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Escape of Mars' CO_2 atmosphere by suprathermal atoms during the past 4 Gyrs

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The escape of atmospheric particles plays a crucial role in the evolution of the atmosphere of Mars. Especially, the escape of oxygen and carbon is thought to have influenced its amount of CO_2.

With a Monte-Carlo model we investigate the escape of hot oxygen and carbon from the martian atmosphere for three points in time in its history corresponding to 3, 10, and 20 times the present EUV level. We study and discuss different possible sources of hot oxygen and carbon atoms in the thermosphere and their changing importance with the EUV flux. We find that the escape due to photodissociation increases with increasing EUV level, as is a commonly assumed opinion. However, for the escape via other reactions, e.g. dissociative recombination, this is only true until the EUV level reaches 10 times the present EUV flux, but then the rates start to decrease. Our results thus suggest that some escape mechanisms related to the loss of CO_2 are less important than previously thought for atmospheres exposed to higher EUV radiation.

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