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Ariel Phase B

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Ariel was selected as the fourth medium-class mission in ESA's Cosmic Vision programme in the spring 2018. This paper provides an overall summary of the science and baseline design derived during the phase A and consolidated during the phase B1.

During its 4-year mission, Ariel will study what exoplanets are made of, how they formed and how they evolve, by surveying a diverse sample of about 1000 extrasolar planets, simultaneously in visible and infrared wavelengths. It is the first mission dedicated to measuring the chemical composition and thermal structures of hundreds of transiting exoplanets, enabling planetary science far beyond the boundaries of the Solar System.

Transit, eclipse and phase-curve spectroscopy means that no angular resolution is required. The satellite is best placed into an L2 orbit to maximise the thermal stability and the field of regard. Detailed performance studies have demonstrated that the current mission design will achieve the necessary precision to observe all the Ariel target candidates within the mission lifetime.

The baseline integrated payload consists of 1-metre class, all-aluminium, off-axis Cassegrain telescope, feeding a collimated beam into two separate instrument modules. A combined Fine Guidance System / VIS-Photometer / NIR-Spectrometer contains 3 channels of photometry between 0.50 μm and 1.1 μm, of which two will also be used as a redundant system for provided guidance and closed-loop control to the AOCS. One further low resolution (R = ~15 spectrometer in the 1.1 μm – 1.95 μm waveband is also accommodated here. The other instrument module, the ARIEL IR Spectrometer (AIRS), provides spectral resolutions of between 30 – 100 for a waveband between 1.95 μm and 7.8 μm. The payload module is passively cooled to ~55 K by isolation from the spacecraft bus via a series of V-Groove radiators; the detectors for the AIRS are the only items that require active cooling to <42 K via an active Ne JT cooler.

The Ariel mission payload is developed by a consortium of more than 50 institutes from 17 ESA countries, which include the UK, France, Italy, Poland, Spain, Belgium, the Netherlands, Austria, Denmark, Ireland, Czech Republic, Hungary, Portugal, Norway, Estonia, Germany and Sweden. A NASA contribution was approved in November 2019.

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