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Miniaturized High-Resolution Mass/Charge Spectrograph: Design Study

A comprehensive study was carried out to determine the optimal parameters for the design of a double-focusing spectrograph that could be used for measuring mass/charge composition of the solar wind. Basic design considerations were to make available in miniature size the high-resolution capability of conventional, large mass/charge spectrographs. Although the design principles of such spectrographs generally apply to the design of a miniaturized instrument, no previously available instrument could perform the specific measurements on the solar wind.

The study showed that it would be feasible to design a double-focusing mass/charge spectrograph (including electronic components) weighing less than 25 pounds. The instrument would have a theoretical resolution exceeding 2000 with a 0.001-inch object slit. The solar wind input could be replaced with a built-in ion source, which is normally used in mass/charge spectrographs. In such an instance, features which pertain to the use of the instrument as a solar wind probe could be eliminated without destroying the novel feature of the proposed instrument, besides its small size; namely, the use of a parallel-plate energy filter between the ion source and the double-focusing units (electric and magnetic sectors). This feature avoids the difficult problem of designing an ion source of small energy spread which is common to available mass/charge spectrographs.

Mass/charge in the range 2 to 10 could be accepted by the instrument using one permanent magnet. This would be accomplished using an accelerator unit and a decelerator unit which together would provide the means of selecting a given mass/charge number. A velocity deviation of ± 0.20 could be accepted by the instrument. However, a velocity deviation of only ± 0.10 would be necessary to display a mass/charge deviation of ± 0.20 over a 1-inch segment of photographic plate. A high-voltage supply of approximately 12 kilovolts with at least 1 percent of regulation would be required. Mass/charge and solar-wind-velocity tuning would be accomplished by interdependently varying the potentials across several high-voltage elements in the instrument.

Note:

Documentation is available from:

The Clearinghouse for Federal Scientific and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference: NASA CR-92438 (N69-14669), Feasibility Study for Double-Focusing Mass Spectrograph

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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