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REDSHIFT MAGNITUDE BANDS AND QUASI STELLAR ABSORPTION LINE MULTIPLE REDSHIFTS

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ABSTRACT

Quasi stellar absorption line redshifts are shown to be consistent with the redshift-magnitude band pattern concept. The redshifts in multiple redshift objects tend to concentrate at band crossings corresponding to the magnitude of each object.

INTRODUCTION

In a previous paper (Tifft, 1973), hereafter referred to as RMB3, it was shown that quasi stellar emission line objects (QSE objects) apparently distribute in a convergent series band pattern (QSE system) in the logz-magnitude diagram. High z quasi stellar sources, including most objects with absorption lines (QSA objects) appear to occupy another band system (QSA system) which originates from the convergent limit of the QSE system. The RMB3 formulation of the QSA band system was based entirely upon the emission line redshifts of the QSA objects. In this paper, absorption line redshifts, especially in the multiple redshift objects, are examined and shown to be consistent with the QSA band system concept.

DATA

Table 1 summarizes emission and absorption line redshifts for the high z QSA objects contained in RMB3. The table also contains references for absorption line data. Information on high z QSE objects included in this paper has already been tabulated in RMB3.

THE RELATIONSHIP OF ABSORPTION LINE REDSHIFTS TO THE QSA BAND SYSTEM

Figure 1 illustrates the QSA band system diagram according to RMB3. Each QSA object is shown with an open circle at its emission line redshift and a set of associated lines for the various absorption line redshifts. The heaviness of each line depends upon the certainty of the absorption line redshift. High z QSE objects are shown with small filled circles.

Inspection of figure 1 shows immediately that for multiple redshift objects the absorption line redshifts, especially the most certain ones, group at the same or lower band crossings corresponding to the magnitude of each QSA system. The absorption line redshifts are, therefore, consistent with the QSA band system as presented in RMB3, and they provide an independent demonstration of the reality and significance of the band concept.

