

EXOCASH

Exo-planetary Cloudy Atmospheres and Stellar High energy
(CUP C53D23001100006)

Models, Spectra & Simulations

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This documentation describes the scientific products resulting from **Axis B and Axis C** of the **EXOCASH project**. The materials are organized into three main categories: Modeling, Spectral Synthesis, and mission-specific simulations for Ariel and JWST.

1) Modeling (axis B.1)

We have developed a comprehensive set of atmospheric models for each target in the sample, utilizing three distinct temperature-pressure profiles (pt1, pt2, pt3). The modeling framework incorporates diverse physical assumptions, including:

- **Chemical Equilibrium** scenarios.
- **Non-equilibrium** forcing through two different vertical mixing regimes.
- **Sulfur Chemistry** networks (Axis C.1), including novel ab initio reaction pathways. Detailed plots and summaries of these models are provided in the *EXOCASH_Simulations_Results.pdf* document.

2) Spectral Synthesis (Axis C.2 & B.2)

High-resolution transmission spectra have been synthesized (axis C.2) from the aforementioned models using cross-sections of the most relevant molecular species. For the **pt2** temperature profile and models **M1, M4, and M5**, we have also generated spectra that account for the presence of **particulates and condensates** (Axis B.2), specifically characterizing the chromatic impact of aerosols like forsterite

3) Mission Simulations (Axis C.3)

To evaluate the observability of the modeled effects, simulations have been performed for:

- **Ariel mission:** Using the **ArielRad** code to derive expected uncertainties for Tier 2 observational scenarios.
- **JWST mission:** Using the **PandExo** tool to simulate NIRCcam observations (filters F322W2 and F444W)

In attachment:

- **targetname_modelli:** Folders containing data files with pressure and mixing ratios for 99 molecules, their corresponding ions, and electrons for each profile (**ptX**) and model (**mody**). Naming convention: *targetname_mody_ptX.dat*. These folders also include files detailing the pressure and number density of various types of condensates
- **targetname_spettri:** Folders including the synthesized transmission spectra for the "clear sky" models and the specific condensate-inclusive models (**mod1, 4, 5**) under the **pt2** profile.

- **EXOCASH_Simulations_Results.pdf**: A comprehensive summary document containing integrated plots of the atmospheric models, synthesized spectra, and mission-specific simulations for both Ariel and JWST

The methodologies and results described herein are detailed in the following project publications and papers in preparation:

Amodeo et al. (2025);
Aresu et al. (in prep.);
La Mura et al. (2026);
Locci et al. (in prep.);
Mrazikova et al. (2024);
Torre et al. (2024).