Why Galaxies Care About AGB Stars:
A Continuing Challenge through Cosmic Time
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Kepler K2: A Search for Very Red Stellar Objects

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Abstract. Analyzing 41 targets data of the *Kepler* K2 Campaign 2 mission suspected to be Long Period Variables (LPVs), we developed a method for the prediction of periods longer than the observation period of 77.48d using the 3500 data points provided by K2. The 'Self-Flat-Field' method (K2SFF or SFF) of the '*Kepler* K2 High Level Science Product' (K2HLSP) corrected the instrumental effects best.

Keywords. stars: AGB and post-AGB, methods: data analysis, stars: variables: other

1. *Kepler* light curves of LPVs

The analysis of *Kepler* light curves of long period variables forms a particular challenge, because the period lengths typically exceed the observed time window significantly. On the other hand, the parts of the light change available is of such high sampling and accuracy that we attempt to derive reliable period estimates from these 2.5 months coverages. For this, we applied an RMS-error minimization using sinusoidal fits to the SFF data. An illustration from C0 is presented in Figure 1a, below.

2. Sinusoidal fits of the light curves

In the meantime, we have several candidates for testing our method, four of them are shown in Figure 2 with the light curve simulations on the left and the errors as a function of period on the right. For EP 202070273 we derive a long period of 763.3d in excellent agreement with the ASAS result of 730.0d. Example 4 shows a clear primary period of 24.9d, for the second period we get 276.3d or higher. Using a three terms sinusoidal function, as shown in Figure 1b, we constrain the second period to 353.2d.

3. *Kepler* C2 sinusoidal fits vs. ASAS

In our C2 sample we have nine stars with known ASAS periods >90d, Table 1. We use these objects to test and optimize our method. The plots of Figure 3 show the TPD and SFF LCs (left), the artificial LCs fit to the SFF (mid) and the error trend with the error bar and the ASAS period mark (right). Typically the ASAS period is close to the fit of the third local error period (marked S3), which is in 6 cases close to the period of the rms-error minimum. The ASAS period can be approximated by 86.5 % of the S3 period with a standard deviation σ of 0.83, except for AT Sco, EP 202913758.

Table 1. K2-C2, the properties of the 10 candidates, the sinusoidal rms-minimum, and the sinusoidal results compared with the ASAS periods.

C2-EP	Name	Type	Jmag	Kmag	Kpmag	SFF Sinusoidal		ASAS
						rms-min[d]	Result[d]	[d]
202913758	AT Sco	Mi	8.666	7.249	8.666	450.3	275.4	130.1
203529462	BQ Sco	Mi?	8.512	6.930	8.512	290.5	290.5	217.9
203748709	BW Sco	Mi	6.381	4.652	10.685	180.8	180.8	115.2
203763661	UZ Sco	Or	7.119	5.539	7.119	90.1	289.2	276.1
203785618	GSC 06797-00345	Star	6.648	5.209	12.039	754.6	286.5	335.
203795904	DI Sco	Mi?	8.679	7.227	8.679	367.8	272.9	197.5
204122147	TY Sco	MiCet	7.112	5.591	7.112	283.1	283.1	291.
204443100	TU Oph	Mi	8.464	6.985	12.044	293.2	293.2	246.
205087771	RR Oph	MiCet	4.533	2.510	8.829	366.9	366.9	299.
205240599	V1158 Sco	LP	8.254	6.815	8.254	449.7	449.7	LC only

