MESUR presents some major challenges for development of instruments, instrument deployment systems, and onboard data processing techniques. The instrument payload has not yet been selected, but the strawman payload is (1) a three-axis seismometer; (2) a meteorology package that senses pressure, temperature, wind speed and direction, humidity, and sky brightness; (3) an alpha-proton-X-ray spectrometer (APXS); (4) a thermal analysis/evolved gas analysis (TA/EGA) instrument; (5) a descent imager; (6) a panoramic surface imager; (7) an atmospheric structure instrument (ASI) that senses pressure, temperature, and acceleration during descent to the surface; and (8) radio science. Because of the large number of landers to be sent (about 16), all these instruments must be very lightweight. All but the descent imager and the ASI must survive landing loads that may approach 100 *g*. The meteorology package, seismometer, and surface imager must be able to survive on the surface for at least one martian year. The seismometer requires deployment off the lander body. The panoramic imager and some components of the meteorology package require deployment above the lander body. The APXS must be placed directly against one or more rocks near the lander, prompting consideration of a microrover for deployment of this instrument. The TA/EGA requires a system to acquire, contain, and heat a soil sample. Both the imagers and, especially, the seismometer will be capable of producing large volumes of data, and will require use of sophisticated data compression techniques.

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A LOW-COST, LIGHTWEIGHT, AND MINIATURIZED TIME-OF-FLIGHT MASS SPECTROMETER (TOFMS).
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P-1

Time-of-flight mass spectrometers (TOFMS) are commonly used for mass analysis and for the measurement of energy distributions of charged particles. For achieving high mass and energy resolution these instruments generally comprise long flight tubes, often as long as a few meters. This necessitates high voltages and a very clean environment. These requirements make them bulky and heavy. We have developed [1] an instrument and calibration techniques [2] that are based on the design principles of TOFMS. However, instead of one long flight tube it consists of a series of cylindrical electrostatic lenses that confine ions under study along the axis of the flight tube. This results in a short flight tube (i.e., low mass), high mass resolution, and high energy resolution. A laboratory version of this instrument is in routine operation. A schematic diagram of this instrument is shown in Fig. 1.

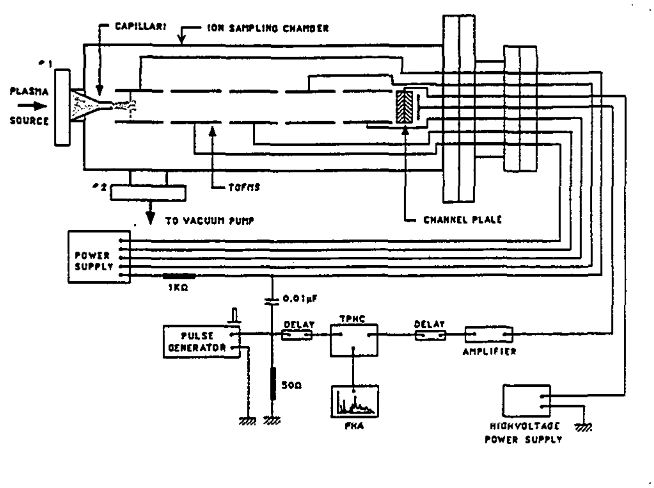

Fig. 1. Schematic diagram of the ion mass sensor.

References: [1] Krishnakumar E. and Srivastava S. K. (1992) *Int. Jour. Mass Spetrom. and Ion Proc., 113*, 1–12. [2] Srivastava S. K. (1990) U.S. Patent #4,973,840.

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PLUTO FAST FLYBY MISSION AND SCIENCE OVERVIEW.
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Planning for the Pluto Fast Flyby (PFF) mission centers on the launch of two small (110–160 kg) spacecraft late in the 1990s on fast, 6–8-year trajectories that do not require Jupiter flybys. The cost target of the two-spaceraft PFF mission is $400 million. Scientific payload definition by NASA's Outer Planets Science Working Group (OPSWG) and JPL design studies for the Pluto flyby spacecraft are now being completed, and the program is in Phase A development. Selection of a set of lightweight, low-power instrument demonstrations is planned for May 1993. According to plan, the completion of Phase A and then detailed Phase B spacecraft and payload design work will occur in FY94. The release of an instrument payload AO, followed by the selection of the flight payload, is also scheduled for FY94. I will describe the scientific rationale for this mission, its scientific objectives, and give an overview of the spacecraft and strawman payload.

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VENUS INTERIOR STRUCTURE MISSION (VISM): ESTABLISHING A SEISMIC NETWORK ON VENUS.
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Introduction: Magellan radar data show the surface of Venus to contain a wide range of geologic features (large volcanos, extensive rift valleys, etc.) [1,2]. Although networks of interconnecting zones of deformation are identified, a system of spreading ridges and subduction zones like those that dominate the tectonic style of the Earth do not appear to be present. In addition, the absence of a mantle low-viscosity zone suggests a strong link between mantle dynamics and the surface [3,4]. As a natural follow-on to the Magellan mission, establishing a network of seismometers on Venus will provide detailed quantitative information on the large-scale interior structure of the planet. When analyzed in conjunction with image, gravity, and topography information, these data will aid in constraining mechanisms that drive surface deformation.

Scientific Objectives: The main objective for establishing a network of seismometers on Venus is to obtain information on both