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The new solar chemical composition: Does the Sun have a sub-solar metallicity?

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In the Sun, the convection zone reaches up to the solar atmosphere and can thus directly influence the emergent spectrum. Traditionally, the effects of convection has been modelled with the local mixing length theory in 1D hydrostatic model atmospheres for stars like the Sun. In a different approach, we have performed realistic time-dependent, 3D, radiative-hydrodynamical simulations of the outer layers of the solar convection zone, including the atmosphere. Both the different mean stratification and the presence of atmospheric inhomogeneities in 3D impact the spectral line formation.
We have applied this 3D solar model atmosphere to the problem of the solar chemical composition while adopting the best possible atomic and molecular line data and taking into account departures from LTE in the line formation when necessary. The inferred C, N, O and Ne abundances are all significantly lower than estimated from previous 1D modelling by 0.2-0.3 dex. These results have significant implications for a range of topics in contemporary astrophysics, including causing a severe headache for helioseismology. In this review talk I will present an overview of our analysis, give arguments why our results are trustworthy and discuss some of their ramifications.

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