

Many faces of Blazhko modulation observed from space



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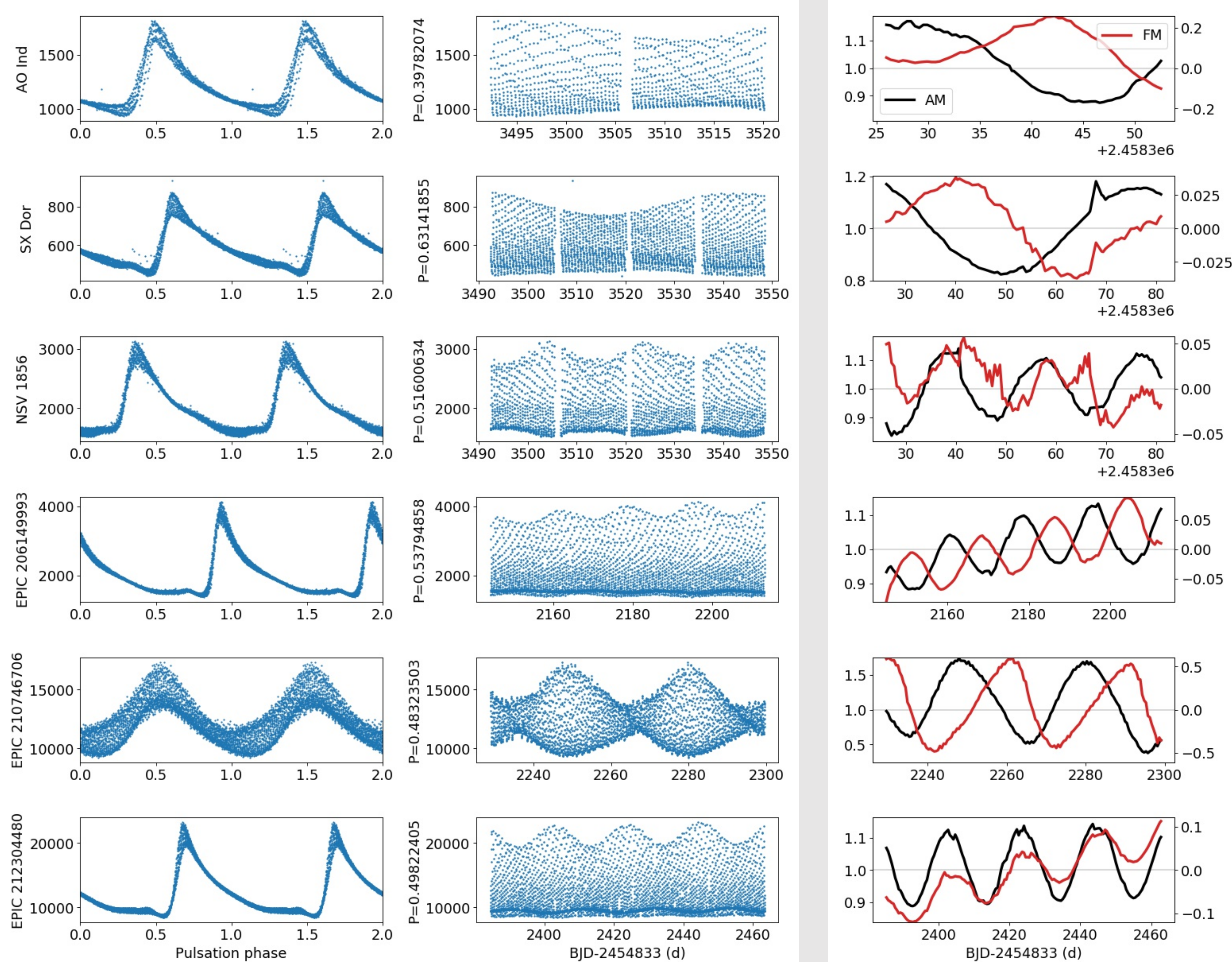
Abstract

The K2 and the TESS missions provide an unique opportunity to investigate the phenomenon of the Blazhko effect in great detail. Here we present the analysis of nearly two hundred Blazhko stars that represent the largest sample of modulated RR Lyrae stars investigated with space-based photometry so far. We focus on the relation between the modulation of the pulsation phase and the pulsation amplitude, as well as the coexistence of the Blazhko effect with the nonlinear phenomenon called period doubling. Given the limited length of observations, we were able to determine only relatively short modulation periods accurately. Nevertheless, we show that the pulsation amplitude and phase changes are not necessarily correlated and their relation can be rather complex.

