpc). This tentatively suggests that complex A is more distant than 5.5 kpc. This result awaits confirmation by: 1) a HST Mg II spectrum

(still pending) of the Seyfert Mark 106; 2) high-resolution HI data; 3) a good determination of the stellar distances using intermediate-resolution spectroscopy.

TABLE 1. Detections of absorption lines in HVCs

Probe	type	HVC	Ref	$v_{\text{HVC}}$	$N_{\text{HI}}$	ion	$N_{\text{ion}}$	$A^a$	Note
Mark 106	Sey	complex A	1	-157	$4.0 \cdot 10^{19}$	$\text{Ca}^+$	$6.7 \cdot 10^{11}$	0.007	
IZw 18	dIrr	complex A	2	-165	$2.1 \cdot 10^{19}$	O	$2.9 \cdot 10^{15}$	0.16	
			2	-165	$2.1 \cdot 10^{19}$	$\text{Si}^+$	$6.6 \cdot 10^{13}$	0.07	
PG 1351+640	QSO	complex C	3	-154	$1.9 \cdot 10^{19}$	$\text{Ca}^+$	$5.7 \cdot 10^{11}$	0.014	1
PG 1259+592	QSO	complex C	4	-127	$6.2 \cdot 10^{19}$	$\text{Mg}^+$	—	—	2
Mark 205	Sey	complex C	5	-214	$1.9 \cdot 10^{19}$	$\text{Mg}^+$	$1.5 \cdot 10^{12}$	0.002	3
				-152	$1.4 \cdot 10^{18}$	$\text{Mg}^+$	$2.5 \cdot 10^{12}$	0.05	3
3C 351	QSO	complex C	4	-180	$9.0 \cdot 10^{18}$	$\text{Mg}^+$	—	—	2
BT Dra	RR Lyr	complex C	6	-136	$3.1 \cdot 10^{18}$	$\text{Ca}^+$	$6.0 \cdot 10^{11}$	0.09	4
			7	-133	$3.1 \cdot 10^{18}$	Na	$<1.5 \cdot 10^{10}$	$<0.002$	4
BD+38 2182	B3	complex M	8	-90	$3.5 \cdot 10^{18}$	$\text{Si}^+$	$>2.0 \cdot 10^{13}$	$>0.16$	5
PG 0043+039	QSO	Mag. Str.	4	-348	$1.9 \cdot 10^{18}$	$\text{Mg}^+$	$>9 \cdot 10^{12}$	$>0.12$	2
PKS 2251+11	QSO	Mag. Str.	4	-374	$4.8 \cdot 10^{18}$	$\text{Mg}^+$	$>1.1 \cdot 10^{13}$	$>0.059$	2
3C 454.3	QSO	Mag. Str.	4	-397	$1.2 \cdot 10^{18}$	$\text{Mg}^+$	$>1.5 \cdot 10^{13}$	$>0.32$	2
Fairall 9	QSO	Mag. Str.	9	+195	$2.0 \cdot 10^{20}$	$\text{Ca}^+$	$2.0 \cdot 10^{12}$	0.004	
HD 135485	B5 II	complex L	10	-98	$1.0 \cdot 10^{18}$	$\text{Ca}^+$	$1.5 \cdot 10^{11}$	0.07	6
4 Lac	B9 Ia	100-7+100	11	+104	$3.0 \cdot 10^{18}$	$\text{Mg}^+$	$3.2 \cdot 10^{14}$	$\sim 3$	7
PKS 0837+12	QSO	242+17+106	12	+105	$1.4 \cdot 10^{19}$	$\text{Ca}^+$	$2.2 \cdot 10^{12}$	0.07	
NGC 3783	Sey	287+22+240	13	+240	$1.2 \cdot 10^{20}$	$\text{Ca}^+$	$5.5 \cdot 10^{11}$	0.002	
			14	+240	$1.2 \cdot 10^{20}$	$\text{S}^+$	$3.4 \cdot 10^{14}$	0.15	
			14	+240	$1.2 \cdot 10^{20}$	$\text{Si}^+$	$>2.6 \cdot 10^{13}$	$>0.006$	

<sup>a</sup> Abundance relative to solar abundance

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NOTES: 1. Preliminary value for  $N_{\text{Ca}}$ ; 2. No column densities because of low velocity resolution (220 km/s); 3. Corrected values for  $N_{\text{ion}}$ ; A recent WSRT map indicates  $N_{\text{HI}}$  may be  $<2 \cdot 10^{18}$ ; 4. Disputed detections, probably spurious; 5. From line wings; detections of O and  $\text{C}^+$  also reported; stellar distance 5 kpc; 6. Distance to star 2.4 kpc; may be circumstellar; 7. Results also given for  $\text{Fe}^+$ , Mg, O and  $\text{Al}^+$ ; HVC not in the Dwingeloo survey, diameter  $<<1^\circ$ ; distance to star 1.2 kpc.