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SURFACE GRAVITY ALONG THE MAIN SEQUENCE

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The photospheres of normal main-sequence stars are stable on the average. In this case the variations in $g_{\rm grav}(R) = g$ for hot stars are small (Fig. 1). An essential increase in the surface gravity is found in the vicinity of $\log T_e \approx 3.8$ (about F5 V) to be progressively continued with the decrease in the effective temperature. For the marginal-stability case — when the equatorial rotation velocity of the star is equal to its critical value v_c, this result can be interpreted on the basis of the variations in R and v_c along the main sequence.

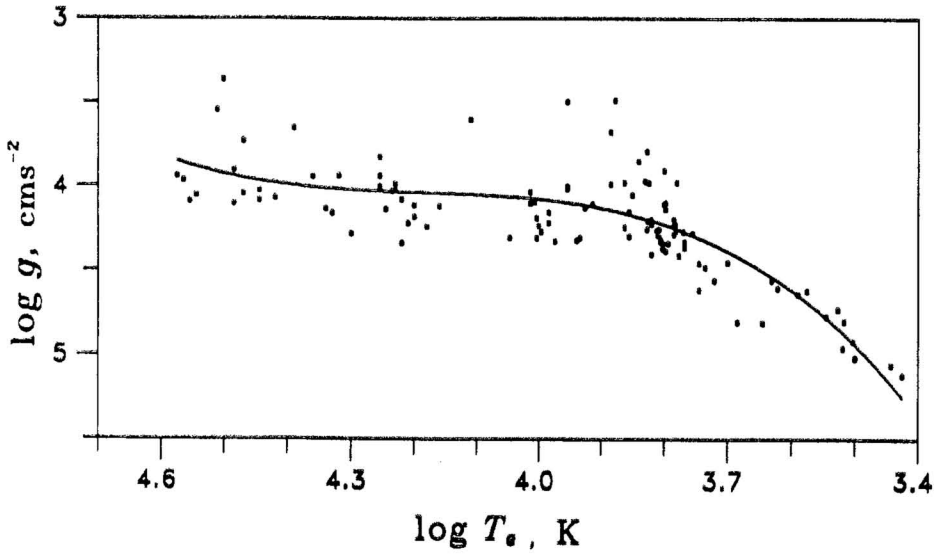

Fig. 1. Surface gravity versus effective temperature along the main sequence. The field of g values on the basis of measured $\mathcal{M}$ and R from Popper's (1980) review is presented.

Namely, the distribution of the critical rotation velocities on the main sequence has a minimum near the spectral subtype F5 V (Angelov, 1995). In view of the empirical dependence on mass-effective temperature (spectral type) one should expect the value $v_c^{\min}$ for the main sequence to be at $\mathcal{M} \approx 1.2 - 1.4\,\mathcal{M}_\odot$. The abscissa of the minimum $v_c(\mathcal{M})$ according to the theoretical star models is also within this mass interval (Sackmann, 1970). From Fig. 2 it is seen that insignificant (and slow) variations in the surface gravity along the upper main-sequence branch are due to the decrease in $v_c^2(\mathcal{M})$ and to the increase in $R^{-1}(\mathcal{M})$ which follow the mass decrease. The character of the $g(\mathcal{M})$ dependence has a change near $\mathcal{M} \approx 1.2 - 1.4\,\mathcal{M}_\odot$ (where the $v_c(\mathcal{M})$ distribution reaches a minimum) because of small variations in v_c^2 and a fast increase in R^{-1} with the mass decrease.

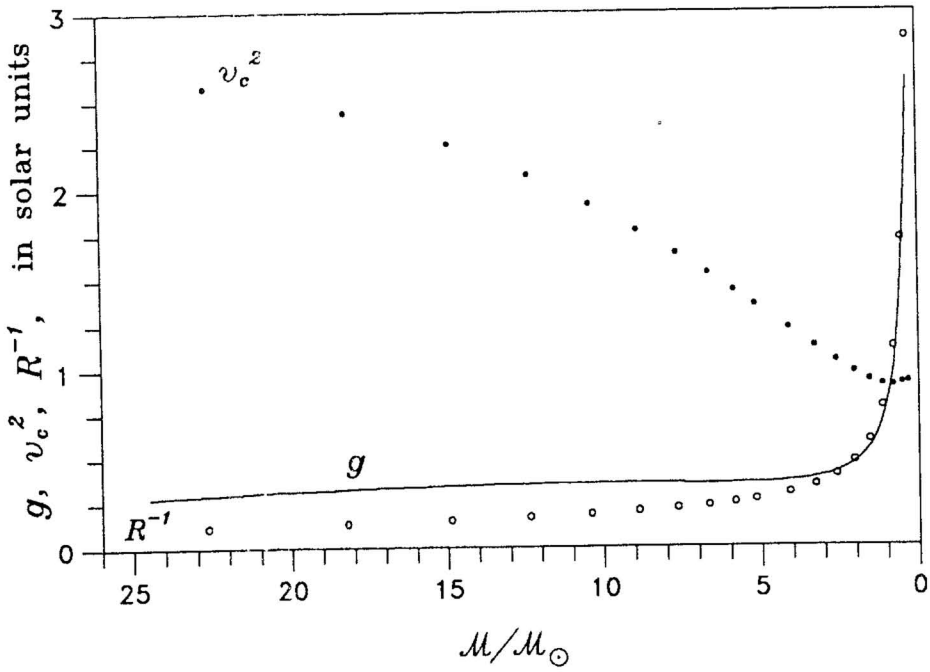

Fig. 2. Surface gravity, v_c^2 and R^{-1} as functions of mass along the main sequence — all quantities are in solar units.

In fact the surface-gravity dependence on the mass along the main sequence is dominantly determined through the $R^{-1}(\mathcal{M})$ distribution which is especially conspicuous within the region of fast changes of $g(\mathcal{M})$.

References

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