Solution for the "solar model problem" ⋆

⋆ Based on:

Drake J.J. & Testa P. 2005, *Nature* 436, 28,

Asplund M., Grevesse N. & Sauval A.J. 2005, *ASP Conf. Ser.* 336, 25

Bahcall J.N. et al. 2004, *Astrophysical Journal* 618, 1049

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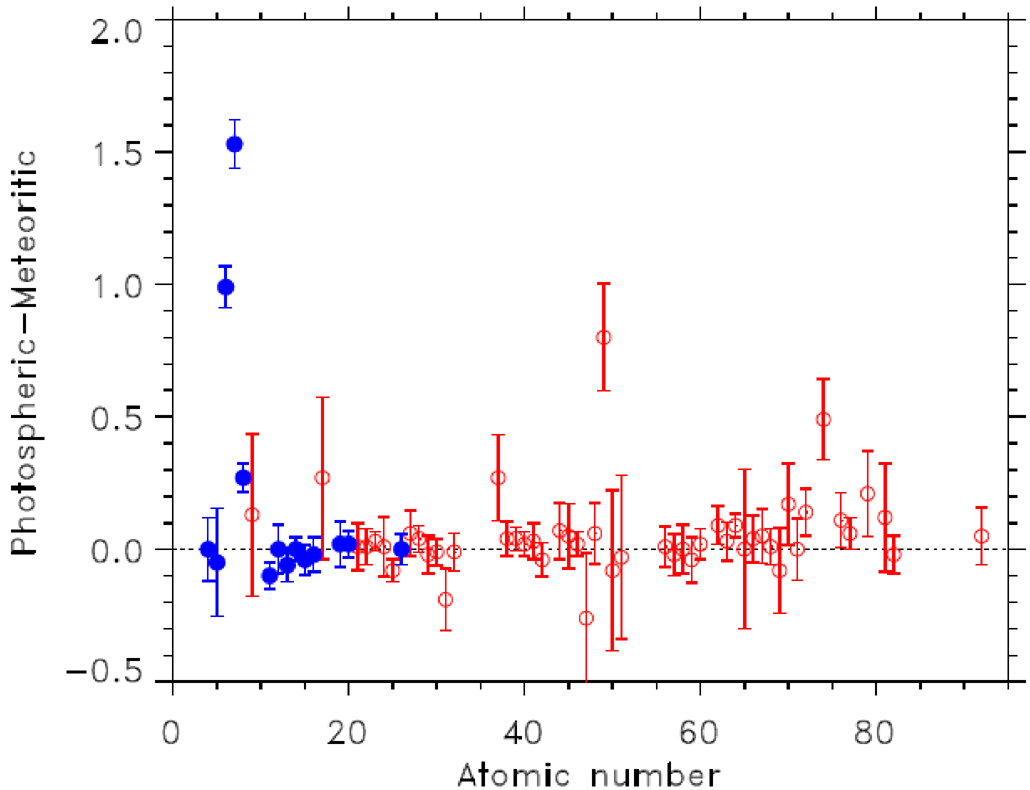

comparison of photospheric and meteoritic abundances as measured in C1 chondrites

