HYDROGEN DEFICIENCY AND MASS LOSS

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Abstract. Some conclusions concerning the luminous hydrogen-deficient stars are presented, as is also a list of 45 such objects.

In a symposium such as this I am rather surprised that no one has yet discussed perhaps the most obvious examples of the effects of stellar mass loss: namely, the stars that exhibit substantial hydrogen deficiency in their atmospheres (Hack 1967, Hunger 1975). Though the phenomenon undoubtedly also exists among stars of lower luminosity, I am thinking here of stars in the range of visual absolute magnitude from -3 to -5 or so. Table 1 contains those objects that I now consider to belong to this class. A few Wolf-Rayet stars probably could be added, but the evidence is not too clear on this point. Also there are several additional objects in the Large Magellanic Cloud that could have been included.

While the objects listed in Table 1 display a remarkably wide variety of observable features, nonetheless some regularities can be discerned:

1. All of the cooler stars exhibit carbon bands, implying C/O ratios of larger than 1. That is, there is no such thing as a hydrogen-poor M-or S-type star. Further, no hydrogen-deficient carbon star shows C^{13}.

2. Most of the cooler stars are variables of the R CrB type (Feast 1975), surrounded by infrared-emitting envelopes (Feast and Glass 1973).

3. In only two cases do we actually see the presumably fairly recently ejected envelope surrounding the stars: V348 Sgr, where the nebulosity is seen only when the central star is faint, and V605 Aql, the "unique variable," where a bubble-like envelope remains clearly visible even though the central star has long since disappeared from view. In both cases the envelopes appear to have plenty of hydrogen.

4.Most of the hotter stars are not variable; however, V348 Sgr and MV Sgr are dramatic exceptions to the general rule.

5. In general, the objects seem to be single stars. However, at least two are unquestionably binaries, KS Per and υ Sgr. These stars do not share the usual excessive abundance of carbon of most of the rest of the group, but appear to be nitrogen-abundant instead. The

P. S. Conti and C. W. H. de Loore (eds.), Mass Loss and Evolution of O-Type Stars, 305-308.

TABLE 1

LUMINOUS HYDROGEN-DEFICIENT STARS

Name	α (1900)	δ	Mag.	Type	References and Notes
+37°442	1 52	+38	10.0	O	CR 262, 1105 (H.P. 8, No. 19)
XX Cam	4 0	+53	8.2-10.3	F(C)	A+A 31, 203
KS Per	4 41	+43	7.6-7.8	A-F	PASJ 24,495; SB: P=363^d; HD 30353; br Hα
W Men	5 27	-71	13.8-<18.3	F(C)	MNRAS 158, 11P; LMC member
SU Tau	5 43	+19	9.1-16.0	F(C)	MKK Atlas
+37°1977	9 18	+37	10.1:	O	CR 278, 227
+10°2179	10 33	+10	10.0	B	A+A 37,87
-58°2721	10 44	-58	10.5	B	JSD; br Hα
UW Cen	12 37	-53	9.6-<13	K(C?)	MNRAS 161, 293
Y Mus	12 59	-64	10.5-12.1	F(C)	IBVS 1453
-37°9248	14 7	-37	8.8:	A-F	PASP 84, 388; br Hα
HD 124448	14 8	-45	10.0	B	A+A 37, 87
S Aps	14 59	-71	9.6-15.2	C	MNRAS 158, 11P
HD 137613	15 21	-24	7.6	C	MNRAS 137, 119
-48°10153	15 31	-48	11.5	B	ApJ Lett. 179, L31
R CrB	15 44	+28	5.8-14.8	F(C)	MNRAS 137, 119
RT Nor	16 15	-59	11.3-16.3	C	HB 920, 32
-9°4395	16 23	-9	10.6	B:	PASP 84, 388
RZ Nor	16 24	-53	11.1-<12.7	F(C)	IAU Symp. 67, 135
LR Sco	17 20	-43	10.9-12.3	F(C)	IBVS 1453
-35°11760	17 31	-35	9.8	B	JSD: HDE 320156; br Hα
V2076 Oph	17 36	-17	9.9	O	Liege No. 357, 337; HD 160641
LS IV -1°2	17 46	-1	11.0	B	JSD

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strong Hα emission seen in these stars may perhaps originate from hydrogen supplied by the other component of the binary.

It is clear that any theories of mass loss and stellar evolution will have to explain the existence of these fascinating objects.

And, in conclusion, though it has nothing to do with this subject, I would like to comment that we should be prepared for some surprises in the interpretation of our early mass-loss observations. It is not clear to what extent some of our favorite stars are typical of the general stellar population. P Cygni and η Carinae are certainly unusual objects, and one might also be somewhat suspicious of such high-mass-loss stars as ρ Leo and τ Sco. Are we certain that these objects are what we think they are?

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DISCUSSION FOLLOWING BIDELMAN

van den Heuvel: I was somewhat surprised to hear you mentioning τ Sco was a peculiar star.

Bidelman: I did not mean to imply that τ Sco is actually peculiar; it is certainly generally considered perfectly normal. Nonetheless, there are several evolved (α Sco) and spectroscopically peculiar (3 Cen and others) objects in the same cluster and, with its very sharp lines, it might perhaps not be a typical B0 V star in all respects.

Bolton: Some of the OBN stars are also H-deficient. HDE 235679 is definitely so, and there are comments in the literature that suggest mild H deficiencies for HD 72754 and V453 Sco. All show evidence that mass transfer has influenced their evolution.

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