AOGS 2005

The Deep Impact Mission

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Comet nuclei are the least processed remnants of our solar system's formation. Their chemical and microphysical properties can provide boundary conditions on solar system formation models, and delivery of pre-biotic material to the planets and satellites. However, comet observations typically sample only the heaviliy altered upper layers of the nucleus, which through thermal processing, and high energy bombardment, no longer retain their primordial character. The Deep Impact mission, NASA's eight Discovery mission, will be the first to explore the interior of a cometary nucleus, delivering a 360kg impactor at 10.2km/s into the nucleus of comet 9P/Tempel 1 on 4 July 2005 at 6:10 UT. The impact will excavate a 25m-deep crater approximately 200m in diameter and release the same amount of material into the coma that would normally be released in a week. A plausible scenario is that Deep Impact will create a new active area, of roughly 10,000 square meters, which remains active for weeks or months after the impact. The flyby spacecraft will take images and near-IR spectra in an 800s window before flying past the nucleus. Observations from the ground and from LEO will provide important complements to the observations from the flyby spacecraft.

Prior to the selection of the comet 9P Tempel 1 as the Deep Impact mission target, the comet was not well-observed. From 1999 through the present there has been an intensive world-wide observing campaign designed to obtain mission critical information about the target nucleus, including the nucleus size, albedo, rotation rate, rotation state, phase function, and the development of the dust and gas coma. The Deep Impact mission is unique in that part of the mission observations will rely on an Earth-based (ground and orbital) suite of complementary observations of the comet just prior to impact and in the weeks following the impact as new activity develops. We will summarize the pre-impact nucleus characterization, and mission status in this talk, and discuss the unprecedented world-wide observing coordination.