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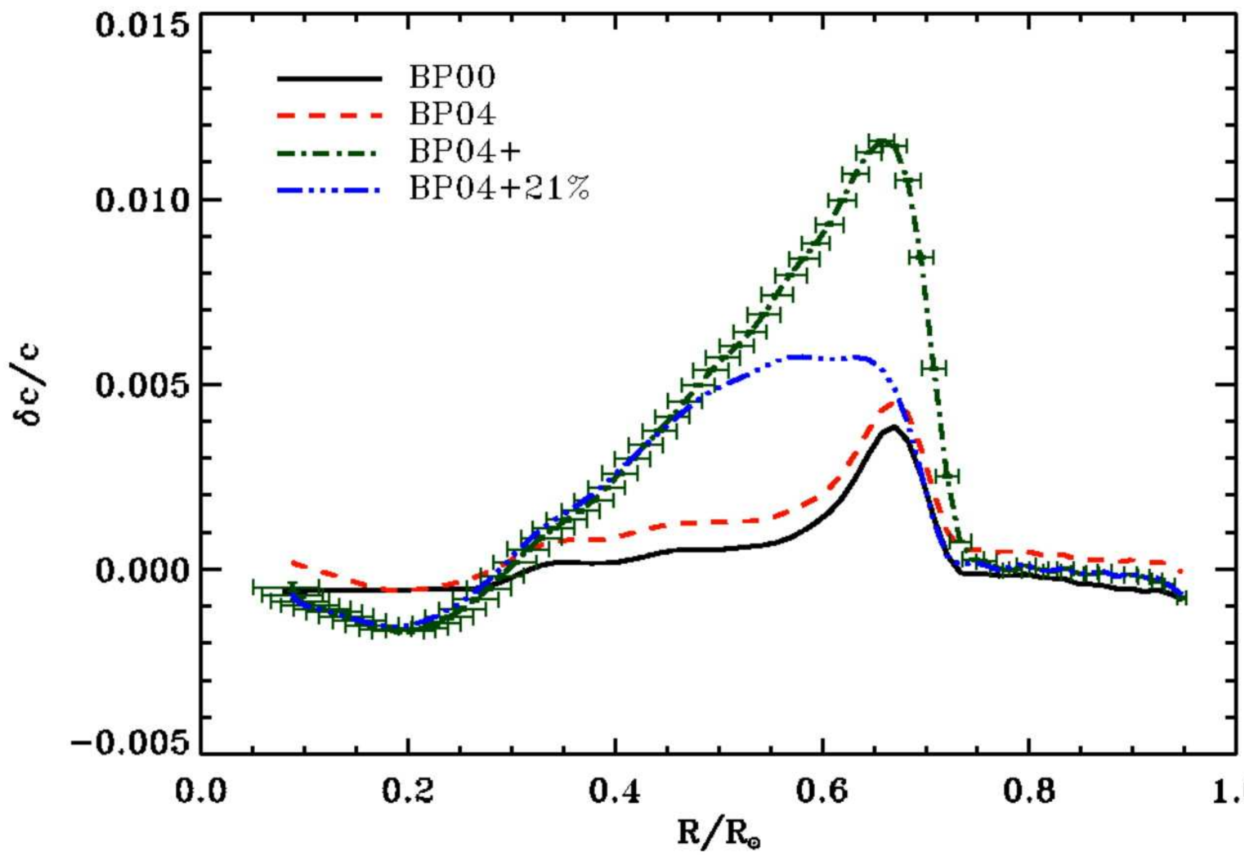
- the predicted sound speed in these new solar models are in much worse agreement with helioseismology

Sound–speed inside the Sun



relative sound–speed differences, $\delta c/c = (c_\odot - c_{\mathrm{model}})/c_{\mathrm{model}}$, between solar models BP00, BP04, BP04+ and BP04+21% and helioseismological results from MDI data.

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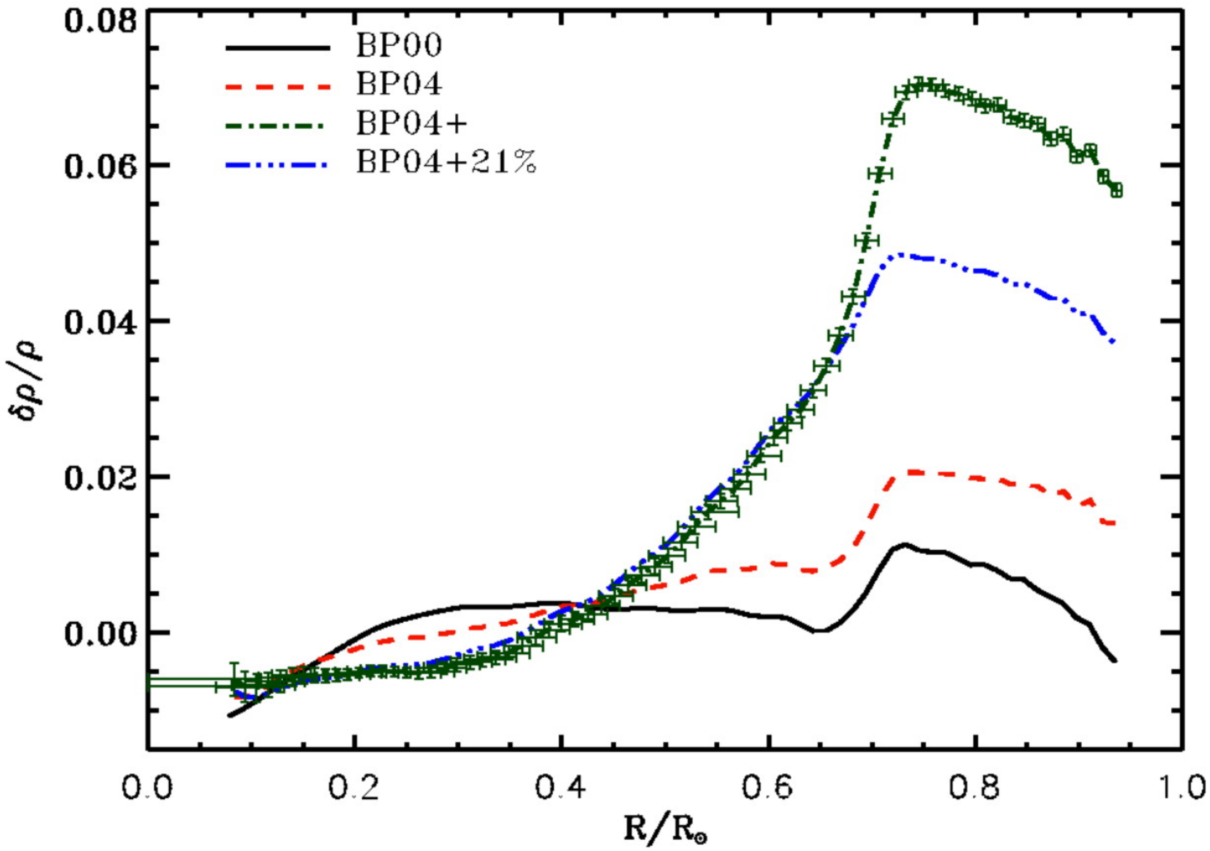

