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ARIEL – The Atmospheric Remote-sensing Infrared Exoplanet Large-Survey

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Abstract

More than 1,000 extrasolar systems have been discovered, hosting nearly 2,000 exoplanets. Ongoing and planned ESA and NASA missions from space such as GAIA, Cheops, PLATO, K2 and TESS, plus ground based surveys, will increase the number of known systems to tens of thousands.

Of all these exoplanets we know very little; i.e. their orbital data and, for some of these, their physical parameters such as their size and mass. In the past decade, pioneering results have been obtained using transit spectroscopy with Hubble, Spitzer and ground-based facilities, enabling the detection of a few of the most abundant ionic, atomic and molecular species and to constrain the planet's thermal structure. Future general purpose facilities with large collecting areas will allow the acquisition of better exoplanet spectra, compared to the currently available, especially from fainter targets. A few tens of planets will be observed with JWST and E-ELT in great detail.

A breakthrough in our understanding of planet formation and evolution mechanisms will only happen through the observation of the planetary bulk and atmospheric composition of a statistically large sample of planets. This requires conducting spectroscopic observations covering simultaneously a broad spectral region from the visible to the mid-IR. It also requires a dedicated space mission with the necessary photometric stability to perform these challenging measurements and sufficient agility to observe multiple times ~500 exoplanets over 3.5 years.

The ESA Cosmic Vision M4 mission candidate ARIEL is designed to accomplish this goal and will provide a complete, statistically significant sample of gas-giants, Neptunes and super-Earths with temperatures hotter than 600K, as these types of planets will allow direct observation of their bulk properties, enabling us to constrain models of planet formation and evolution.

The ARIEL consortium currently includes academic institutes and industry from eleven countries in Europe; the consortium is open and invites new contributions and collaborations.