Probing $O(^3P)$ behaviour on interstellar ice analogues using the PSD-REMPI method

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The triplet oxygen atom, $O(^3P)$, is a product of the VUV photolysis of water. As a highly reactive and abundant species, involved in the formation of other abundant species, such as H_2O and O_2, understanding its surface diffusion and desorption is essential.

We used a combination of photostimulated desorption (PSD) and resonance-enhanced multiphoton ionisation (REMPI) techniques, known as the PSD-REMPI method, to selectively and sensitively monitor $O(^3P)$ and O_2 photodesorption from amorphous solid water in the visible range (400-650 nm) [1, 2]. To produce $O(^3P)$ radicals and minimise the interference of OH radicals, we deposited a thin layer (0.03 ML) of N_2O on H_2O ice (40 ML) and irradiated it at 193 nm. We observed a dependence of the PSD wavelength on temperature for O_2 and possibly for $O(^3P)$. Both species desorbed more efficiently at longer wavelengths at lower temperatures.

Theoretical calculations are necessary to investigate how this observed trend relates to different types of binding sites on the ice surface. Further experiments are necessary to clarify the photodesorption efficiency of $O(^3P)$ at varying wavelengths and temperatures with $O(^3P)$ at steady state.
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References

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