



Multiwavelength campaign on Mrk 509. VI. HST/COS observations of the far-ultraviolet spectrum

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We present medium resolution ($R \sim 20,000$) HST/COS ultraviolet spectra covering 1155-1760 Å of the Seyfert 1 Mrk 509 obtained simultaneously with a Chandra/LETGS spectrum as part of a multiwavelength campaign in 2009 that included observations with XMM-Newton, SWIFT, and Integral. Our high S/N spectrum detects additional complexity in the absorption troughs from a variety of sources in Mrk 509, including the outflow from the active nucleus, the ISM and halo of the host galaxy, and infalling clouds or stripped gas from a merger that are illuminated by the AGN. Variability between the STIS and COS observation of the -400 km/s component allows us to set an upper limit on its distance of < 250 pc. Similarly, variability of a component at +150 km/s between two prior FUSE observations limits its distance to < 1.5 kpc. The UV absorption only partially covers the emission from the AGN nucleus. Covering fractions are lower than those previously seen with STIS, and are comparable to those seen with FUSE. Given the larger apertures of COS and FUSE compared to STIS, we favor scattered light from an extended region near the AGN as the explanation for the partial covering. As observed in prior X-ray and UV spectra, the UV absorption has velocities comparable to the X-ray absorption, but the bulk of the ultraviolet absorption is in a lower ionization

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state with lower total column density than the gas responsible for the X-ray absorption. We conclude that the outflow from the active nucleus is a multiphase wind.

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