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Mars Atmosphere Argon Density Measurement on MER Mission.

T. E. Economou

Laboratory for Astrophysics and Space Research, University of Chicago, Chicago, IL. 60637, USA, tecon@tecon.uchicago.edu

Using the Alpha Particle X-ray Spectrometer (APXS) on board Spirit and Opportunity rovers on MER mission, we were able to measure the argon density variation in the martian atmosphere as a function of seasonal changes. Due mainly to the variation of the temperature as a function of season on martian poles, the air mass on Mars is constantly moving from North pole to South pole in the summer, and vice versa in the winter on North pole. The freezing and melting of the CO₂ in the martian atmosphere at the poles creates local atmospheric lows/highs that moves the air mass. The argon, however, due to its much lower freezing point, never freezes and stays in the air. An enhancement of Ar/CO₂ mixing ratio by a factor of six at the martian South pole during the winter has been observed by the Gamma Ray Spectrometer onboard the Odyssey orbiter around Mars(1).

The Spirit and the Opportunity that landed on the opposite sites of Mars near the equator can determine the variation of the amount of the argon in the atmosphere from the K line of the Ar peak in the x-ray spectra. About one year ago we have started to make dedicated APXS measurements of the martian atmosphere, where there is no other interference in the Ar K line and therefore an accuracy of several percent has been achieved.

From the data obtained so far there is clear indication that even at the equator region there is a variation in the argon density that corresponds roughly with yearly seasonal variations and which is inversely correlated to the atmospheric pressure. We intend to obtain additional data as long as the MER mission will last from which we can

determine the Ar/CO₂ mixing ratio that could provide a ground truth to the Mars Global Circulation Models.