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An extremely high altitude plume seen at Mars morning terminator

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We report the occurrence in March and April 2012 of two bright very high altitude plumes at the Martian terminator at 250 km or more above the surface, thus well into the ionosphere and bordering on the exosphere. They were located at about 195 deg West longitude and -45 deg latitude (at Terra Cimmeria) and lasted for about 10 days. The features showed day-to-day variability, and were seen at the morning terminator but not at the evening limb, which indicates rapid evolution in less than 10 hours and a cyclic behavior. Photometric measurements are used to explore two possible scenarios to explain their nature. If the phenomenon is due to suspended particles (dust, CO₂ or H₂O ice clouds) reflecting solar radiation, the mean size is about 0.1 microns with a nadir optical depth > 0.06. Alternatively, the plume could be auroral emission above a region with a strong magnetic anomaly and where aurora has previously been detected. Importantly, both explanations defy our current understanding of the Mars upper atmosphere. Acknowledgements This work was supported by the Spanish MINECO projects AYA2012-36666 with FEDER support, CONSOLIDER program ASTROMOL CSD2009-00038 and AYA2011-30613-CO2-1. Grupos Gobierno Vasco IT765-13 and UPV/EHU UFI11/55.

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