Direct observation of OH formation in the photolysis of amorphous water

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Many interstellar dust grains are coated with an ice mantle, a major component of which is amorphous solid water (ASW) that is constantly exposed to photon, magnetospheric ions, the solar wind and cosmic rays. When water ice is exposed to vacuum-ultraviolet radiation, the hydrogen-oxygen bond breaks followed by formation of OH, HO_2, H_2O_2 and so on.

$$H_2O(ice) + h\nu \rightarrow H + OH \qquad (1)$$

Tappe et al. [1] have reported the detection of rotationally excited OH by analyzing a 5-7 μm infrared spectrum obtained with *Spitzer Space Telescope* toward the southeastern lobe of the young protostellar out flow HH 211. The origin of the highly excited emission is most likely the photodissociation of H_2O by the UV radiation generated in the terminal outflow shock of HH 211.

Previous experiments on the photolysis of an amorphous ice focused on species formed on/in ice, and did not investigate atoms and molecules released into the vacuum. Here we have investigated OH radical desorption following 157 nm photodissociation of amorphous solid water at 90 K. Ro-vibrational excited OH(v=0 and 1) radicals are directly detected with the resonance-enhanced multiphoton ionization technique. In addition, we discussed OH radical desorption from photodissociation of H_2O_2 formed with 157 nm irradiation on ice as the secondary process.

$$OH + OH \rightarrow H_2O_2 \qquad (2)$$

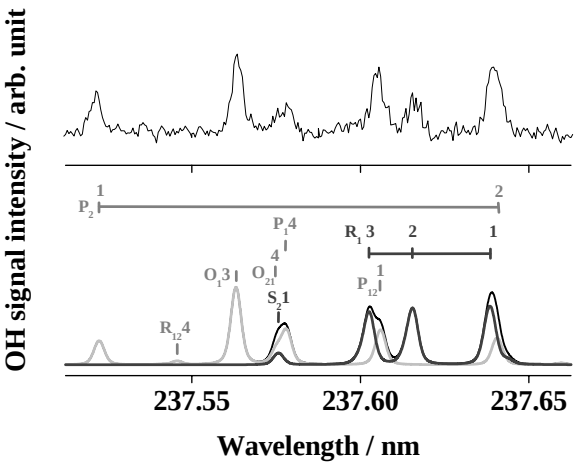

Figure 1: (upper) REMPI spectrum of OH($D^2\Sigma^- - X^2\Pi$) and OH($3^2\Sigma^- - X^2\Pi$), and (lower) Calculated spectra of OH($D^2\Sigma^-$, v'=1 - $X^2\Pi$, v"=0) (pale gray line) and OH($3^2\Sigma^-$, v'=0 - $X^2\Pi$, v"=1) (dark grey line).

Reference

[1] Tappe, A.; Lada, C. J.; Black, J. H.; and Muench, A. A., *Astrophys. J.* **680**, L117 (2008)