than the northern one. On July 27, the northern auroral zone was much (6 to 7 times) brighter than the southern zone. The North Polar Hot Spot disappeared during the impacts and reappeared on July 28.

OVERVIEW OF OBSERVATIONS OF THE IMPACTS

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To attempt an overview of the worldwide scientific results only a month after an unprecedented event and before any results have been published is foolhardy. Nevertheless, the remarkable willingness of observers to transmit their results electronically to the wide community of other observers both indicates a revolution in scientific cooperation and makes it possible to attempt an overview at a very early stage.

The first remarkable result is that there are no confirmed measurements of impact flashes reflected from the Galilean satellites. While many possible detections were reported, they are all susceptible to either poor signal-to-noise ratio or to interpretation as artifacts, particularly due to variations in the scattered light from Jupiter. It is now clear that the reflected flashes were faint and that any satisfactory claims of detection will require simultaneous detections at more than one site.

The observations from HST show unambiguously that solid particles are present in the plume above the site very soon after the impact since the shadow of Jupiter is seen on the plume, indicating that the plume is reflecting sunlight. This requires rapid recondensation of solids (within a few minutes of the eruption of the fireball) unless a way is found to preserve solid cometary material in the fireball without totally vaporizing it.

Observations from the Galileo spacecraft show outbursts for several fragments which last a bit less than a minute, with a very sharp rise and a somewhat slower decline. It is unclear whether these are observations of the bolide entering the atmosphere, the subsequent fireball rising in the atmosphere, or some combination of the two. Comparison of timing for fragment H between Galileo and Calar Alto yields a delay that is too short to be consistent with both a Galileo observation of the bolide and the upward velocities obtained in some simulations of the fireball.

The most dramatic Earth-based detections are in the infrared where the brightness was sufficient to saturate detectors on some telescopes. The emission is largely thermal emission, rather than reflected sunlight. Light curves for different events are quite dissimilar but this is due in large part to the varying geometry, with later impacts occurring successively closer to the limb. In the infrared, the excess emission persists indicating that there is a component of reflected sunlight which lasts much longer than the thermal emission.

The most dramatic chemical result is the second astronomical detection of S_2 and in an amount comparable to all the sulfur in a 1 km cometary nucleus. This suggests that fragment G penetrated to the clouds of NH_4SH and dredged up considerable sulfur from the Jovian troposphere. Other species have been detected, including H_2O, CO, CH_4, NH_3 and so on but it is too early to completely separate the temperature from the abundance or to determine unambiguously the source of the material.

Auroral studies showed dramatic effects in the opposite hemisphere, both in the auroral zone and at the northern magnetic footpoint corresponding to the impact site in the southern hemisphere. There was also a significant increase in the magnetospheric emission during the week of impacts although there are not any clear bursts associated with individual impacts.