variation will probably not be very large. The reorganization time of an atom appears to be an atomic constant, and to be of the same order for all atoms hitherto examined in the laboratory or in stellar atmospheres. As a working assumption, then, the equality of the atomic absorption coefficients is assumed with

TABLE XXVIII

Atomic Number	Atom	Log a_r	Atomic Number	Atom	Log a_r	Atomic Number	Atom	Log a_r
1	H	11	13	Al	5.0	23	V	3.0
2	He	8.3	14	Si	4.8	24	Cr	3.9
	He+	12		Si+	4.9	25	Mn	4.6
3	Li	0.0		Si+++	6.0	26	Fe	4.8
6	C+	4.5	19	K	3.5	30	Zn	4.2
11	Na	5.2	20	Ca	4.8	38	Sr	1.8
12	Mg	5.6		Ca+	5.0		Sr+	1.5
	Mg+	5.5	22	Ti	4.1	54	Ba+	1.1

some confidence in the discussion of observed marginal appearances.

As stated above, the relative abundances of the atoms are given directly by the reciprocals of the respective fractional concentrations at marginal appearance. The values of the relative abundance thus deduced are contained in Table XXVIII. Successive columns give the atomic number, the atom, and the logarithm of the relative abundance, a_r.

Comparison of Stellar Atmosphere and Earth's Crust

The preponderance of the lighter elements in stellar atmospheres is a striking aspect of the results, and recalls the similar feature that is conspicuous in analyses of the crust of the earth.[6] A distinct parallelism in the relative frequencies of the atoms of the more abundant elements in both sources has already been suggested by Russell,[7] and discussed by H. H. Plaskett,[8] and the

[6] Clarke and Washington, Proc. N. Ac. Aci., **8**, 108, 1922.
[7] Russell, Science, **39**, 791, 1914.
[8] Pub. Dom. Ap. Obs., **1**, 325, 1922.

data contained in Table XXVIII confirm and amplify the similarity.

A close correspondence between the percentage compositions of the stellar atmosphere and the crust of the earth would not, perhaps, be expected, since both sources form a negligible fraction of the body of which they are a part. There is every reason to suppose, on observational and theoretical grounds, that the composition of the earth varies with depth below the surface; and the theory of thermodynamical equilibrium would appear to lead to the result that the heavier atoms should, on the average, gravitate to the center of a star. If, however, the earth originated from the surface layers of the sun,[9] the percentage composition of the whole earth should resemble the composition of the solar (and therefore of a typical stellar) atmosphere. But the mass of the earth alone is considerably in excess of the mass of the reversing layer of the sun.[10] Eddington,[11] quoting von Zeipel,[12] has pointed out that an effect of rotation of a star will be to keep the constituents well mixed, so that the outer portions of the sun or of a star are probably fairly representative of the interior. Considering the possibility of atomic segregation both in the earth and in the star, it appears likely that the earth's crust is representative of the stellar atmosphere.

The most obvious conclusion that can be drawn from Table XXVIII is that all the commoner elements found terrestrially, which could also, for spectroscopic reasons, be looked for in the stellar atmosphere, are actually observed in the stars. The twenty-four elements that are commonest in the crust of the earth,[13] in order of atomic abundance, are oxygen, silicon, hydrogen, aluminum, sodium, calcium, iron, magnesium, potassium, titanium, carbon, chlorine, phosphorus, sulphur, nitrogen, manganese, fluorine, chromium, vanadium, lithium, barium, zirconium, nickel, and strontium.

The most abundant elements found in stellar atmospheres,

[9] Jeffreys, The Earth, 1924.
[10] Shapley.
[11] Nature, **115**, 419, 1925.
[12] M. N. R. A. S., **84**, 665, 1924.
[13] Clarke and Washington, Proc. N. Ac. Sci., **8**, 108, 1922.