Thomas, Richard N., and Fred L. Whipple.
Astroballistic heat transfer.

The astroballistic region is defined as that region where heat transfer to a solid body moving through a resisting medium is sufficiently rapid that appreciable mass-loss from the body occurs, through either melting or evaporation. Current aerodynamic theory, presumably applicable to sea-level air-densities and ballistic velocities, gives the heat transfer proportional to the temperature difference between solid body and immediately adjacent air, with proportionality factor varying as the square root of the air density; current meteor theory assumes the heat transfer at the high-velocity, low air-density meteor conditions proportional to air density and cube of the velocity. No experiments have earlier been performed to investigate the physical basis of the empirical meteor theory. We have carried out experiments in the controlled-pressure free-flight range of the Naval Ordnance Laboratory at velocities 6000 ft/sec. and less, and over an air density range one-tenth to ten times the sea-level values. We find: (1) the air-density dependence of the heat transfer shows the meteor expression to be preferable to the aerodynamic even at these low velocities; (2) the efficiency of the heat transfer is about one per cent for the velocities around 5000 ft/sec. and about 10 per cent at some kind of a mean over the meteor velocity range of 10 to 100 km/sec. We have further investigated the temperature at the surface of the meteor by a reaction-rate approach¹ and find a temperature of about 3000°K for meteors at maximum luminosity. An investigation of the maximum meteor size capable of reaching the earth without disintegration is now in progress by Whipple. This result when compared with observed meteor finds will yield additional information on the heat-transfer efficiency.

1. Cook, Eyring, Thomas, *Ap. J.*, in press.

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Underhill, Anne B. On the helium content of the early-type stars.

The method of model atmospheres is used to estimate the abundance of helium in the O-type stars from a study of the strength of the line $\lambda 4541$ of $HeII$. This line is hydrogen-like, hence, an expression for the line absorption coefficient

broadened by Stark effect was obtained following the method of Verweij, the necessary matrix elements giving the relative intensities of the Stark components having been computed from the theoretical expressions. With this information the profile of the line $\lambda 4541$ was computed in an O9.5 V and an O5 V model atmosphere for two values of the ratio H/He . A comparison of the observed strengths of this line in spectra corresponding to the model atmosphere to the computed values leads to the conclusion that the important ratio $H/He \geq 20$, that is, helium is only about one-third to one-half as abundant as recent spectrographic studies have suggested.

The line profile is shown to have greatly extended, shallow wings due to Stark effect, and these are demonstrated in a high dispersion plate of 10 Lacertae. It is pointed out that such a profile for the lines of the Pickering series of $HeII$ may cause the Pickering lines apparently to disappear earlier in late O-type stars with bad lines than in such stars with good lines. Such an effect might introduce a systematic error in the spectral classification of the late O-type stars.

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van de Kamp, Peter, and Sarah Lee Lippincott.
Astrometric study of Lalande 21185.

Only α Centauri distant 4.3 light years, and Barnard's star distant 6.0 light years are known to be definitely nearer than Lalande 21185, Wolf 359 and L726-8. The latter three stars vie at present for third place in order of stellar distance; about 8 light years. Since the discovery of variable proper motion in 1942 by Dr. G. Land, Lalande 21185 has been kept under observation with the 24-inch Sproul refractor. A recent study based on 679 plates taken on 188 nights over the interval 1937-1950 shows that the perturbation is well represented by the following dynamical elements: Period 1.14 years, eccentricity .75, periastron passage 1941.12. The geometric elements of the photometric orbit yield a semi-axis major of ".029 or .07 astronomical units, for a parallax of ".41. The corresponding value for the lower limit of the companion mass is .066 ($M + m$)³.

The apparent magnitude and spectrum of Lalande 21185 are 7.6 and M2, the absolute visual magnitude 10.7 and the bolometric magnitude 8.7. In view of the results for the primary, we assume .25 $\odot$ and .50 $\odot$ as reasonable lower and upper limits for the sum of the masses. In the