Gutenberg had supposed, some with SKSPP, a wave which had not been studied hitherto. The primary question whether the disturbances which had reached the observing stations had the characteristics to be expected in shearing waves could only be answered by reference to the records from observatories provided with seismographs giving the two components of horizontal movement. Bastings had reproduced such records for five stations, and the Kew records were also available for examination. In general, "sympathy" persisted through the initial parts of the records, as was to be expected if the movements were azimuthal, the bearing of New Zealand from Northern Europe being N.E. It had to be admitted that the sympathy was not as perfect as might be wished, possibly because in some cases the two seismographs of a pair were not tuned to exactly the same period. However, if there had been appreciable shearing waves through the core, there would have been obvious disturbances of the azimuthal movements at some of the stations. Dr. Whipple's inference from the material published by Dr. Bastings was that it was very unlikely that such waves had occurred.

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CORRESPONDENCE.

To the Editors of 'The Observatory'.

On the maximum possible Central Radiation Pressure in a Star of a given Mass.

GENTLEMEN,—

According to a theorem due to Eddington the total pressure $P$ inside a star cannot anywhere exceed the value $P_{\text{max.}}$ given by

$$P_{\text{max.}} = \frac{1}{2} \left( \frac{4}{3} \pi \right)^{1/3} GM^{2/3} \rho_0^{4/3}, \ldots \ldots \ldots(1)$$

where $\rho_0$ is the greatest density inside the star. $P_{\text{max.}}$ given by (1) is just equal to the central pressure in a configuration of mass $M$ with a uniform density $\rho_0$. If it is further assumed that the density increases monotonically inwards then $\rho_0$ in (1) specifies the central density.

Let the radiation pressure be a fraction $(1 - \beta_c)$ of the total pressure at the centre of a star. We shall simply...
Correspondence.  

refer to \((\mathbf{I} - \beta_c)\) as the central radiation pressure. If the perfect gas laws are obeyed at the centre then we can express the central pressure \(P_c\) in terms of \((\mathbf{I} - \beta_c)\) in the form

\[
P_c = \left[ \frac{k}{\mu \hbar} \frac{4}{3} \frac{\mathbf{I} - \beta_c}{a \beta_c^4} \right]^{1/3} \rho_0^{4/3}, \quad \ldots \quad (2)
\]

where \(k=\) Boltzmann’s Constant, \(\mu=\) molecular weight, \(\hbar=\) mass of the proton, \(a=\) radiation constant.

On comparing (1) and (2) we have the inequality

\[
\left[ \frac{k}{\mu \hbar} \frac{4}{3} \frac{\mathbf{I} - \beta_c}{a \beta_c^4} \right]^{1/3} \leq \frac{1}{2} \left( \frac{4}{3} \pi \right)^{1/3} GM^{2/3}. \quad \ldots \quad (3)
\]

After some minor transformations (3) is found to be equivalent to

\[
M \leq 0.3035M_3 \left( \frac{960 \mathbf{I} - \beta_c}{\pi^4 \beta_c^4} \right)^{1/2}, \quad \ldots \quad (4)
\]

where \(M_3\) is the limiting mass for completely degenerate configurations. Thus we have proved that for a given mass \(M\) the central radiation pressure \((\mathbf{I} - \beta_c)\) cannot exceed the value \((\mathbf{I} - \beta_m)\) which satisfies the quartic equation

\[
M = 0.3035M_3 \left( \frac{960 \mathbf{I} - \beta_c}{\pi^4 \beta_c^4} \right)^{1/2}. \quad \ldots \quad (5)
\]

Eddington’s quartic equation, which determines the “actual value” of \((\mathbf{I} - \beta)\) (now assumed constant in the star), differs from equation (5) only by the factor \(0.304\), in front of \(M_3\) being absent.

As an illustration of the use of (5) we see that a star which has a \((\mathbf{I} - \beta_c)\) greater than \((\mathbf{I} - \beta_w)\), where

\[
\frac{960 \mathbf{I} - \beta_c}{\pi^4 \beta_c^4} = \mathbf{I},
\]

must have a mass certainly greater than \(0.304M\), where \(M\) is the mass on the standard model which has a “\(\mathbf{I} - \beta_1\)” = \(\mathbf{I} - \beta_w\). (Clearly \(M = M_3 \beta_w^{2/3}\).) In other words, stars for which central degeneracy cannot set in at all on contraction must have masses at least greater than \(0.304M\) (which is about 2.01 \(\mathcal{M}_\odot\mu^{-2}\)).

I am Gentlemen,

Yours faithfully,

S. Chandrasekhar.

Harvard College Observatory, Cambridge, Mass., U.S.A.,
1935 December 31.

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