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► **To cite this version:**

Gaël Cessateur, Johan de Keyser, Romain Maggiolo, Andrew Gibbons, Guillaume Gronoff, et al.. Photochemistry of O(1D) and O(1S) lines in the coma of 67P/Churyumov-Gerasimenko. EGU General Assembly 2016, Apr 2016, Vienne, Austria. insu-03573511

HAL Id: insu-03573511

<https://hal-insu.archives-ouvertes.fr/insu-03573511>

Submitted on 15 Feb 2022

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Photochemistry of O(¹D) and O(¹S) 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(¹D) and O(¹S) states, for comet 67P/Churyumov-Gerasimenko. The recent discovery of O₂ 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 O₂ on the green to red-doublet emission intensity ratio, which is traditionally used to assess the CO₂ abundance within cometary atmospheres. Model simulations, solving the continuity equation with transport, show that not taking O₂ into account leads to an underestimation of the CO₂ abundance within 67P. This strongly suggests that the green to red-doublet emission intensity ratio alone is not a proper tool for determining the CO₂ abundance, as previously suggested. O₂ 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 CO₂ abundance in cometary atmospheres have to be revisited.