IAF SPACE EXPLORATION SYMPOSIUM (A3)
Small Bodies Missions and Technologies (Part 2) (4B)

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THE EMIRATES MISSION TO THE ASTEROID BELT: SCIENCE OVERVIEW

Abstract

The Emirates Mission to the Asteroid belt (EMA) is a main belt asteroid tour planned for launch in 2028. Six asteroid flybys will be followed by a rendezvous with (269) Justitia, a 54-km diameter extremely red object with possible origins in the distant solar system. Among the flyby targets are (623) Chimaera, the largest remnant of the primitive C-type Chimaera family, and members of the Baptistina, Eos, Erigone, and Euterpe families. Five of the seven targets are C-complex, which form a key piece of the puzzle of early solar system formation and its dynamical evolution. Here, we describe the overall science goals of the mission and the planned science instruments.

The primary science goal is to probe the origin and evolution of water-rich asteroids, with a focus on three main questions: 1) Where did the volatile-rich asteroids form? 2) Are these asteroids linked to specific meteorites? 3) What does their chemical inventory and volatile abundances tell us about main belt evolution? To answer these questions, the mission will perform science investigations based on the following objectives: A) Determine the geologic history and volatile content of multiple main belt asteroids and investigate the interior structure of the rendezvous target. B) Determine temperatures and thermophysical properties on multiple asteroids to assess their surface evolution and volatile histories. The EMA remote sensing instruments include: 1) Visible color narrow-angle camera (CNAC), 2) Mid-wave infrared spectrometer (MIST-A), 3) Thermal IR spectrometer (EMBIRS), and thermal IR camera (IR-Cam). MIST-A is provided by the Agenzia Spaziale Italiana (ASI) in partnership with the Italian National Institute for Astrophysics (INAF) and Leonardo S.p.A. The CNAC and IR-cam will be provided by Malin Space Science Systems, and EMBIRS will be provided by Northern Arizona University and Arizona State University. The spectral coverage of the multiple infrared instruments is expected to span 2.0 to > 100 μm, providing opportunities for detailed compositional and thermophysical analyses. Visible images with few meters/pixel resolution will be acquired for (269) Justitia, along with thermal infrared images with 10-100 m/pixel resolution.

Acknowledgement: Funding for the Emirates Mission to Explore the Asteroid Belt is provided by the United Arab Emirates Space Agency, in collaboration with its knowledge partner, the Laboratory for Atmospheric and Space Physics at the University of Colorado Boulder.