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Evolution of the 2009 impact on Jupiter: high-resolution HST UV/optical imaging

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The 2009 impact on Jupiter was discovered by amateur astronomer Anthony Wesley on 19 July, and the impact nature of the event was rapidly confirmed by observers at the IRTF and Keck Observatories in Hawaii. Within four days, we directed the Hubble Space Telescope (HST) to acquire optical and near-UV images of the impact site using the newly installed Wide Field Camera 3 (WFC3). Far-UV images were obtained with HST's Solar-Blind Channel of the Advanced Camera for Surveys (ACS/SBC) on 8 September, and WFC3 imaged the evolution of the impact site on 3 August, 8 August, 22-23 September, and 2-3 November.

We will present results drawn from the Hubble imaging data and compare them with results from the Shoemaker-Levy 9 (SL9) impacts that occurred exactly 15 years prior. Morphology of the 2009 ejecta pattern suggests the impactor approached from the northwest, whereas the SL9 fragments entered Jupiter's atmosphere from the southeast. The low resolution UV/optical spectra of the dark material in both 1994 and 2009 impacts were quite similar, revealing a grey color with an albedo in the range of 0.09 to 0.12 between 200 and 900 nm. As the impact site evolved, we tracked clumps of material to measure drift rates. Comparing these drift rates to high-altitude winds derived from contemporaneous Very Large Telescope thermal data, we found impact aerosols at pressure levels between 10 and 300 mbar, consistent with the detection of the impact site in the UV images. The confinement of impact aerosol into clumps is similar to some, but not all, of the SL9 impact sites, and the isolated nature of the 2009 impact allowed to clumps to be studied over a longer time. Stratospheric eddies may be responsible for confining the aerosols into clumps.

Differences between the 1994 and 2009 impacts are still being analyzed. Diffuse UV-dark halos were observed in SL9 impact sites, but not in the 2009 impact, suggesting lower aerosol densities or faster precipitation in the 2009 impact. This could indicate differences in the nature of the impact (shallower? less energetic?) or differences in the composition or structure of the impacting body.