IONS FROM THE LUNAR ATMOSPHERE, R.A.Lindeman*,J.W. Freeman,Jr.*, R.R.Vondrak*, *Space Science Dept.,Rice Univ., Houston,Texas 77001

The analysis of 5 months (August-December,1971) of data from the Suprathermal Ion Detector Experiments (SIDE) deployed on Apollo missions 14 and 15 have shown that the lunar ionosphere is highly variable. Ions are observed at almost every terminator crossing having energy spectra ranging from mono-energetic to broad (100 to 10 eV) and fluxes varying from 10^3 to 10^5 ions/cm^2sec (all fluxes are given assuming a parallel beam and thus represent minimum values). The observed masses have been tentatively identified as 20,36, and 40 amu. The mass resolution, $\Delta m/m$, for Apollo 14 SIDE is approximately 0.1 and for 15 SIDE 0.07. Due to the frequent observations from one lunation to the next these ions are believed to be from the ambient lunar atmosphere.

Figure 1 shows the times at which low energy (<100 eV) ions were observed. The horizontal lines indicate theperiods for which the Apollo 14 and 15 instruments were on. The blocks indicate the duration of the ion events. The correlation with terminator crossing is easily seen. There are definite mass spectra for nine of these events. For the other events the background in the Mass Analyzer was too high to obtain good mass data. In general each ion event has a narrow mass spectrum. For example the event observed by Apollo 15 on day 312 had an energy spectrum of 70 to 10 eV. The observed flux was 10^4 ions/cm^2sec and consisted almost entirely of mass 20 amu. Note also that the ion events are not usually observed simultaneously at both instruments. Only on days 342 and 359 are simultaneous ion data observed. On day 342 ions having an energy range of 70 to 30 eV were seen at both instruments. However the mass spectrum at Apollo 15 was predominantly mass 40 and at Apollo 14 mass 36. This tends to indicate some form of mass separation by the local acceleration mechanism.

The fact that ions are observed mainly at the terminators lends apparent support to an acceleration mechanism based on a $\vec{v} \times \vec{B}$ electric field due to the motion of the solar wind past the moon. However the observed energy spectra do not always agree with the wide spectra predicted by the $\vec{v} \times \vec{B}$ model

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proposed by Manka (1). For example on day 300 Apollo 14 SIDE observed a very narrow energy spectrum ($\Delta E < 10$ eV) at 30 eV.

Low energy ion events have also been observed in the earth's magnetotail. On days 305,306, and 307 Apollo 15 SIDE was cycled on for two hours each day for thermal control. During each of these look periods 50 to 20 eV ions were observed with fluxes of 5×10^3 ions/cm^{2}sec.

REFERENCES

(1) Manka,R.H., E.O.S. Transactions of American Geophysical Union,abstract,53,439,April,1972.

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