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## Photochemistry of O(<sup>1</sup>D) and O(<sup>1</sup>S) lines in the coma of 67P/Churyumov-Gerasimenko

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We present here a chemistry-emission coupled model to study the production and loss mechanisms of the O(<sup>1</sup>D) and O(<sup>1</sup>S) states, for comet 67P/Churyumov-Gerasimenko. The recent discovery of O<sub>2</sub> in significant abundance relative to water (3.80% +/- 0.85%, Bieler et al. 2015) within the coma of 67P has been taken into consideration for the first time in such models. We evaluate the effect of the presence of O<sub>2</sub> on the green to red-doublet emission intensity ratio, which is traditionally used to assess the CO<sub>2</sub> abundance within cometary atmospheres. Model simulations, solving the continuity equation with transport, show that not taking O<sub>2</sub> into account leads to an underestimation of the CO<sub>2</sub> abundance within 67P. This strongly suggests that the green to red-doublet emission intensity ratio alone is not a proper tool for determining the CO<sub>2</sub> abundance, as previously suggested. O<sub>2</sub> might indeed be a rather common and abundant parent species, following the re-analysis of the comet 1P/Halley data (Rubin et al. 2015). Therefore, it is likely that earlier determinations of the CO<sub>2</sub> abundance in cometary atmospheres have to be revisited.