AAVSO "PEP" Photometry of the Great Dimming of Betelgeuse

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Abstract Observers most commonly use imagers to gather Johnson/Cousins photometry, but cameras have a difficult time with stars as bright as alpha Orionis. Superior results are obtainable with single-channel photometers in the old-school technique known as PEP. We review such data in UBVRIJH from 2019-2020.

The Great Dimming of Betelgeuse caused much popular excitement, inspiring many AAVSO observers to follow the star. While the collected results were somewhat mixed (figure 1), data from the photoelectric photometry group[3] came out very clean (figure 2).
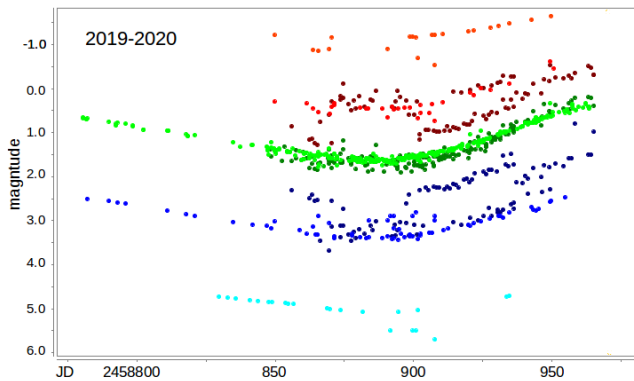

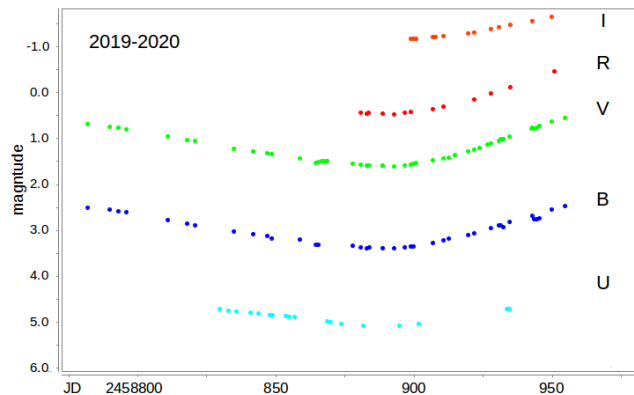Figure 1: All optical photometry, 22 Oct 2019-25 Apr 2020.

Figure 2: PEP UBVRI. Note how U band had a more shallow approach to minimum than B band.

One observer (CTOA) gathered a considerable number of paired BV observations, permitting construction of a homogeneous B-V light curve (figure 3). This curve can be contrasted against the same CTOA curve for the prior season. Both peaked at minimum light, but 2019-2020 showed more reddening as the star brightened.
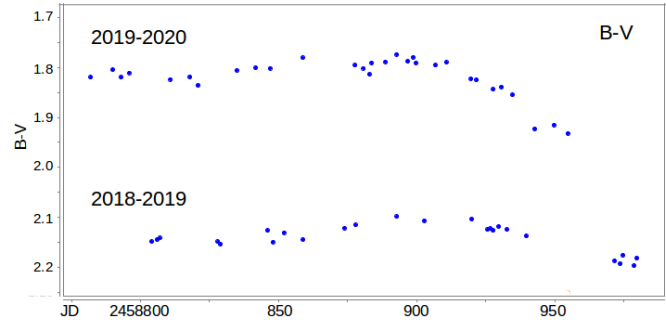

Figure 3: PEP B-V in two seasons. The 2018-2019 trace is shifted +0.3 and its maximum aligned with date of maximum in 2019-2020.

The AAVSO PEP group has JH photometers suitable for very bright stars. An increase in infra-red flux could have been expected if more dust had formed around Betelgeuse. However, our primary near-IR observer (PGD) saw a slight *decrease* in JH, aligned with the optical minimum.
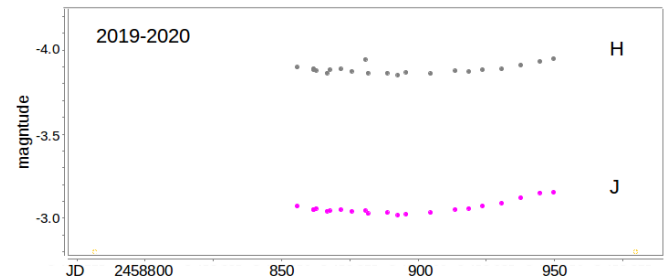

Figure 4: PEP JH.

We hope that this photometry will prove helpful for interpreting the extraordinary variations of Betelgeuse last year. When viewing light curves on the AAVSO website[4], PEP data can be identified by clicking on individual observations. A pop-up then appears with details (figure 5).

Name	ALF ORI
JD	2459232.7032
UTC	2021/01/18 04:52:36
Magnitude	0.614
Uncertainty	0.002
Band	V
Obstype	PEP

Figure 5: Excerpt of information box.

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2   American Association of Variable Star Observers
3   https://www.aavso.org/aavso-photoelectric-photometry-pep-section
4   https://www.aavso.org/LCGv2