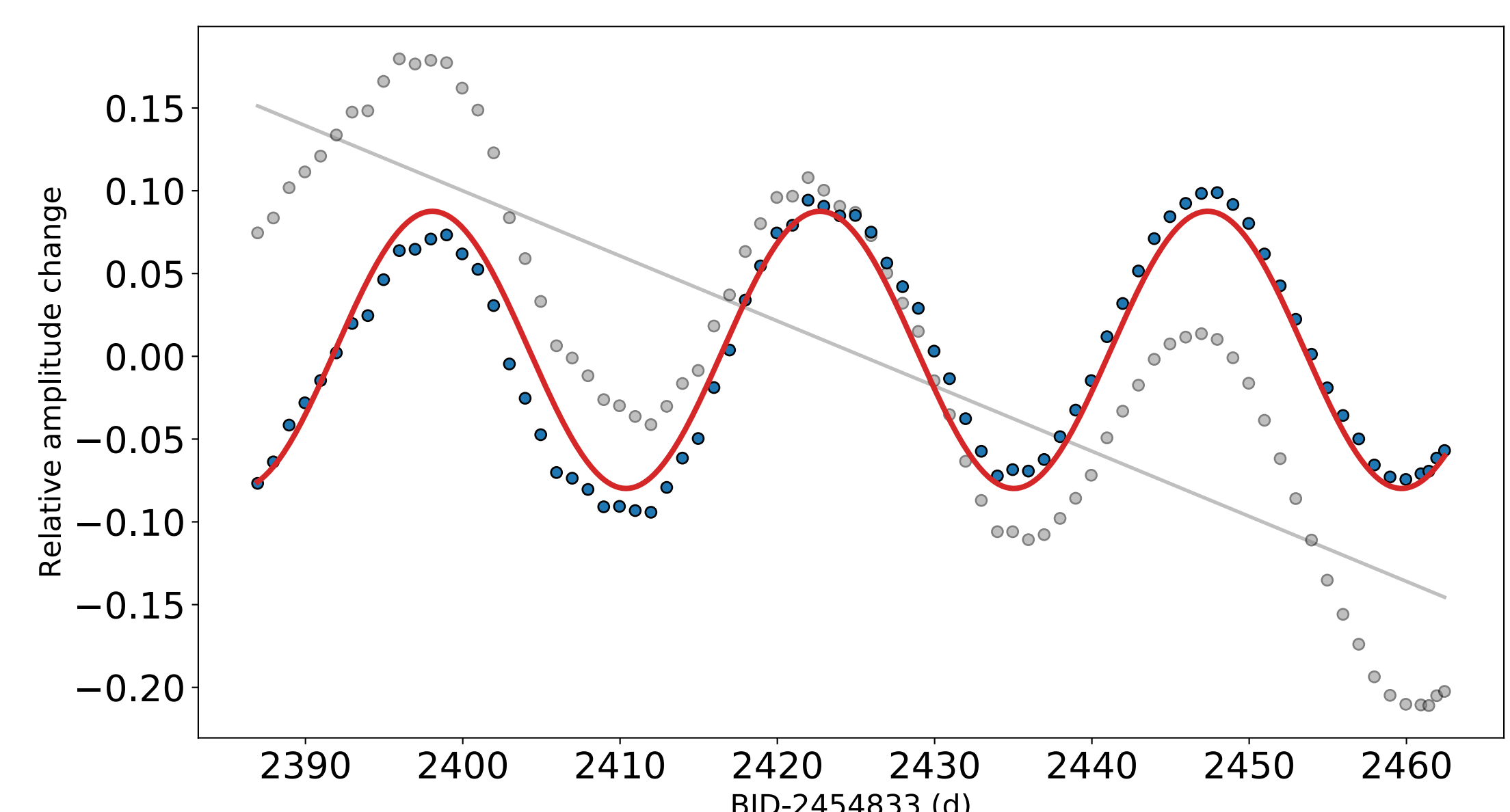
Methods

- We generated K2 light curves using Extended Aperture Photometry (Plachy+ 2019)
- We applied aperture photometry on TESS data using the fitsh code (Pál+ 2012)
- We fitted templates to the light curves to calculate amplitude and phase variations (O–C curves)
- We used both classical methods and Monte-Carlo based sine wave fitting for period analysis