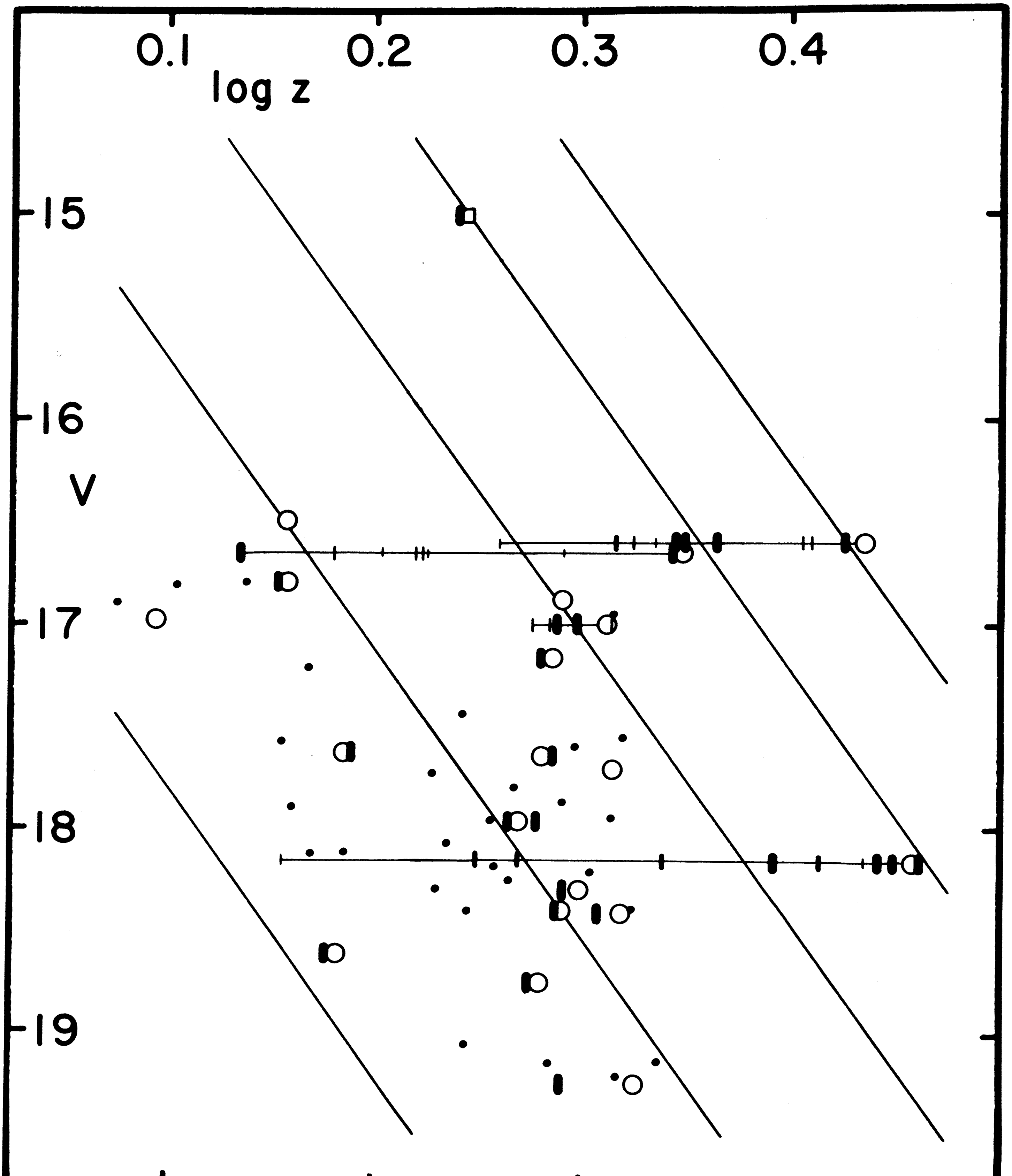
Table 1

QSA Absorption Line Redshifts

Identification	V	z_{emm}	z_{abs}	Reference (abs)
BSO 1	16.98	1.241	None published, close to z_{emm}	
PHL 1377	16.49	1.434	None published, close to z_{emm}	
3C298	16.79	1.439	1.419	1
3C270.1	18.61	1.519	1.498	1
3C205	17.62	1.534	1.538	1
B 194	17.96	1.864	1.837, 1.895	2
RS 23	18.74	1.908	1.873	2
PHL 1222	17.63	1.910	1.934	2
PHL 938	17.16	1.930	1.906, 0.613	2
3C191	18.40	1.952	1.947	2
PKS 0119-04	16.88	1.955	1.965	2
PHL 1127	18.29	1.990	1.95	2
TON 1530	17.00	2.051	1.980, 1.936 (good), 2.055, 1.922, 1.887 (possible)	3,4,9
PKS 0229+13	17.71	2.065	None published, close to z_{emm}	
BSO 11	18.41	2.084	2.028	2
PKS 1116+12	19.25	2.118	1.947	2
PKS 0237-23	16.63	2.224	2.202, 1.364 (good), 1.671, 1.656, 1.513 (possible), 1.956, 1.674, 1.596 (doubtful)	3,5
PHL 957	16.60	2.720	2.662, 2.310, 2.226, 2.206 (good), 2.072 (probable), 2.551, 2.543, 2.108 (possible), 2.158, 1.824 (doubtful)	6
4C05.34	18.16	2.877	2.875, 2.810, 2.770, 2.474 (good), 2.592, 2.181, 1.859, 1.776,(probable), 2.726, 1.431 (doubtful)	7,10
Mark 132	(15)	1.75	1.73 and others?	8

Figure 1

The logz-magnitude diagram for high z QSS objects. Absorption line objects are shown with open circles and emission line objects with small filled circles. Markarian 132 is shown with an open square. Absorption line redshifts are shown with short vertical lines; the weight of each line indicates the certainty of the redshift. Light horizontal lines connect the redshifts of the more complex objects. The absorption line redshifts tend to concentrate at the band crossings.



