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Oxygen Atmospheres: Europa and Saturn's Main Rings

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The solar UV and energetic ions and electrons can decompose icy outer solar system surfaces producing molecular hydrogen and oxygen. Remarkably, oxygen atmospheres have been detected indirectly over the surface of Europa and over Saturn's main rings. The energetic ions and electrons trapped in the Jovian magnetosphere bombard and decompose Europa's surface, a process often called radiolysis. However, the oxygen over Saturn's main rings, where the energetic particle flux is small, is produced primarily by UV photons, a process often referred to as photolysis. Although the incident radiations eject water molecules more efficiently than molecular hydrogen or oxygen, the temperatures are such that on re-impact water molecules stick but hydrogen and oxygen do not. Since the hydrogen is light and escapes, it is readily lost and the heavier molecular oxygen accumulates [1,2]. Using a recent model for the radiation-induced decomposition of ice [1], the oxygen atmospheres over the surface of Europa [3] and Saturn's main rings [4] are described. These are classical boundary layer atmospheres that are in equilibrium with the surface temperatures [5].

References

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