Parker, Eugene N. On the instability of gaseous media.

Introducing the assumption that all large scale astrophysical structures, e.g., gas clouds, galaxies, etc. have formed by collapse of regions of an initially more homogeneous distribution of matter according to Jeans' gravitational instability criterion, it is possible to work backwards from existing conditions to the initial conditions. It is found that gravitational instability produces a collapse in which the scale of the final structure is approximately one-sixth of its original dimensions. This agrees with observations of the interstellar gas clouds which show that the clouds are separated by approximately twice the diameter of their extremities. Given the relative velocity of neighboring clouds, it is possible from the diameter of the clouds to determine the average density of the interstellar medium. The relative velocity 3 km/sec gives roughly 10 hydrogen atoms per cm^3 . This agrees with the average density computed by smearing out the estimated mass of the galaxy over the estimated dimensions of the galaxy. The collapse time in such a medium is of the order of 10^7 years.

On the other hand, galaxies are separated by distances of the order of 100 or more times their diameters, implying that they have separated greatly since their formation. Observations imply masses of the order of $10^{11} M_\odot$ and internal velocities 300 km/sec for the brighter galaxies. From these is predicted a relative velocity 50 km/sec for galaxies not in clusters. The observed motions and dimensions of both spheroidal and spiral galaxies yield an initial mean density of the order of $5 \times 10^{-26} \text{ gm/cm}^3$ at the time the collapse of the primordial homogeneous medium began. That both types give the same initial density suggests that regions not occupied by relatively active eddies have collapsed over smaller dimensions to form spheroidal galaxies, i.e., galaxies of low mass, whereas active regions, if they collapse at all, form the more massive galaxies. Finally, the collapse time for forming a galaxy is found to be of the order of 3×10^8 years.

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Pearce, Joseph A. The spectrographic binary HD 37756.

The following orbital elements of this class B1-B1 spectrographic binary, of high eccentricity, were computed by least-squares from 17

observations secured near the nodes, when the lines of both components could be measured.

Orbital Elements

T	J.D. 2,429,991.0976 $\pm$ 0.1071
P	27.1546 $\pm$ 0.00006 days
e	0.73 $\pm$ 0.025
ω_1	84.6 $\pm$ 2.97
ω_2	264.6 $\pm$ 2.97
V_0	+36.2 $\pm$ 1.41 km/sec
K_1	88.5 $\pm$ 3.70 km/sec
K_2	137.9 $\pm$ 5.99 km/sec
$m_1 \sin^3 i = 6.36 \odot, \quad m_2 \sin^3 i = 4.08 \odot$	

A magnitude difference $\Delta m = 1.14 \pm 0.03$ was derived from spectrophotometric measures of the line intensities of $\lambda\lambda 4471$ and 4340 , on eight spectrograms. Absolute magnitudes -2.60 and -1.46 were found for the components from the measured equivalent width of $H\gamma$. An inclination of 52° was estimated from the mass-luminosity relationship.

Physical Characteristics of the System

	HD 37756A	HD 37756B
Sp.	B1	B1
T_e	22,900°K	22,900°K
L	980 $\odot$	340 $\odot$
R	5.8 $\odot$	3.4 $\odot$
Mass	13.3 $\odot$	8.5 $\odot$
ρ	0.07 $\odot$	0.21 $\odot$

Separation of stars: at periastron 19.9×10^6 km.
at apastron 127.7×10^6 km.
Parallax: $\pi = 0''.0026$.

The spectrum exhibits the co-existence of stellar and interstellar calcium lines. The interstellar calcium K-line has a value of $+13.9 \pm 2.8$ km/sec.

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Sen, Hari K. The non-Maxwellian distribution in a shock front and the anomaly of the chromospheric temperature.

Radio observations of the quiet sun indicate an electron temperature $\simeq 10,000^\circ\text{K}$ for the lower chromosphere, whereas optical observations of the widths of chromospheric emission lines indicate a temperature $\gtrsim 30,000^\circ\text{K}$. An attempt is made in this paper to reconcile these two apparently conflicting observational results by the physical picture of a "two-temperature" atmosphere in a shock front. It is shown that the shocks caused by the photospheric granules may be frequent enough to overcome the effects of collisions and preserve a quasi-steady state, non-Maxwellian electron velocity distribution in the high, and possibly even in the low chromosphere.

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