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Retrieving stellar parameters and dynamics of AGB stars with Gaia parallax measurements and radiative hydrodynamics simulations

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Asymptotic Giant Branch (AGB) undergo complex dynamics, including convection, pulsation and shockwaves. These processes trigger strong stellar winds, enriching the interstellar medium with various elements, and impact astronomical measurements, amplifying uncertainties in the determination of fundamental stellar parameters. Gaia Data Release 3 provides the parallax for about 2 million variable stars, including Mira stars showing extreme magnitude variations. Convection results in bright surface asymmetries and photocentre variability in the Gaia G band. Observations and three-dimensional radiative-hydrodynamics (RHD) simulations of stellar convection computed with CO5BOLD showed that convection substantially accounts for the parallax uncertainty measured by Gaia.
I will present AGB RHD simulations covering a large enough set of stellar parameters and derive analytical laws to retrieve the surface gravity, the radius, the temperature, and the pulsation period using the Gaia parallax uncertainty thanks to the use of photocentre variability of RHD simulations. The objective is to provide a systematic and statistical approach for quantitatively determining stellar parameters of AGB stars.

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