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Keck Infrared Observations of Saturn's Main Ring Surrounding Earth's August 1995 Ring Plane Crossing

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We present results of near-infrared (2.26 μm) observations of Saturn's main rings taken with the W. M. Keck telescope during August 8-11, 1995, surrounding the time that Earth crossed Saturn's ring plane. These observations provide a unique opportunity to study the evolution of the ring brightness in detail, and by combining our data with Hubble Space Telescope (HST) results (Nicholson et al. 1996, Science 272, 453-616), we extend the 12-hour HST time span to several days around the ring plane crossing (RPX) time. Here we focus on the temporal evolution of the brightness in Saturn's main rings. We examine both edge-on ring profiles and radial profiles obtained by "onion-peeling" the edge-on data. Before RPX, when the dark (unlit) face of the rings was observed, the inner C ring (including the Colombo gap), the Maxwell gap, Cassini Division and F ring region were very bright in transmitted light. After the RPX the main rings brighten rapidly as expected. The profiles show east-west asymmetries both before and after RPX. Prior to RPX, the evolution in ring brightness of the Keck and HST data match each other quite well. The west side of the rings showed a non-linear variation in brightness during the last hours before ring plane crossing, suggestive of clumping and longitudinal asymmetries in the F ring. Immediately after the RPX, the east side of the rings brightened more rapidly than the west. A quantitative comparison of the Keck and HST data reveals that the rings were redder before RPX than after; we ascribe this difference to the enhanced multiple scattering of photons passing through to the unlit side of the rings.