Measurement of binding of oxygen on dust grains (amorphous silicates and amorphous water ice): consequences for oxygen chemistry in the interstellar medium

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We performed experiments to quantify the ability of dust grain analogues to hold atomic oxygen[1]. We find that atomic oxygen is retained on an amorphous silicate surface with a much higher binding energy (1850K ± 90K) than previously estimated (800K). We then used such value in the simulation of the chemical evolution of an interstellar environment – a molecular cloud edge in star-forming regions in Orion exposed to FUV illumination, and found that OH and H_2O formation on grains is considerably enhanced while O formation is suppressed because of the higher O binding energy. These effects are especially important in dense gas exposed to high FUV fields because of the wider temperature range in which oxygen can reside. Because of the higher binding energy, photodesorption controls the gas phase chemistry. Consequences of this discovery for observations will be discussed.

This work is supported by the NSF Astronomy and Astrophysics Division (Grant No.1311958 to GV) and by NASA support for US research with the Herschel Space Observatory (RSA No. 1427170 to MJK).

[1] He et al. Astrophys.J., 801, 120 (2015)