to observe through the increasing effective optical depths as one goes poleward.

By using a photochemical model that included multiple scattering of solar radiation, Lindner [3] showed that the absorption and scattering of solar radiation by clouds and dust should actually increase O₃ abundances at winter polar latitudes. Hence, regions with high dust and cloud abundance could contain high O₃ abundances (heterogeneous chemistry effects have yet to be fully understood [2,9]). It is quite possible that the maximum O₃ column abundance observed by Mariner 9 of 60 pm-atm is common. In fact, larger quantities may exist in some of the colder areas with optically thick clouds and dust. As the Viking period often had more atmospheric dust loading than did that of Mariner 9, the reflectance spectroscopy technique may even have been incapable of detecting the entire O₃ column abundance during much of the Mars year that Viking observed, particularly at high latitudes. The behavior of O₃ is virtually unknown during global dust storms, in polar night, and within the polar hood, leaving large gaps in our understanding.

Acknowledgments: I thank K. Stammes for providing the radiative transfer program, and NASA's MSATT Program for support.

ESCAPE OF MARS ATMOSPHERIC CARBON THROUGH TIME BY PHOTOCHEMICAL MEANS. J. G. Luhmann1, J. Kim2, and A. F. Nagy3, 1Institute of Geophysics and Planetary Physics, University of California, Los Angeles CA 90024-1567, USA, 2KARI, Seoul, Korea, 3Space Research Laboratory, University of Michigan, Ann Arbor MI 48109, USA.

Luhmann et al. [1] recently suggested that sputtering of the martian atmosphere by reentering O+ pickup ions could have provided a significant route of escape for CO2 and its products throughout Mars' history. They estimated that the equivalent of C in a ~140-mbar CO2 atmosphere should have been lost this way if the Sun and solar wind evolved according to available models. Another source of escaping C (and O) that is potentially important is the dissociative recombination of ionospheric CO+ near the exobase [2]. We have evaluated the loss rates due to this process for "ancient" solar EUV radiation fluxes of 1, 3, and 6x the present flux in order to calculate the possible cumulative loss over the last 3.5 Gy. (Earlier estimates of loss by McElroy [2] used the present-day rates and thus represent underestimates.) The inputs and assumptions for this calculation are the same as used by Zhang et al. [3] for an evaluation of historical O escape by dissociative recombination of ionospheric O2+. We find loss rates of C that are at least comparable to the sputtering loss rates, thereby potentially accounting for another 100 mbar or more of Mars' original atmosphere.