0.1
0.2
0.3
0.4
log z
15
16
V
17
18
19

The highest populated band of the QSA system is the fifth band which contains PHL 957 as its sole known member. The redshift values of PHL 957 have been discussed by Lowrance, et. al. (1972). As seen in figure 1, one absorption line redshift lies close to the emission line value on the fifth band. The three other principal absorption line redshifts group closely about band four while one doubtful redshift value falls directly at band three. Several less certain redshift values fall slightly below the fourth and fifth bands. PHL 957 is the most striking example of concentration of redshifts at band crossings.

The fourth band of the QSA system contains three objects--Markarian 132, PKS 0237-23, and 4C05.34. All three of these objects are well known multiple redshift objects although only preliminary data has been published on Markarian 132 (Sargent, 1972). 4C05.34 has been discussed by Lynds (1971) and more recently by Bahcall and Goldsmith (1971). The two investigations have four redshifts in common--three lie close to the emission line redshift on the fourth band and the other falls nearly on the third band. Of the less certain redshifts two fall at the second band and the lowest one close to band 1. Only two of the less certain redshifts lie any distance from a band crossing. There is a general tendency in 4C05.34 and other objects for redshift values to distribute on the low side of each band consistent with absorbing cloud ejection velocities toward the observer.

The final band four object is PKS 0237-23 which has been discussed by Burbidge, et. al. (1968) and Bahcall, et. al. (1968). The two most prominent absorption redshifts are one near the emission line value on band four and the z=1.36 value at band two. Most of the remaining values distribute about band two and one doubtful value falls at band three. Two probable redshift values fall between bands two and three and are the values least consistent with band crossings.

Four objects brighter than V=17.5 are considered to be members of the third band; some fainter objects may be members but may alternatively be associated with structure on the second band. One of the four band three objects is PHL 1305 which has no known absorption lines; a second object is PKS 0119-04 which shows absorption at a single redshift near the emission line redshift. The remaining two objects are Ton 1530 and PHL 938. Ton 1530 has a complex absorption line spectrum with as many as five known redshift values and has been studied by Burbidge, et. al. (1968), Bahcall, et. al. (1969), and Morton and Morton (1972). All the redshift values group closely about band 3. The final object is PHL 938 which has an absorption line redshift near the emission line value and a second redshift which is much smaller, 0.6. With the exception of the very discordant redshift in PHL 938 it is apparent that the multiple band redshift pattern seen in higher band objects does not apply to band 3. This is also true on band 2 which contains many objects. At band 3 and below the multiple redshift values are apparently largely confined to the same band. The other obvious trend from higher to lower bands is the increasing occurrence of objects showing no absorption lines.

In figure 2 the band system is shown projected at the band slope of 4.28 magnitudes per factor of two in redshift as derived in RMB3. The QSA objects and absorption line redshift values clump at the band positions. QSE objects group primarily at band two and may have more overlap into the QSE system at lower redshifts.

