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Introduction to ”The first-ever lunar–Earth flyby: a unique test environment for Juice” special issue

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The JUpiter ICy moons Explorer (JUICE) Lunar–Earth Gravity Assist (LEGA), performed on 19–20 August 2024, marked a major milestone in the mission’s interplanetary journey towards Jupiter. This first-ever Lunar–Earth gravity-assist sequence, comprising a lunar flyby followed by an Earth flyby, enabled a substantial change in the spacecraft trajectory. The successful execution of this highly complex manoeuvre also demonstrated the robustness of JUICE’s navigation, spacecraft operations, and flight-dynamics capabilities.

Beyond its role as a mission-enabling trajectory manoeuvre, LEGA provided a unique opportunity to operate and characterize the JUICE payload within the well-understood Earth–Moon environment. The encounter enabled instrument teams to exercise observing strategies and operational procedures, assess instrument and spacecraft performance, and acquire scientifically valuable measurements in preparation for the mission’s future investigations of the Jovian system.

The overarching objective of this special issue, “*The first-ever lunar–Earth flyby: a unique test environment for Juice*,” is to provide an integrated account of the scientific, technical, and operational activities associated with the JUICE LEGA. Bringing together results from the JUICE instruments, operation and science teams, the collection documents the scientific return and lessons learned from this unprecedented encounter and their relevance to JUICE’s future exploration of Jupiter and its icy moons.

We invite the reader to explore the collection and discover the diversity of investigations enabled by LEGA, from the scientific observations acquired during the encounter to the technical and operational insights gained along the way.

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