Towards a new era in giant exoplanet characterisation

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Determining the composition of giant exoplanets is crucial for understanding their origin and evolution. However, the planetary bulk composition is not measured directly but must be deduced from a combination of mass-radius measurements, knowledge of the planetary age and evolution simulations. Accurate determinations of stellar ages, mass-radius, and atmospheric compositions from upcoming missions can significantly improve the determination of the heavy-element mass in giant planets. In this talk, we first demonstrate the importance of an accurate age measurement, as expected from Plato, in constraining the planetary properties. Well-determined stellar ages can reduce the bulk-metallicity uncertainty up to about a factor of two. We next infer the bulk metallicity of warm giants from the Ariel mission reference sample and identify the Ariel high-priority targets for which a measured atmospheric metallicity can clearly break the degeneracy in the inferred composition. We show that a knowledge of the atmospheric metallicity can broadly reduce the bulk-metallicity uncertainty by a factor of four to eight. We conclude that the accurate age determination from Plato and atmospheric measurements by Ariel and the James Webb Space Telescope will play a key role in revealing the composition of giant exoplanets.