relative density differences, $\delta\rho/\rho = (\rho_{\odot} - \rho_{\mathrm{model}})/\rho_{\mathrm{model}}$, between solar models and helioseismological results from MDI data.

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- a great deal of fine–tuning would be necessary to simultaneously bring the C, N and O abundances up by some 0.2 dex, if at all possible

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- present $A_{Ne}/A_O = 0.15$ but it has been pointed out that the solar model problem could be solved if the solar Ne abundance is at least a factor of 2.5 times higher

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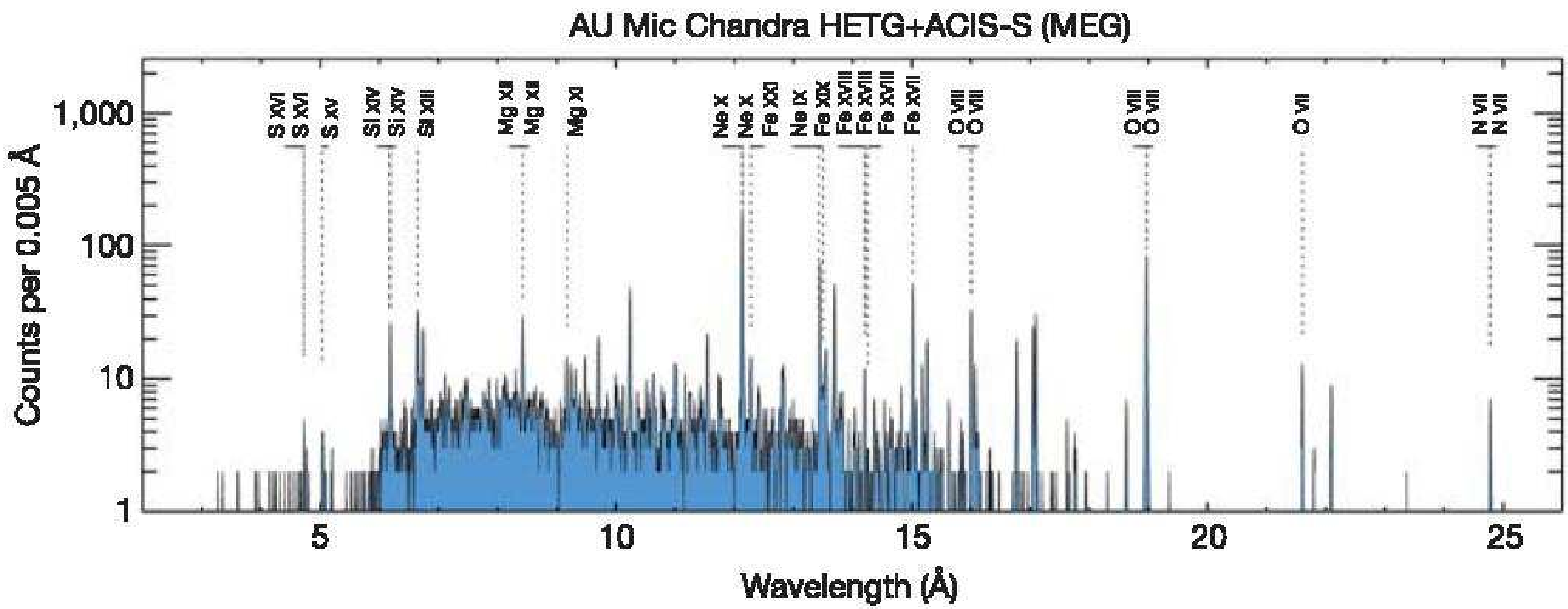
- the error-weighted mean ratio is $A_{Ne}/A_O = 0.41$ (Ne/O ratios for Procyon, an F5 subgiant, and ϵ Eri, a K2 dwarf, added because they have lower activity level than the remaining stars)

Ne **abundance of late–type stars**



A Chandra Medium Energy Grating X-ray spectrum of the M1 V star AU Mic.

