HELIOSPHERIC INTERACTIONS WITH KUIPER BELT OBJECTS

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Interactions of heliospheric plasma, energetic particles, and dust with icy surfaces of Kuiper Belt Objects in the outer heliosphere have potentially observable effects on surface chemistry of these objects. Visible surface albedoes are generally presumed to be low (~ 0.04) because of radiolytic processing of cometary ices by cosmic rays. Observed spectral reddening of some KBO's may arise from formation of complex hydrocarbons in irradiation mantles. Radiolytic products can be buried by impact ejecta from collisions with other cometary objects and from bombardment by interplanetary dust, thereby generating diversity in spectra as the result of random collisions. Many Scattered Kuiper Belt Objects have sufficiently eccentric orbits to pass through the solar wind termination shock out into the heliosheath region, some even going beyond into local interstellar space to at least 1000 A.U. The primary energy source for radiolytic chemistry in the termination shock region, located somewhere at 80 to 100 A.U. or more, would likely come from locally accelerated, anomalous cosmic ray (ACR) ions. Time scales for significant radiolytic evolution of surface ices to sensible depths ~ 1 mm could vary from millions of years in the region of highest ACR intensity to billions of years elsewhere from irradiation by modulated galactic cosmic ray ions. Improving spectroscopic analysis of SKBO's by earth-based observations may provide limits on the cosmic ray and dust environment in the heliospheric boundary regions yet to be probed in-situ by the outbound Pioneer and Voyager spacecraft. Targeted surveys of surface composition and space environments for some known KBO's and SKBO's should be considered for future missions to the outer heliosphere beyond the orbit of Neptune and out to 1000 A.U.