Preface to the special section: Space Simulations in Laboratory: Experiments, Instrumentation, and Modeling

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[1] Space simulation experiments are performed in several laboratories around the world. The main objective of these activities is the study of materials analogous to those thought to be present in various space environments, from our solar system to the interstellar medium. In recent years, experiments have been performed under simulated space conditions to reproduce not only material properties but also their behavior under a variety of environmental conditions.

[2] Analog samples are usually produced in laboratory by a variety of techniques, subjected to a variety of space environments and processes, and then analyzed to determine physical, chemical, and structural properties. Such an approach offers the possibility of gaining information about formation and evolution mechanisms active in space and their efficiency in determining actual space material properties.

[3] The evolution of analog materials is monitored by simulating the major processes that are expected to be active in space, such as thermal annealing, ultraviolet irradiation, ion bombardment, and gas-solid interactions. Quantitative measurements provide information on the sensitivity of species to processes active in space and about the modification of materials under the local environmental conditions.

[4] In the context of solar system exploration a fundamental contribution comes from the laboratory analysis of samples of natural extraterrestrial origin collected on Earth or in its neighbors. This is the case for meteorites and interplanetary dust particles, which are believed to be fragments of comets, asteroids, and, perhaps, planets (Mars, in particular). Thus the application of macroscale and microscale investigations on such samples can help to understand the geological, chemical, and physical properties of solar system bodies.

[5] Results of this approach summarized above enable the interpretation of observational data coming from telescopes and remote and in situ space experiments. Identifying the properties and tracing the evolution of compounds may tell us the past history and present status of the solar system and shed light on the different behavior of planetary bodies and interplanetary medium.

[6] However, the role of the laboratory is even wider, as it is the place where instruments for present and future solar system missions are calibrated, validated, and better understood. These steps are of paramount importance to the production of experiments capable of providing quantitative and scientifically meaningful data during operations in space. Such work also requires the use of laboratory facilities where space conditions can be simulated. Experimental installations appropriate to various scales (from large to small chambers) are available in laboratories around the world to provide proper conditions for the thorough characterization of instrument performance.

[7] The selection of papers collected in this present special section of *Journal of Geophysical Research–Planets* is an example of these considerations. We have collected work concerning laboratory experiments on cosmic analogues, laboratory experiments on meteorites, and space instrument testing, calibration, and data analysis. This series originated with the session on "Space simulations in laboratory: Experiments, instrumentation and modeling" held at the EGS-AGU-EUG Joint Assembly in Nice, France, on 6–11 April 2003. We believe

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that the ''laboratory'' is a place where big science with a strong interdisciplinary character can be performed, whether it concerns astrophysics or planetology. Laboratory simulation studies represent a prime example of the synergy between science and technology.

[8] In order to fully realize the value of such synergistic efforts, special sessions and special journal issues are essential. In this way it is possible to demonstrate how important laboratory work is and what new perspectives it offers to us all, especially our younger researchers.

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