

Venus's Ultraviolet Absorber and Sulfuric Acid Droplets

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The ultraviolet absorber in Venus's clouds remains a mystery. There have been many interesting and sometimes bizarre suggestions, but sulfur is a leading candidate. The molecular form is unknown and simple molecules such as diatomic, triatomic, and tetrasulfur have been suggested along with cyclo-octal and polymeric sulfur. The sulfur source is similarly unknown. It could be produced photochemically in the high atmosphere or from chemical reactions taking place deeper in the atmosphere. The relationship to the sulfuric acid cloud droplets is also unclear. Sulfur grains and sulfuric acid aerosols can be formed independently, producing separate clouds or two-component clouds if mixed. Composite particles are also possible, with sulfur-containing grains acting as condensation nuclei to form aerosols with sulfurous cores and sulfuric acid mantles (Toon et al., 51, 358, 1982). Most forms of sulfur are hydrophobic, and may not form cores. Instead, sulfur grains may exist on the surfaces of acid droplets as in the "gumdrop" model of Young (Icarus 56, 568, 1983). The spectral properties of these types of aerosols have been investigated and show that separate clouds, two-component clouds, and clouds with "gumdrop" particles are consistent with Venus's ultraviolet spectrum when a few percent of the sulfur is in elemental (cyclo-octal+ polymeric) form. Clouds consisting wholly of composite particles with sulfur cores are more difficult to reconcile with observations, but cores of polymeric sulfur or long-chained sulfur molecules such as thionates may be spectrally consistent.