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# The chemical composition of the Orion star-forming region: II. Stars, gas, and dust: the abundance discrepancy conundrum

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We re-examine the recombination/collisional emission line (RL/CEL) nebular abundance discrepancy problem in the light of recent high-quality abundance determinations in young stars in the Orion star-forming region.

We re-evaluate the CEL and RL abundances of several elements in the Orion nebula and estimate the associated uncertainties, taking into account the uncertainties in the ionization correction factors for unseen ions. We estimate the amount of oxygen trapped in dust grains for several scenarios of dust formation. We compare the resulting gas+dust nebular abundances with the stellar abundances of a sample of 13 B-type stars from the Orion star-forming region (Ori\,OB1), analyzed in Papers I and III of this series.

We find that the oxygen nebular abundance based on recombination lines agrees much better with the stellar abundances than the one derived from the collisionally excited lines. This result calls for further investigation. If the CEL/RL abundance discrepancy were caused by temperature fluctuations in the nebula, as argued by some authors, the same kind of discrepancy should be seen for the other elements, such as C, N and Ne, which is not what we find in the present study. Another problem is that with the RL abundances, the energy balance of the Orion nebula is not well understood. We make some suggestions concerning the next steps to undertake to solve this problem.

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