motions and the equations of variations. This criterion is then applied to the two periodic orbits whose stability has been investigated by Darwin (Darwin, G. H., *Acta Math.* **21**, 99, 1897), who has used Hill's equation as the starting point. Our conclusion that one orbit is marginally stable and the other is marginally unstable agrees with what has already been concluded by Darwin.

Possibility of Explosive $He^3(e^-, \nu)T^3$ and $T^3(p, \gamma)-He^4$ Reactions in Low Mass Stars. ICKO IBEN, JR., *California Institute of Technology*.—At sufficiently high densities ($\rho \geq \rho_m \cong 2 \times 10^4$ g/cm³) the p - p chain may be closed by the reactions $He^3 + e^- + 18$ keV $\rightarrow T^3 + \nu$ and $T^3 + p \rightarrow He^4 + \gamma + 19.8$ MeV. Since the first of these reactions is extremely sensitive to changes in density (Bahcall, J. N., private communication) and the second reaction is very rapid in any case, it is of interest to determine whether or not conditions in a star become favorable for this method of closure to occur explosively. On the basis of models that appear in the literature, regions that attain densities in excess of ρ_m in stars of one solar mass or more are depleted of H^1 and He^3 . If noexplosive nuclear reactions occur, the evolution of stars of mass less than $0.5 M_\odot$ may be followed fairly simply to the completely degenerate stage. The maximum central density for a star of mass $0.01 < M/M_\odot < 0.50$ follows the low $(\rho_c)_{\max} \cong 4.22 \times 10^6 (M/M_\odot)^2 / (1+X)^5$. The method of closure in question is therefore limited to stars of mass in excess of $0.07 M_\odot$. Whether stars in the range $0.07 < M/M_\odot < 0.5$ will attain central densities in excess of ρ_m before burning up their H^1 and He^3 , and whether the nuclear fuel remaining is sufficient to disrupt the star can be answered by constructing evolutionary sequences. Preliminary results indicate that regions attaining $\rho > \rho_m$ are devoid of H^1 and He^3 .

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Formation of Absorption Bands in a Scattering Atmosphere. WILLIAM M. IRVINE, *Harvard College Observatory and Smithsonian Astrophysical Observatory*.—Within the wavelength region of an absorption band formed in a nonemitting planetary atmosphere the absorption coefficient will be a rapidly changing function of frequency. Many spectral lines may be contained within the bandwidth of the detector, and the attenuation will in general not be exponential. Let I_n be the specific intensity of n -times scattered radiation in a nonabsorbing layer, and let p_n be the probability density of the optical paths of photons contributing to I_n . On the assumption that the scattering properties of the

atmosphere are constant across the band, the specific intensity I is expressed in terms of I_n , p_n , and the transmittance relative to the continuum ψ of a sample of the atmosphere. The mean geometric path $\langle l \rangle$ traveled by reflected or transmitted light may be expressed in terms of I_n and the first moments $\langle \lambda_n \rangle$ of p_n . Knowledge of $\langle l \rangle$ is important in the determination of the abundance of an absorbing constituent. The $\langle \lambda_n \rangle$ provide an estimate of the absorption suffered by n -times scattered light.

The probabilities p_n may be expressed by an inverse Laplace transform involving the I_n . The results for $n=1$ and $n=2$ for finite atmospheres and for all n when the layer is semi-infinite are obtained explicitly. The $\langle \lambda_n \rangle$ may be expressed directly in terms of I_n and $\partial I_n / \partial \tau$ (τ is the optical thickness of the atmosphere).

This work will be described in detail in a forthcoming article in the *Bulletin of the Astronomical Institutes of the Netherlands*.

Atmospheric Heating in the Auroral Zones from the Drag Analysis of the Injun III Satellite. LUIGI G. JACCHIA AND JACK SLOWEY, *Smithsonian Astrophysical Observatory*.—Two moderate magnetic storms (maximum $K_p=6-$, $a_p=67$ in each instance) occurred on 31 January and 10 February 1963, respectively, while the perigee of the Injun III satellite was located at 70° north latitude and at 254 km above the geoid. Each of the two magnetic storms was accompanied by an increase in the atmospheric drag of the satellite by a factor comprised between 2 and 3, corresponding to a temperature increase of the order of 300°K . From a study of 46 atmospheric-drag perturbations of the Explorer IX satellite, whose orbital inclination is 38.8° to the equator, the authors had previously obtained the relation $\Delta T = 1.2 \Delta a_p$ (ΔT is the temperature increase in $^\circ\text{K}$, Δa_p is the increase in the 3-hourly geomagnetic index a_p). Had the two drag perturbations of the Injun III satellite been observed at low latitudes, one would have expected to record values of ΔT between 60° and 70° ; the actual temperature increase was thus four times larger than at low latitudes. Three drag perturbations in March and April 1963, when the perigee of the Injun III satellite had reverted to low latitudes, are of intensity more normal for the accompanying geomagnetic disturbances. The atmospheric-temperature increase in the auroral zones during first-class geomagnetic storms ($K_p=9$, $a_p=400$) can be estimated, by extrapolation, to be in excess of 1500° .

The search for a systematic temperature increase with geomagnetic latitude during quiet days was hampered by the fact that, while the satellite perigee was proceeding from high to low latitudes, it was also moving from the dark hemisphere to the