A BRIEF REVIEW OF INFRARED, VISIBLE, AND ULTRAVIOLET SPECTROSCOPY OF EUROPA AND RECOMMENDATIONS FOR THE JUPITER ICY MOONS ORBITER.

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Ground-based, *International Ultraviolet Explorer, Hubble, Voyager*, and *Galileo* observations have provided information about Europa's surface composition and related atmospheric emissions. The presence of water ice has been known for some time from ground based observations while infrared observations from Galileo's Near Infrared Mapping Spectrometer (NMIS) show additional features due to CO_2, H_2O_2, and a hydrated material, interpreted as a hydrated salt or hydrated sulfuric acid. Hydrated salts were suggested to have been upwelled from an internal ocean while sulfuric acid was suggested to be produced radiolytically and likely derived from Iogenic sulfur with a possible contribution from internal sulfurous material. An upper limit for magnesium hydroxide has been derived. Molecular oxygen, presumably derived from radiolysis of water, is condensed in the surface and is thought to produce the observed atmospheric atomic oxygen. A dark, brownish material correlates with the hydrate and may be sulfur polymers associated with sulfate radiolysis. Ultraviolet observations show SO_2 on the trailing side and H_2O_2 on the leading side, similar to the infrared measurements. The SO_2 concentration correlates with the hydrate concentration and their relative concentrations are in good agreement (factor of two) with laboratory-derive radiolysis rates. Atmospheric sodium and potassium emissions suggest an internal source of these metals in addition to Iogenic plasma contributions. Thermal infrared observations have not been diagnostic due to grain size effects.

Future measurements may be aided by higher spectral resolution and these are possible from ground-based telescopes, with resolving power of ~ 2000 at spatial resolution of ~ 130 km. High spectral resolution measurements, from the ground or from JIMO, can aid in identifying hydroxyl absorption and search for spectral structure associated with hydrated salt spectra. High-spectral-resolution measurements in the visible region can determine the spatial distribution of surficial molecular oxygen.

The ultraviolet, visible, and infrared regions should be measured simultaneously with the same high spatial resolution. High spatial resolution that can resolve the lineae would be useful; only a few lineae were resolved by NIMS and they show that the centers are icy compared to the hydrated margins.

Enhanced detector shielding compared to NIMS will provide better long wavelength spectra. Distant observations of Europa (e. g., from the orbit of Ganymede or Callisto) will also reduce radiation-induced noise. Spectrometers aboard JIMO can be used to detect weak emissions from the night side such as Cerenkov emission (with possible OH absorption), surface fluorescence, airglow, and perhaps flashes from artificial impactors.

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