

## Composition of asteroid 84 Klio with NIRSpec/JWST

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Primitive C-complex asteroids, primarily located in the main asteroid belt, are commonly associated with carbonaceous chondrites (CCs) due to their low geometric albedo (typically  $p_v < 10\%$ ) and similar spectral shape [e.g. 1]. The presence of hydrated minerals and organics in CCs attests to the accretion of volatiles by their parent body in the early solar system. These volatiles subsequently evolved through secondary processes, such as aqueous alteration. Thus, primitive asteroids are key witnesses for tracing the distribution and evolution of volatiles since solar system formation, as well as the role of primitive asteroids in Earth's water budget. Low-albedo collisional families of asteroids located in the inner main asteroid belt, between the  $\nu_6$  secular resonance at 2.1 au and the 3:1 mean motion resonance with Jupiter at 2.5 au, are likely the sources of primitive near Earth asteroids (NEAs) and CCs [e.g. 2]. Recently, two space missions, Hayabusa2 (JAXA) and OSIRIS-REx (NASA), collected and returned to Earth samples from two primitive NEAs, Ryugu and Bennu. Laboratory analysis of the samples and their contextualization in relation to primitive asteroids will be key to understanding the evolution of the solar system.

The aim of James Webb Space Telescope (JWST) SAMBA3 program (**S**pectral **A**nalysis of **M**ain **B**elt **A**steroids in the **3**- $\mu$ m region, General Observer program #6384, Cycle 3) led by Driss Takir, is to observe and analyze spectra of nine asteroids from the seven low-albedo and low-inclination ( $i < 10^\circ$ ) inner main belt families (New Polana, Eulalia, Erigone, Sulamitis, Clarissa, Chaldaea and Klio) with the NIRSpec instrument. Primitive asteroids typically present featureless spectra in the 0.5-2.5  $\mu$ m, with the exception of a shallow absorption at 0.7  $\mu$ m attributed to Fe-rich phyllosilicates in some asteroids [3]. On the contrary, several diagnostic spectral features can be observed at wavelengths  $> 2.5$   $\mu$ m in spectra of primitive bodies, such as bands associated also with phyllosilicates at 2.7-2.8  $\mu$ m, water ice around 3.1  $\mu$ m, organics around 3.4  $\mu$ m and carbonates around 3.4 and 3.9  $\mu$ m [e.g. 4, 5, 6]. The inaccessibility of certain wavelengths in the infrared from ground-based observations, due to the atmospheric opacity, makes JWST essential for constraining the composition of primitive asteroids. Here, we aim at analyzing the reflectance spectra of the primitive asteroid (84) Klio, the largest member of the Klio family, with NIRSpec.

The observation of Klio was conducted on July 6, 2024. The data were calibrated using the JWST pipeline. The solar analog P330E (JWST program #1538, led by Karl Gordon) was used to separate the reflected and emitted components of the spectrum. The thermal emission was fitted using the Near-Earth Asteroid Thermal Model (NEATM, [7]), allowing us to estimate Klio's diameter to 78.1 km. We then analyzed the reflectance spectrum in the 2.8, 3.4 and 3.9  $\mu\text{m}$  regions. Different Gaussian fits were used to estimate the peak position and the amplitude of the features. Those spectral parameters give valuable information on the composition, in particular when compared with primitive samples analyzed in the laboratory. We thus compared Klio with reflectance spectra of samples of carbonaceous chondrites from Takir et al. [6,8], Ryugu samples from Pilorget et al. [9] and Bennu samples from Lauretta et al. [10]. We will present the result of this analysis, as well as the interpretation of Klio's composition and the evolution processes undergone by its parent body. In particular, this study revealed significant spectral differences between Klio and the Bennu/Ryugu samples, reinforcing the hypothesis that Klio is an unlikely parent body for the Hayabusa2 and OSIRIS-REx targets.

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