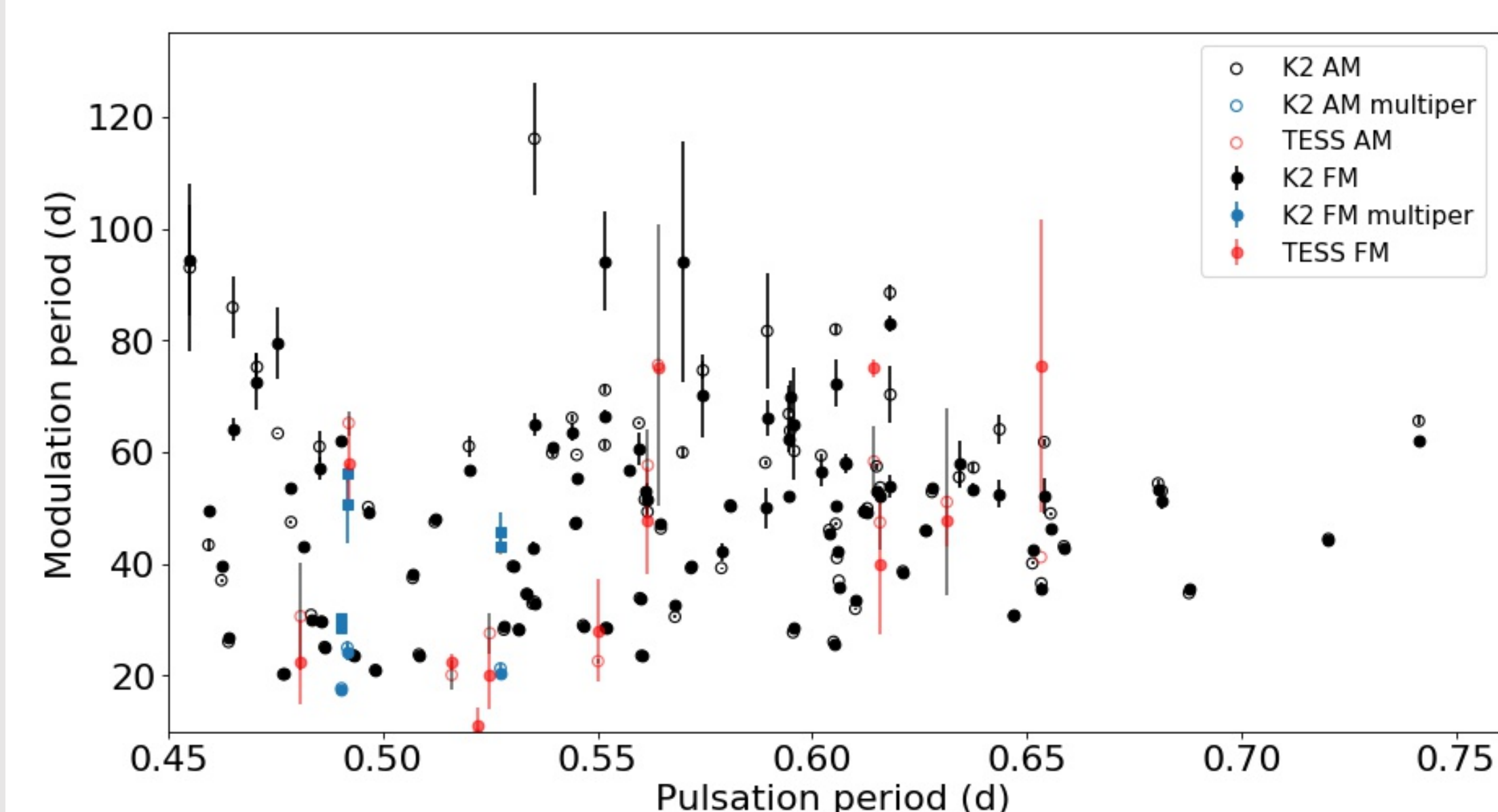
Gallery of phase curves (left), light curves (middle) and amplitude-phase modulations



