

RESULTS OF THE APOLLO 14 AND 15 SOLAR WIND COMPOSITION EXPERIMENTS. F. Buehler, H. Cerutti, P. Eberhardt, and J. Geiss, Physikalisches Institut, University of Bern, Sidlerstrasse 5, 3012 Bern, Switzerland.

It is the aim of the Solar Wind Composition experiment to measure the abundances and the isotopic composition of noble gases in the solar wind. A collection technique is employed at the lunar surface by which the solar wind particles are implanted in a catcher foil and brought back to earth for laboratory determinations.

The experiment was successfully carried out during the Apollo 11, 12 (1) and also during the 14 and 15 missions (2, 3). All experiments yielded the elemental and isotopic abundances of helium and neon in the solar wind. In the Apollo 14 and 15 experiments, argon was detected for the first time. Argon data will be presented at the Conference.

In the Apollo 14 experiment the angular distribution of the arriving  $\text{He}^4$  ions was determined with higher resolution and precision than was possible in the preceding experiments.

In Table 1 the fluxes of  $\text{He}^4$  during the four exposure periods are given, and in Table 2 the relative abundances of the helium and neon isotopes. There are large differences between the helium flux measured during the four Apollo landings. In particular the Apollo 14 and 15 fluxes differ by about a factor of four, and yet the relative abundances of helium and neon, and also the isotopic abundances are very similar. Comparison with proton flux measurements obtained from unmanned spacecrafts will show whether there existed a similar difference in the fluxes of hydrogen during the Apollo 14 and 15 landings, or whether the abundances of the helium and neon isotopes changed relative to hydrogen by a large and rather uniform factor. The variations in the  $\text{He}^4/\text{He}^3$  and  $\text{He}^4/\text{Ne}^{20}$  ratios (Table 2) are small but significant. A distinct correlation between these two ratios exists. These variations are linked to the level of disturbances in the solar wind, as indicated by the observed positive correlation between  $\text{He}^4/\text{He}^3$  and geomagnetic activity (Figure 1). This correlation may actually be expected on the basis of models of solar wind ion acceleration (4). This type of correlation is useful in estimating the long-time average of the  $\text{He}^4/\text{He}^3$  ratio in the solar wind.

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The significance of the results will be discussed in relation to questions of solar evolution and abundances in the solar nebula.

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References

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Mission	Date	Average solar wind <sup>4</sup> He flux [ 10 <sup>6</sup> cm <sup>-2</sup> sec <sup>-1</sup> ]
Apollo 11	July 21, 1969	6.2 ± 1.2
Apollo 12	Nov. 19, 1969	8.1 ± 1.0
Apollo 14	Feb. 5, 1971	4.2 ± 0.8
Apollo 15	July 31, 1971	17.7 ± 2.5

Table 1. He<sup>4</sup> flux averages during the times of foil exposure. Data for Apollo 11 and 12 from (1).

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	$\frac{\text{He}^4}{\text{He}^3}$	$\frac{\text{He}^4}{\text{Ne}^{20}}$	$\frac{\text{Ne}^{20}}{\text{Ne}^{22}}$	$\frac{\text{Ne}^{22}}{\text{Ne}^{21}}$
Apollo 11	1860 ±140	430 ± 90	13.5 ±1.0	
Apollo 12	2450 ±100	620 ± 70	13.1 ±0.6	26 ±12
Apollo 14	2230 ±140	550 ± 70	13.65 ±0.50	
Apollo 15	2310 ±120	550 ± 50	13.65 ±0.30	31 ± 4
Atmosphere	$7 \times 10^5$	0.3	9.8	34.5

Table 2. Abundance ratios of solar wind ions determined for the foil exposure periods of the Apollo landings. Data for Apollo 11 and 12 from (1).

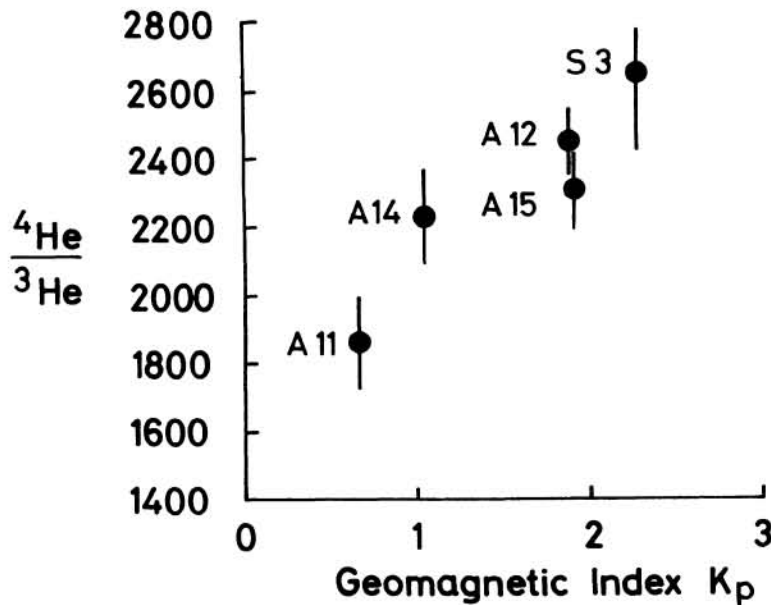


Figure 1. Correlation between the solar wind  $\text{He}^4/\text{He}^3$  abundance ratio and the level of disturbance in the solar wind as indicated by the geomagnetic index  $K_p$  (cf. 3). A  $\equiv$  Apollo; S3  $\equiv$  Surveyor 3 (5).