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Betelgeuse: Twinkle, Twinkle Bright Red Star How We Wonder What You Are?

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Betelgeuse (alpha Ori; M2-M4Iab) is the brightest red supergiant (RSG) and (probable) core-collapse supernova (SN) progenitor. In <105-yrs. Betelgeuse should explode and shine nearly as bright as the full moon. Last year Betelgeuse underwent an unprecedented dimming, decreasing in brightness by more than 50% (~1.0 mag) by Feb-2020. This notorious “Great Dimming” caught the attention of astronomers and the public as a possible harbinger of an impending supernova. But no such luck! However, this surprising behavior stimulated many studies using a wide variety of instruments & techniques covering X-ray to radio wavelengths.

We discuss the analysis of ~180-yrs. of photometry from its discovery as a variable star by Sir John Herschel in 1837 up to now. The *Period Analysis Software (Peranso-3)* package [with the CLEANest and Wavelet (WWZ) programs] were used to study the “periods”. The early observations of Herschel, Argelander, Baxendell and others were included along with those from BAA-VSS, and over 40,000 observations from AAVSO observers. We also studied the high-precision V and TiO/Near-IR photometry of Wasatonic and Guinan (1996-2021). The analyses of all data indicate two dominant periods of ~5.3-6.1 yrs, & ~385-435 days but also show other significant transient periodicities. There is evidence of period variations: the long-period is P~5.3-yr during 1837-1884 & P~6.1-yr during ~2000-2021; the ~420-d period is also time-variant. The WWZ-wavelet analyses show the complexity of the time-domain period variations. Radial velocities from Granzer et al. 2021 are also included and show correlations with TiO (=Teff) and brightness (see Harper-this meeting). These indicate mass-motions (convection) and pulsations with the ~420-d and ~6-yr periods. We discuss efforts to unravel the behavior of Betelgeuse and the cause(s?) of the “great dimming”: ejected dust and/or pulsation /convection-induced cooling/dimming.

Thanks for efforts of over six generations of observers, including the AAVSO, for making this study possible.

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