

The Beta Cephei instability domain for the new solar composition and with new OP opacities

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The recent revision of the solar chemical composition (A04: Asplund et al. 2005) leads to a decrease of about 40% in the C, N, O, Ne abundances and to a $\sim 20\%$ decrease of Fe and some other metal abundances in comparison with older abundances (GN93: Grevesse & Noels 1993), as shown in Fig. 1.

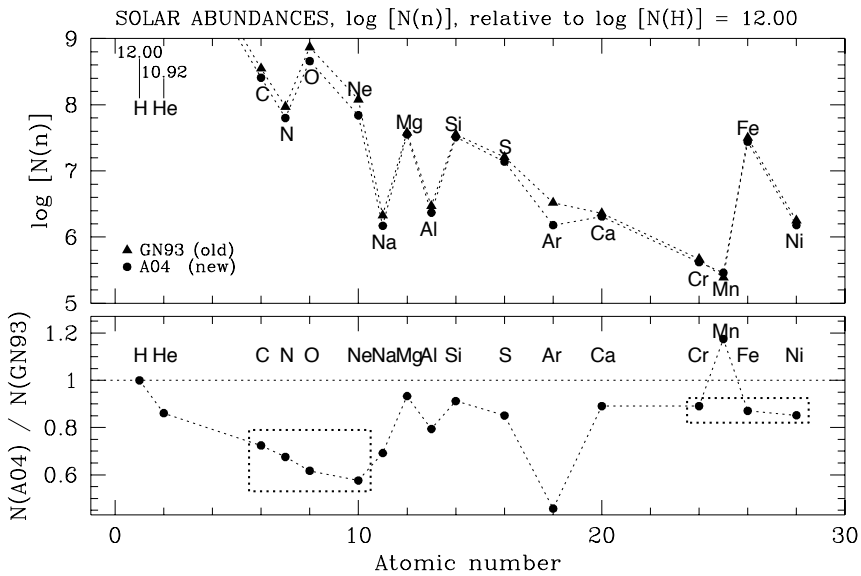


Figure 1: The new solar abundances in comparison with the older ones.

We tested the effects of these modifications of the heavy element abundances on the instability of β Cephei models. For opacities, the newest data from the Opacity Project (Seaton 2005) were used. Fig. 2 shows that the β Cephei instability domain in the HRD, when computed with new data for $Z = 0.012$ (revised solar value), is very similar to the instability domain computed with the OPAL opacities (Iglesias & Rogers 1996) for older solar metallicities and $Z = 0.02$. For the older data and assuming $Z = 0.012$, we obtain only weak β Cep instability (Pamyatnykh 1999). Two effects are responsible for stronger instability when using the new data: (i) The metal opacity bump in the OP case is located slightly deeper in the star than that in the OPAL case, which results in more effective driving; (ii) at a fixed Z value, the new Fe-group abundances are higher than the older ones because the Z value is determined mainly by the abundances of C, N, O, and Ne (see Fig. 1).

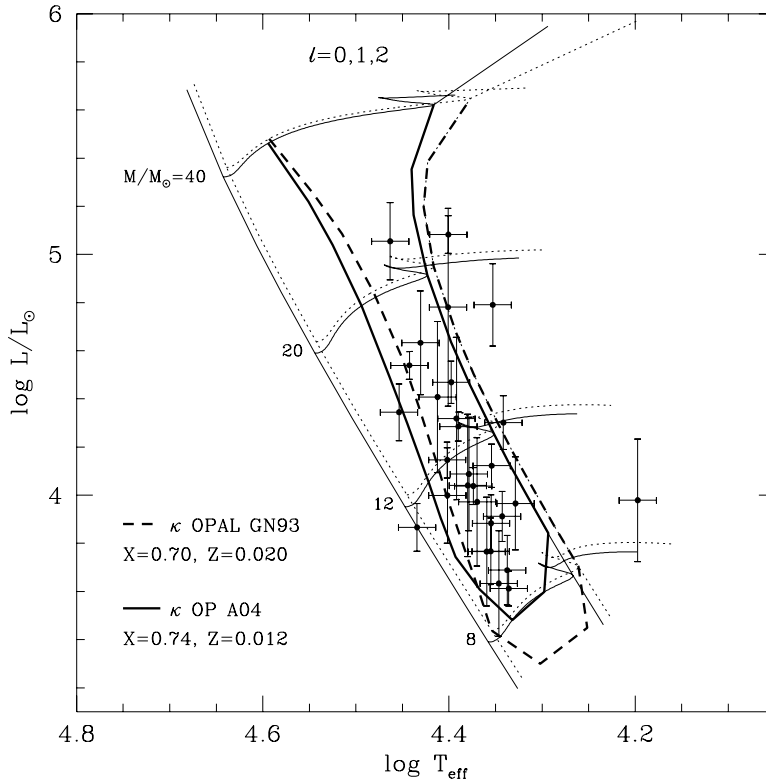


Figure 2: The new β Cephei instability domain in the main-sequence band (OP opacity, A04 mixture, $Z = 0.012$) compared with the older one (OPAL GN93, $Z = 0.02$, see Pamyatnykh 1999). 29 bright variables from Stankov & Handler (2005) with $m_V < 6.0$ and well-measured Hipparcos parallaxes are plotted.

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