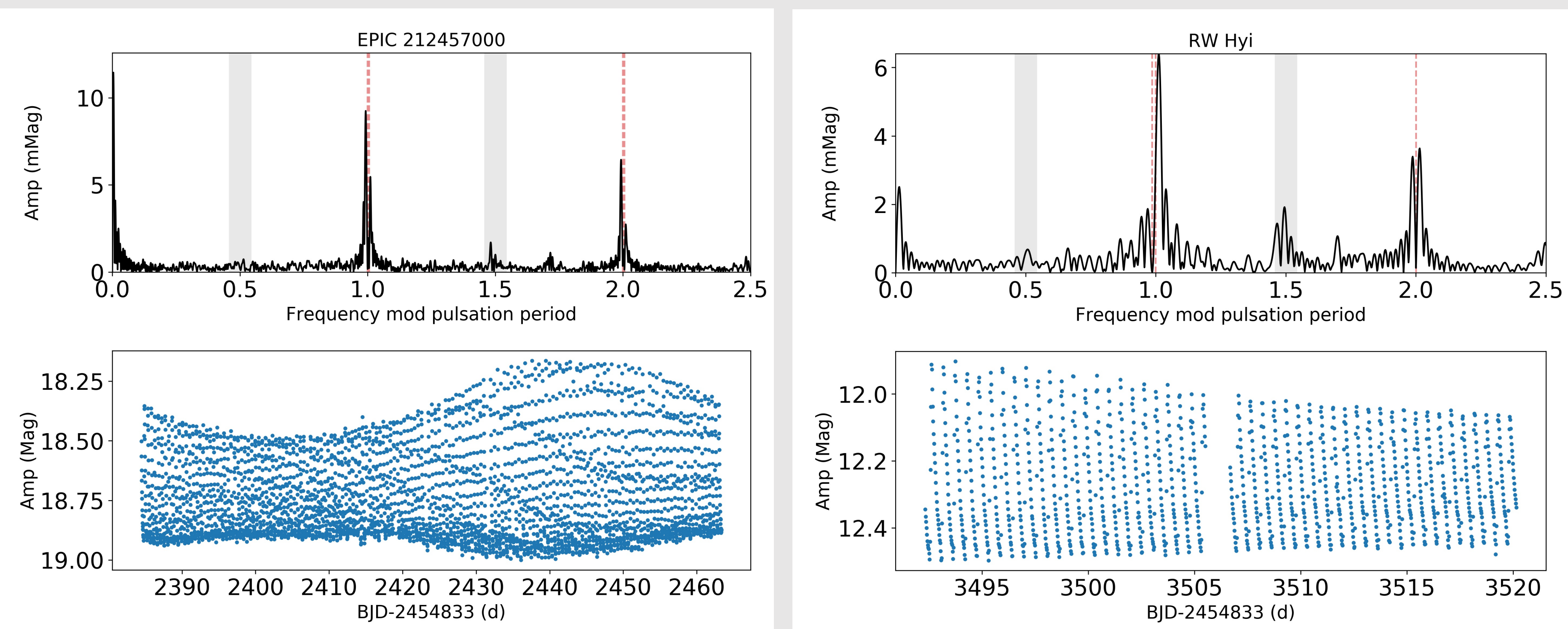
O-C fitting procedure: after a linear fit (gray), a sine is fitted to the residual



