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Physico-Chemical Models of Comet 9P/Tempel 1

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To successfully interpret observations of cometary comae, relevant physico-chemical processes must be identified to provide the framework for understanding comets and inferring their composition. Analyses of observations and in situ measurements of recent comets have provided valuable insights into the intrinsic properties of their nuclei and the important physical and chemical processes that occur in their comae but many questions remain unresolved. On 4 July 2005, NASA's Deep Impact (DI) spacecraft successfully encountered comet 9P/Tempel 1, adding to our knowledge base concerning comets. We discuss an initial modeling effort as applied to the DI encounter of 9P/Tempel 1, detailing important physico-chemical processes, i.e., thermodynamics, photo- and gas-phase chemistry, interactions between gaseous species and dust, role of electrons in the coma, optical depth effects and issues related to radiative transfer within the coma, and other topics, concentrating on the collision-dominated inner coma. Where available and appropriate, the latest observational results from the DI campaign are provided with comparisons to previous comet missions and theoretical models.