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Multiwavelength Variability in Nearby Evolved Stars

Tuesday 11 June 2024 09:00 (20 minutes)

I will present results from our recent work on collecting and analysing multiwavelength light curves for targets from the Nearby Evolved Stars Survey (NESS; Scicluna et al. 2022). The NESS collaboration is studying ≈800 asymptotic giant branch (AGB) and red supergiant (RSG) stars in the Solar Neighbourhood (d $lesssim$ 3 kpc) in order to obtain a robust understanding of the mass-loss process and its connection to the content, distribution, and properties of the circumstellar gas and dust. These nearby, bright AGB/RSG stars are long-period pulsators for which variability data exists in many all-sky surveys across a large range of wavelengths. A systematic study of multiwavelength light curves is required to connect photospheric variability to changes in the circumstellar emission. We have performed such a study for the first time for a large, nearby sample of evolved stars by combining light curves in over 20 photometric filters from optical, near-infrared, and mid-infrared surveys resulting more than 5000 light curves for over 700 NESS targets.

We extract periods, amplitudes, and mean magnitudes from these light curves using the Python Gaussian processes for MUltiwavelength Variability Inference (PGMUVI; Scicluna et al. 2023) code. We reproduce the general trends seen in the literature between these parameters and with other properties such as mass-loss rates. Our analysis provides robust constraints on the properties of evolved stars in the Solar Neighbourhood –previous studies have typically either focussed on small samples or a narrower range of wavelengths.

A small fraction (~5%) of the AGB stellar population dominates (>75%) the dust production in nearby galaxies. Of these, the dustiest can only be detected at near- and mid-infrared wavelengths; however, in the absence of mid-infrared spectra, they are impossible to distinguish from young stellar objects. One application of our work is the analysis of mid-infrared light curves for identifying such stars, which might reveal extreme carbon stars and/or massive AGB/super-AGB candidates in nearby galaxies. I will discuss one such interesting sample.

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