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An update on modeled ion sputter yields of planetary bodies in agreement with recent experimental data

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Thin, collisionless atmospheres are created around otherwise atmosphere-free celestial bodies through space weathering processes. Impinging solar wind ions eject highly energetic particles into these atmospheres by sputtering. Some ejected particles escape from the atmosphere, some return to the surface or are ionized and might be caught in a surrounding magnetosphere or the solar wind plasma. This process can be observed far into space through ground based and in-situ observations.

Determining the sputter yield of the various species from a realistic mineral surface is still a work in progress [1]. Modeling of sputtering with commonly used Binary Collision Approximation (BCA) models such as TRIM [2] has been shown to overestimate the sputter yields compared to experimental data [3, 4]. The number of sputter experiments performed on rock forming minerals is growing steadily, however. We apply the latest findings to obtain yields for a range of minerals from the state-of-the-art model SDTrimSP [5], which is based on TRIM.

To obtain yields of surface compositions of rocky bodies we present an approximation through weighing each mineral's sputter yield contribution. This improves upon the simplification of assuming a bulk surface composition with TRIM and the resulting overestimated sputter yields. Simulating each mineral separately with SDTrimSP and considering the current knowledge on sputter behavior is tedious and requires extensive computing power. For this reason, we develop a database of sputter yields for important rock-forming minerals allowing easy access for researchers on which we will show our progress.

[1] Jäggi, N., et al. (2021). *Icarus,* 365, 114492.

[2] Ziegler, J.F., et al. (2010). *Nucl. Instrum. Methods Phys. Res. B,* 268, 1818–1823.

[3] Biber H., et al. (2020). *Nucl. Instrum. Methods Phys. Res. B,* 480, 10.

[4] Szabo, P.S., et al. (2018). *Icarus,* 314, 98–105.

[5] Mutzke, A., et al. (2019). *SDTrimSP Version 6.00*. Max-Planck-Institut für Plasmaphysik.