



## **Carbon Dioxide Ice Structure and Density in the Martian Mesosphere**

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CO<sub>2</sub> ice has been grown experimentally via deposition in order to mimic ice formation in Martian mesospheric CO<sub>2</sub> clouds. This is achieved through the use of a low temperature and low pressure controlled stage mounted within an X-ray diffractometer (XRD). XRD patterns of CO<sub>2</sub> deposited at temperatures of 80 – 130 K and pressures below 1 mbar were analysed using a Rietveld refinement method and fitted to a crystalline cubic structure (space group *Pa3*). This crystal structure is consistent with XRD patterns also taken of dry ice. CO<sub>2</sub> ice densities were then determined from the refined lattice parameters across the 80 – 130 K range and extrapolated using literature values resulting in a temperature dependent density parameter valid over 80 – 195 K. This temperature dependent parameter for CO<sub>2</sub> ice density was applied to nucleation, sedimentation and growth rates of CO<sub>2</sub> ice particles under conditions relevant to the Martian mesosphere. The results were then compared to commonly used literature values, illustrating the need for the use of temperature dependent CO<sub>2</sub> ice densities.