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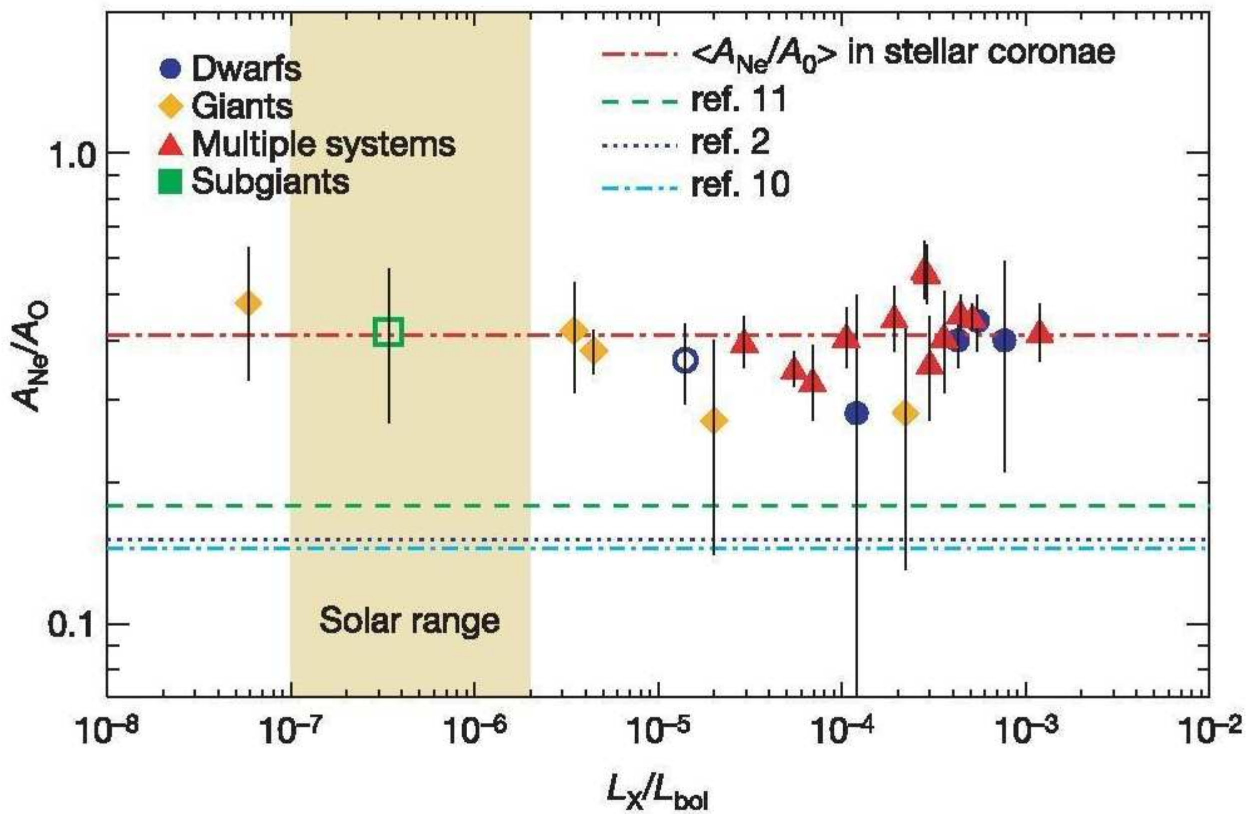

derived Ne/O abundance ratios, A_{Ne}/A_O, vs. the coronal activity index, $L_X/L_{\rm bol}$.

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- adjusting the elements all together is not unreasonable because the recent downward revisions are correlated

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- conclusion: the results represent the true Ne/O abundance ratios

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- high Ne/O ratios have also been seen in γ–ray observations of flares, ^3He–rich solar energetic particle events, and in the decay phase of long duration soft X–ray events

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- this scenario is in accordance with the observations of Ne/O in nearby stars and reconciles solar models with helioseismology