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The Curious Case of Betelgeuse

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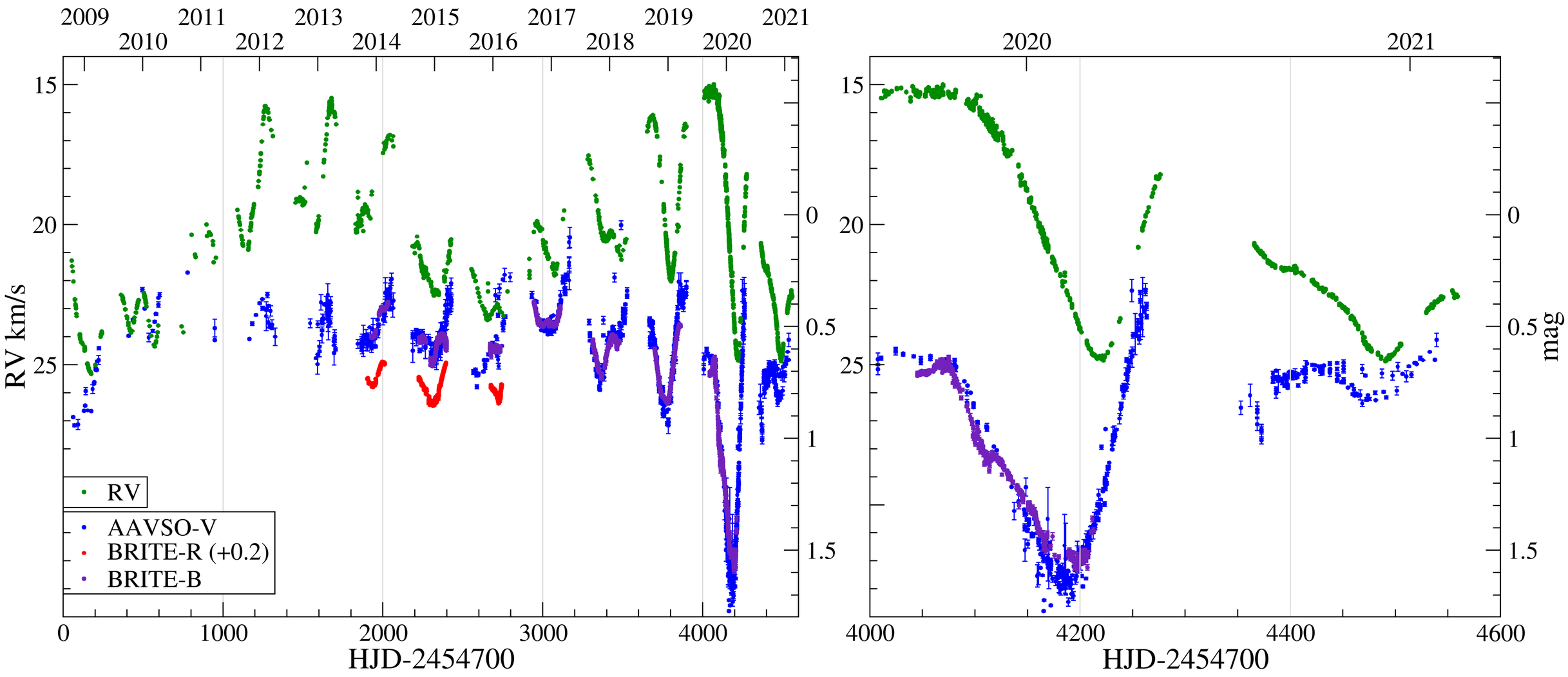
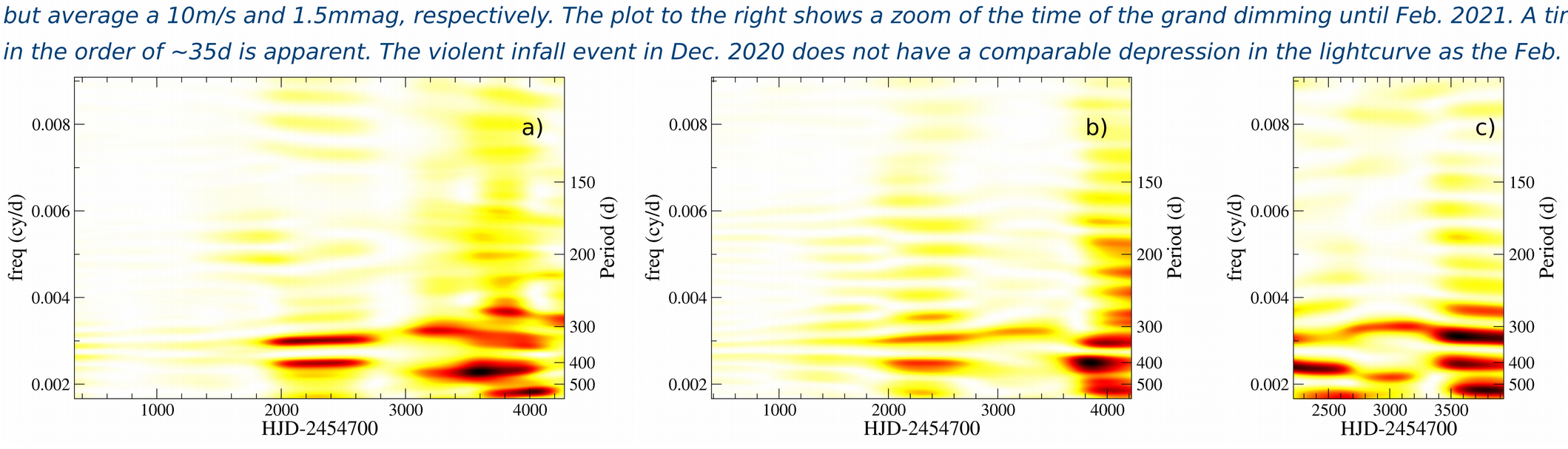
Betelgeuse is among the biggest stars in the Milky Way. It has been known as a semi-regular Variable since the 19th century. In Feb. 2020, it reached an unprecedented minimum light of V~1.6^{m}, subsequently followed by a quick re-brightening. At the end of its visibility (May 2020), it had regained its previous brightness. Two main explanations have been proposed: A massive appearance of cool spots in the photosphere versus an at least partly occultation of the star by a recently emitted dust cloud. While the latter theory gained support by HST UV observations[1] showing the massive ejection of hot material just prior to the dimming event, the former is backed by sub-mm and near-IR data[2,3] suggesting a drop in the T_{eff} of Betelgeuse rather than additional dust blocking the light at optical wavelength.

