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The Advanced Mass and Ionic Charge Composition Experiment (AMICCE)

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Ions with energies from a few times the solar wind plasma thermal energy up to 100s of keV/q are called suprathermal (ST) ions. Measuring the composition (ionic charge and elemental) of ST ions in the heliosphere has proved to be rather difficult. This is because their energy regime lies between that sampled by solar wind instruments, which require long integration times to acquire adequate statistics at these energies, and that by the energetic particle instruments, which typically do not extend down into the ST regime due to the low-energy thresholds (50-100 keV) of solid-state detectors.
Our design approach for an Advanced Mass and Ionic Charge Composition Experiment (AMICCE) has a novel electrostatic analyzer (ESA) that essentially serves as a spectrograph and selects ions simultaneously over a broad range of energy-per-charge (E/q) simultaneously. Only three voltage settings are required to cover the entire range from 10 to 270 keV/q, thus dramatically increasing the product of the geometric factor times the duty cycle when compared with other instruments. In this paper, we describe the AMICCE concept with particular emphasis on the prototype of the entrance system (ESA and collimator), which we designed, developed, and tested. We also present comparisons of the laboratory results with electrostatic simulations.