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# Atmosphere dissolution in magma oceans in exoplanets

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The question of hydrogen dissolution in a silicate planet is longstanding within the Earth and planetary science community. Its presence and amount can drastically change the functioning of the planet from the redox state to the characteristics of its atmosphere. This question becomes of utmost importance when studying exoplanets, sub-Neptunes, and super-Earths. Here, we employ ab initio molecular dynamics to compute the solubility of hydrogen in a magma ocean with bulk silicate Earth composition. We find that magma oceans can dissolve almost 2 wt% hydrogen at typical conditions relevant to their interfaces with hot, dense atmospheres. The hydrogen influx changes the redox state of the magma ocean (which becomes reduced), and generates a massive outflux of oxygen, which combines with atmospheric hydrogen to form large amounts of water vapor. Numerous other complex chemical species are released into the atmosphere. This changes profoundly the thermal and chemical evolution of the primitive atmosphere for early Earth-like conditions. For sub-Neptune exoplanets, this offers an amazing diagnostic tool, as their atmospheres would bear spectral signatures observable from space telescopes. These atmospheric composition changes are a testable signature of hidden magma oceans on exoplanets. Moreover, the uptake of volatiles by the magma implies that sub-Neptunes are more volatile-rich than once thought.