# Cometary Atmospheres

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Comets are icy leftovers from the formation of the solar system about 4.5 billion years ago. Because they have been stored at cold temperatures and their interiors have been protected by an overburden of insulating layers, comets contain the most unaltered remnants from the birth of our solar system. For this reason, determining their chemical composition and physical properties as well as how the composition and structure of the nucleus changes with time are fundamental problems in planetary science. This information provides clues as to how material in our solar system formed and evolved.

Direct study of the composition and structure of the cometary nucleus is generally not possible other than for the few targets of spacecraft missions. Therefore, most of the information obtained about the overall comet population comes from remote observations of their comae. There is a broad area of fundamental research enabled by the NASA Planetary Atmospheres Program. These include: (1) Determining the composition of volatile species in the coma through the analysis of spectroscopic and photometric data. (2) Determining the coma morphology through the analysis of coma images. (3) Theoretical modeling of coma phenomena that includes relating the coma chemistry and evolution to the composition of the nucleus, relating coma morphology to the mechanisms for the release of materials and the physical evolution of the comet nucleus, and determining how the coma and the solar radiation field interact. (4) Laboratory studies of cometary analogs. These areas of research are enabled by a growing database of comet observations improving our understanding of cometary coma processes.