DISCUSSION

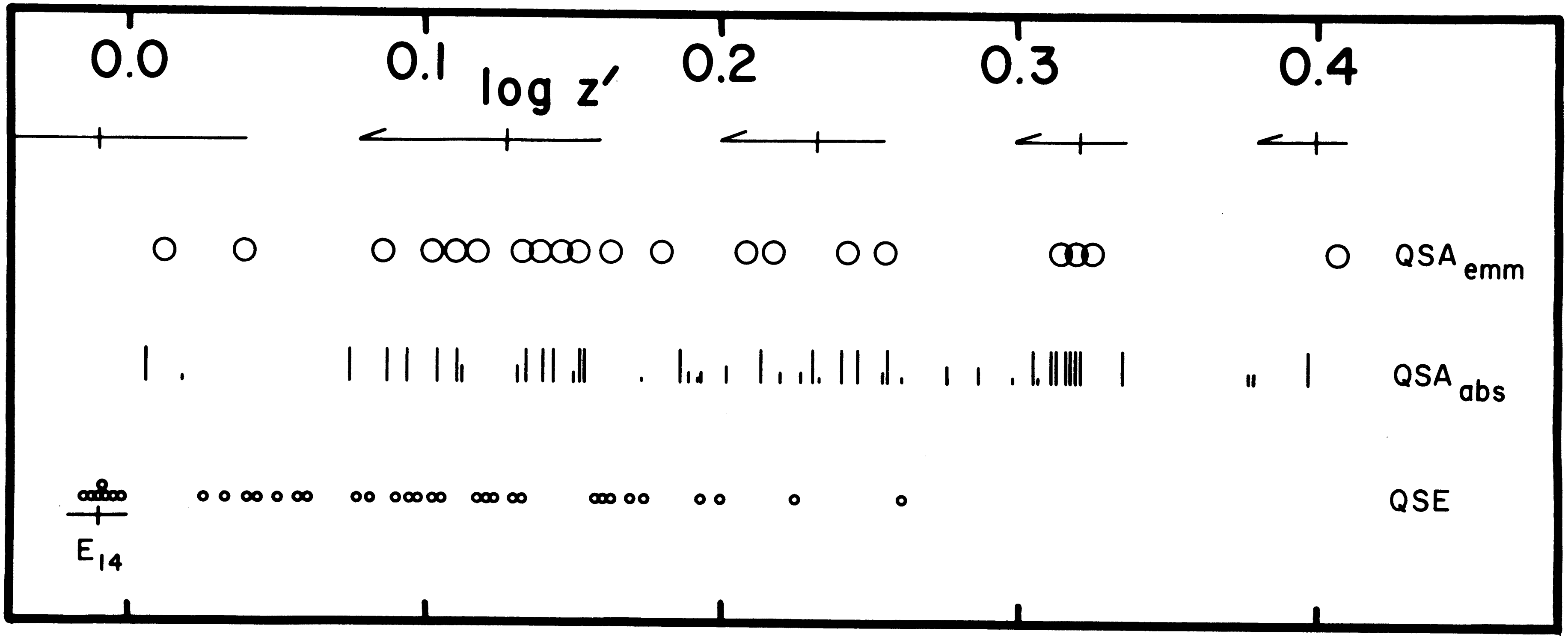
In RMB3 the band concept was interpreted with a general model where each band and possibly substates within a band represent different states or conditions of matter which have unique scaling factors for the energy levels of all atoms in each state. This interpretation, coupled with rapid luminosity evolution of galaxies (and QSS) and possible time evolution of matter itself can produce the observed band phenomenon and fit other fundamental observations discussed in RMB3.

In most objects we apparently see only one substate of matter at any one time, hence, a unique redshift is present. Among the higher band objects, however, a different condition may prevail and several states of matter may be coexistent. The close groupings of redshift values near and just below band crossings may represent real Doppler separation of individual absorbing clouds, however, the large separations between bands is probably due to the same underlying intrinsic effect which produces the entire band system phenomenon.

One final point to conclude this brief paper relates to the apparent upper limit on high z values and the simultaneous appearance of multiple redshifts. If the very high z states of matter were unstable, matter might spontaneously decay and cascade to lower z values. This could

Figure 2

The projection of the logz-magnitude diagram shown in Figure 1. Logz' is the projection of logz along the band direction to a uniform magnitude of 16.2. The concentration of absorption redshifts at band locations is easily seen. There is some tendency for redshifts to disperse more below the band centers consistent with ejection velocities toward the observer. The final band of the QSE redshift system discussed in RMB3 is shown at the lower left. This band represents the limit of the QSE redshift system and the start of the QSA system.


0.0
0.1
log z′
0.2
0.3
0.4
QSA emm
QSA abs
QSE
E 14

produce multiple redshifts in individual objects and also explain why only the lowest bands of the QSA system are populated. High z means in effect low binding energy for the matter and the least tightly bound matter states are presumably the most likely to spontaneously decay. Thus, a real upper limit to redshift may be set by stability conditions in the binding of matter itself.

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