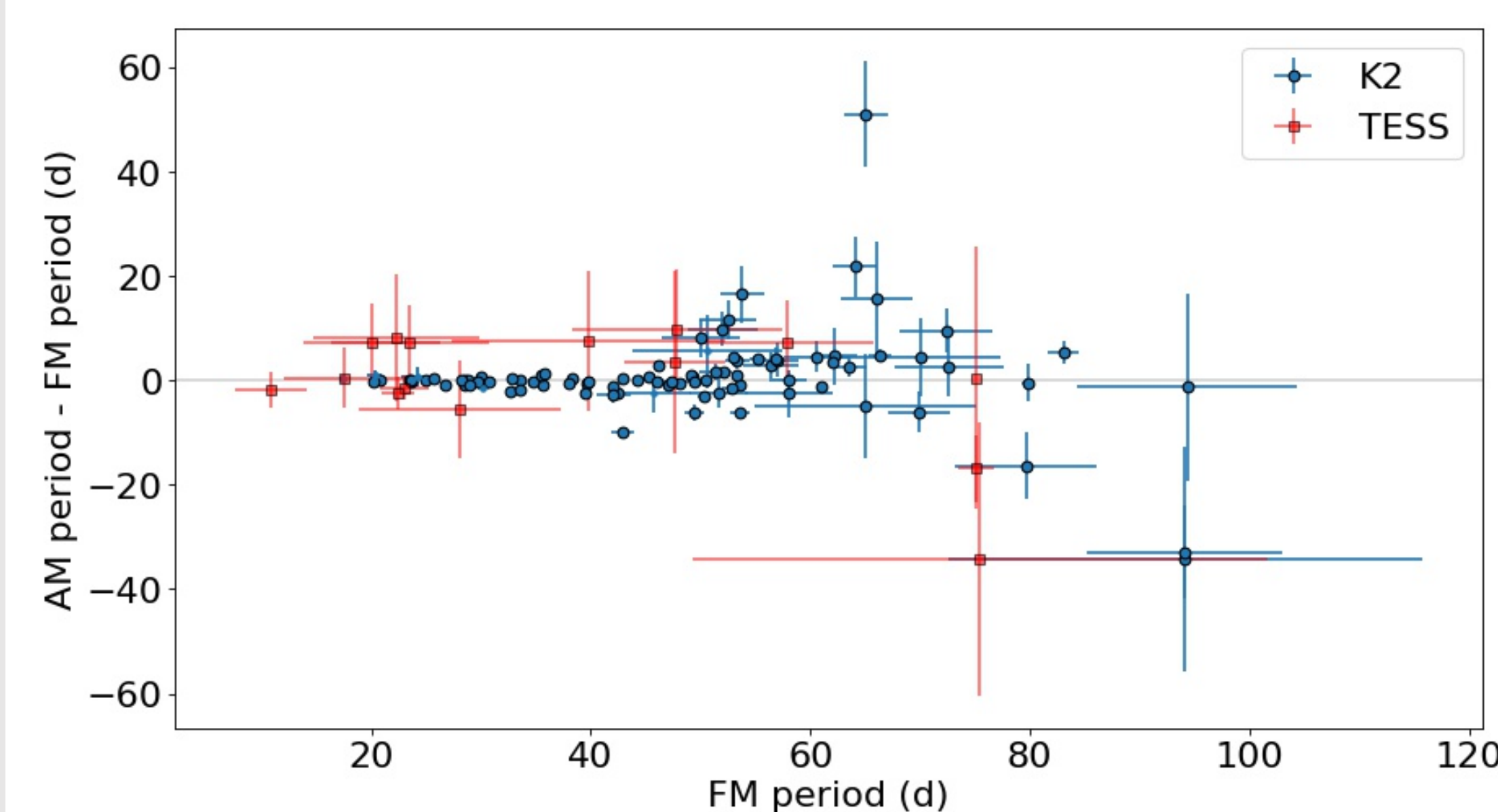
Amplitude (AM) and phase modulation (FM) period as a function of the pulsation period



Top: Fourier-spectra where sub-harmonics are present. Bottom: corresponding light curves



Difference between the period of amplitude (AM) and phase modulation (FM) versus phase modulation period



Conclusions

We found that...

- out of 462 stars, 191 (41 %) show Blazhko modulation
- ~8 % of modulated stars shows subharmonics in their Fourier-spectra
- there is a difference between period of amplitude and phase modulation above ~55 days modulation period

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