WR 110: A Single Wolf-Rayet Star With Corotating Interaction Regions In Its Wind?

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A 30-day contiguous photometric run with the MOST satellite on the WN5-6b star WR 110 (HD 165688) reveals a fundamental periodicity of P = 4.08 +/- 0.55 days along with a number of harmonics at periods P/n, with n ~ 2,3,4,5 and 6, and a few other possible stray periodicities and/or stochastic variability on timescales longer than about a day. Spectroscopic RV studies fail to reveal any plausible companion with a period in this range. Therefore, we conjecture that the observed light-curve cusps of amplitude ~ 0.01 mag that recur at a 4.08 day timescale may arise in the inner parts, or at the base of, a corotating interaction region (CIR) seen in emission as it rotates around with the star at constant angular velocity. The hard X-ray component seen in WR 110 could then be a result of a high velocity component of the CIR shock interacting with the ambient wind at several stellar radii. Given that most hot, luminous stars showing CIRs have two CIR arms, it is possible that either the fundamental period is 8.2 days or, more likely in the case of WR 110, there is indeed a second weaker CIR arm for P = 4.08 days, that occurs ~ two thirds of a rotation period after the main CIR. If this interpretation is correct, WR 110 therefore joins the ranks with three other single WR stars, all WN, with confirmed CIR rotation periods (WR 1, WR 6, and WR 134), albeit with WR 110 having by far the lowest amplitude photometric modulation. This illustrates the power of being able to secure intense, continuous high-precision photometry from space-based platforms such as MOST. It also opens the door to revealing low-amplitude photometric variations in other WN stars, where previous attempts have failed. If all WN stars have CIRs at some level, this could be important for revealing sources of magnetism or pulsation in addition to rotation periods.

Reference: ApJ
Status: Manuscript has been accepted

Weblink: http://arxiv.org/abs/1105.0919

Comments: 25 pages, 8 figures, 2 tables

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