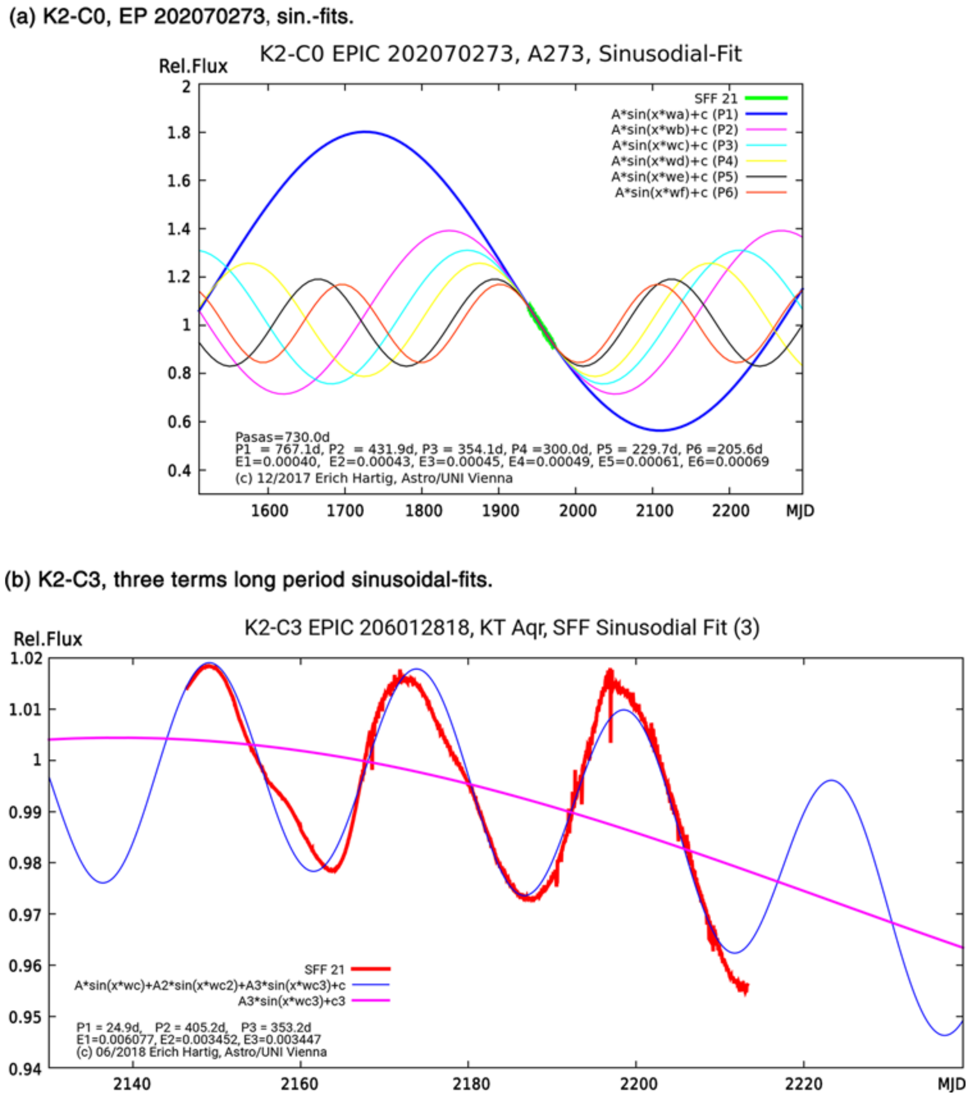

Figure 1. *Kepler*-K2 light curve samples.

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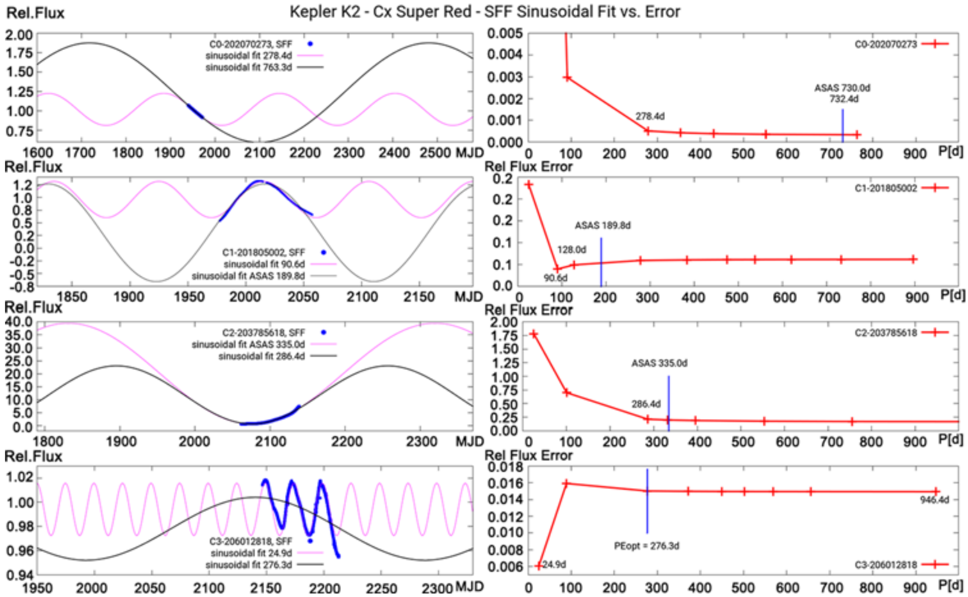

Figure 2. C0-C3, four samples of sinusoidal-fits and rms-errors.

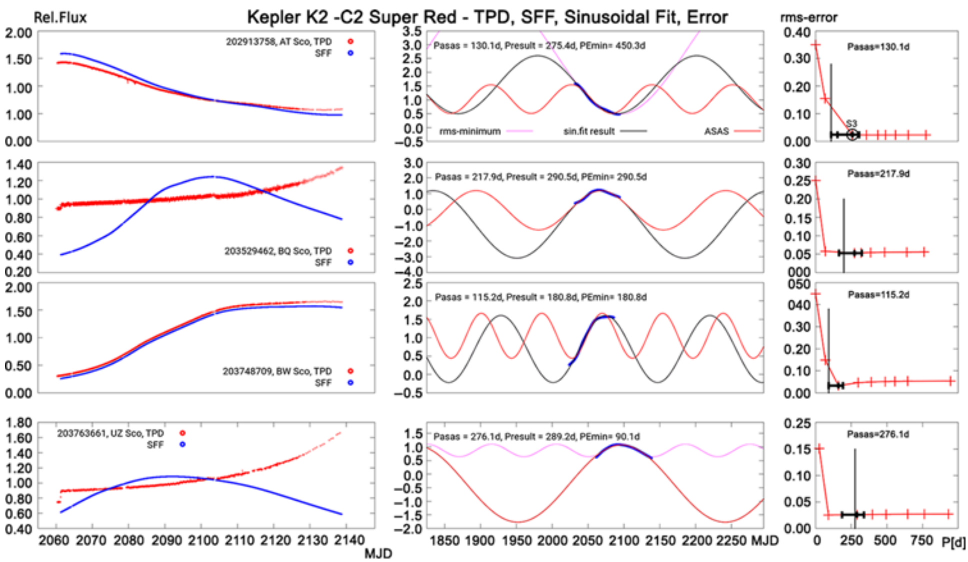

Figure 3. K2-C2, sinusoidal-fits samples, the rms-errors and the ASAS periods.

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