OSIRIS-REx sample return space mission exploring primitive carbonaceous asteroid Bennu: Spectroscopy of laboratory analogs to understand data from an astrobiology-relevant target

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Abstract

OSIRIS-REx is a NASA sample return space mission with the ambitious goal of collecting a pristine sample of regolith from the surface of (101955) Bennu, a primitive carbonaceous near-Earth asteroid (NEA).
Asteroids, in particular those orbiting near Earth, are thought to be the transfer vehicle of complex organic molecules from the protoplanetary disk towards terrestrial planets. The rocky surfaces of small bodies could also be the sites for increasing the chemical complexity with mineral-catalysed reactions of more simple molecules formed in gas phase. For all these reasons, having a sample of a carbonaceous asteroid available on Earth will increase our knowledge enormously in this field. Sample is expected to be returned to Earth in 2023. The spacecraft is currently surveying Bennu's surface. The mission team is investigating the chemical and geological composition and dynamics of this primitive asteroid, improving our knowledge of the role of NEAs in the context of origin of life on Earth.
While the instrument suite of the spacecraft is collecting data from Bennu, simulated environments in the laboratory are still one of the most powerful tools to interpret data coming to Earth. Bennu's surface in particular is subjected to a variety of process that increase the difficulties in data interpretation: as a result of space weathering and thermal variation due to the solar irradiation, minerals and possible organics on the surface are changing through

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time. We will show results obtained in our laboratory at INAF – Astrophysical Observatory of Arcetri on analogs mineral samples and meteorites on thermal modification of infrared spectra. Our results show substantive reversible changes in spectral features observed in reflectance. Changes affect different spectral properties such as peak position and band area, with a similar trend for all the samples analysed. We will compare laboratory results with data collected by the visible and near infrared spectrometer OVIRS and thermal infrared spectrometer OTES on board the OSIRIS-REx spacecraft.

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