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The VenSpec instrument suite on the EnVision mission consists of three channels: VenSpec-M, VenSpec-H, VenSpec-U, and the Central Control Unit (CCU).

VenSpec-H will be dedicated to high-resolution atmospheric measurements. The main objective of the VenSpec- H instrument is to detect and quantify SO2, H2O and HDO in both the troposphere and the mesosphere, to enable characterization of volcanic plumes and other sources of gas exchange with the surface of Venus, complementing VenSAR and VenSpec-M surface, SRS subsurface observations and VenSpec-U observations in the upper cloud layer. A nadir pointed high-resolution infrared spectrometer is the ideal instrument for these observations in different spectral windows between 1 and 2.5 microns, that permit measurements of the troposphere during the night, and of the mesosphere during the day. VenSpec-U will monitor sulphur-bearing minor species (mainly SO and SO2) and the yet unknown UV absorber in Venusian upper clouds and just above. It will therefore complement the two other channels by investigating how the upper atmosphere interacts with the lower atmosphere, and especially characterize to which extent outgassing processes such as volcanic plumes are able to disturb the atmosphere through the thick Venusian clouds. The twin channel (0.2 nm in high-resolution, 2 nm in low-resolution) spectral imager in the 190-380 nm range able to operate in nadir is ideally suited to such a task.

VenSpec-M will provide near-global compositional data on rock types, weathering, and crustal evolution by mapping the Venus surface in five atmospheric windows. The broadest window at 1.02 µm is mapped with two filters to obtain information on the shape of the window. Additional filters are used to remove clouds, water, and stray light. VenSpec-M will use the methodology pioneered by VIRTIS on Venus Express but with more and wider spectral bands, the NASA VERITAS VIRSAR and Envision VenSAR-derived DEMs, and EnVision's lower orbit compared to Venus Express to deliver near-global multichannel spectroscopy with wider spectral coverage and an order of magnitude improvement in sensitivity. It will obtain repeated imagery of surface thermal emission, constraining current rates of volcanic activity following earlier observations from Venus Express. In combination with the observations provided by the identical VEM instrument on the NASA VERITAS mission VenSpec-M will provide more than a decade of monitoring for volcanic activity, as well as

search for surface changes.

In combination, VenSpec spectrometers will provide unprecedented insights into the current state of Venus and its past evolution. VenSpec will perform a comprehensive search for volcanic activity by targeting atmospheric signatures, thermal signatures and compositional signatures, as well as a global map of surface composition. VenSpec will be key to studying the coupled system of surface and atmosphere on Venus following the holistic approach of Envision.

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