This poster shows more than a decade of photospheric radial velocity (RV) measurements with the STELLA robotic facility and compares them to photometric data from the BRITE satellites. It is shown that two distinct periods, at length of ~320d and ~420d, appear and fade in both, the RV and photometric data concurrently, indicating a strong link of the Betelgeuse‘s pulsation to light-level variations.



Radial velocity (green) taken with SES/STELLA (R~55000) in comparison to BRITE-blue (B, violett) and red (R, red) data. BRITE data have varying zero-points and thus each block has been shifted to match AAVSO-V data (blue). BRITE red is offset by 0.2^{m} for plotting reasons. Error bars in RV and BRITE are invisibly small, but average a 10m/s and 1.5mmag, respectively. The plot to the right shows a zoom of the time of the grand dimming until Feb. 2021. A time-lag of the RV data in the order of ~35d is apparent. The violent infall event in Dec. 2020 does not have a comparable depression in the lightcurve as the Feb. 2020 event.



Time-frequency analysis[4] of the RV data in Panel a), of AAVSO-V data in b) and BRITE-B in c). Note the slightly different range in th x-axes. All data show an onset of a split frequency at P~400d around JD 2456700 which subsequently faded out just to reappear more violently just prior to the grand dimming event.

References:

[1] ApJ **899**, 68D

[2] ApJ **905**, 34H

[3] ApJ **897**L, 9D

[4] A&A **590**A, 133