

**IRAS 19015+1625: A MULTI-PERIODIC, HIGHLY REDDENED  
 M6III SR VARIABLE**

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Henden and Munari (2000, 2001, 2006) established accurate  $UBVR_cI_c$  photometric sequences around more than 80 symbiotic stars. Inclusion of stars in the comparison sequences was based on several criteria, including among others (i) covering a wide brightness range (for estimation of brightness on archival photographic plates), (ii) extending over the larger possible color range (for calibration of color corrections in CCD and photoelectric photometry), and (iii) photometric stability over three, well separated in time, re-observations. The latter requirement intended to avoid the most obvious variables from entering the photometric sequences. However, Henden and Munari were well aware that three observations were not enough to prevent from some contamination to leak in, and it would have been only the protracted use of the sequences that would have ultimately pruned them.

The ANS (Asiago Novae and Symbiotic stars) Collaboration is monitoring intensively all symbiotic stars for which Henden and Munari calibrated the photometric sequences. While observing the symbiotic star AS 338 = V1413 Aql, we have noted that one of the reddest comparison stars, at RA:285.941467 and DEC:+16.497797, is indeed variable. This star is IRAS 19015+1625, and at the time Henden and Munari worked out their sequences, the coincidence with the suspected variable NSV 24674 was not noted, otherwise the star would not have been used.

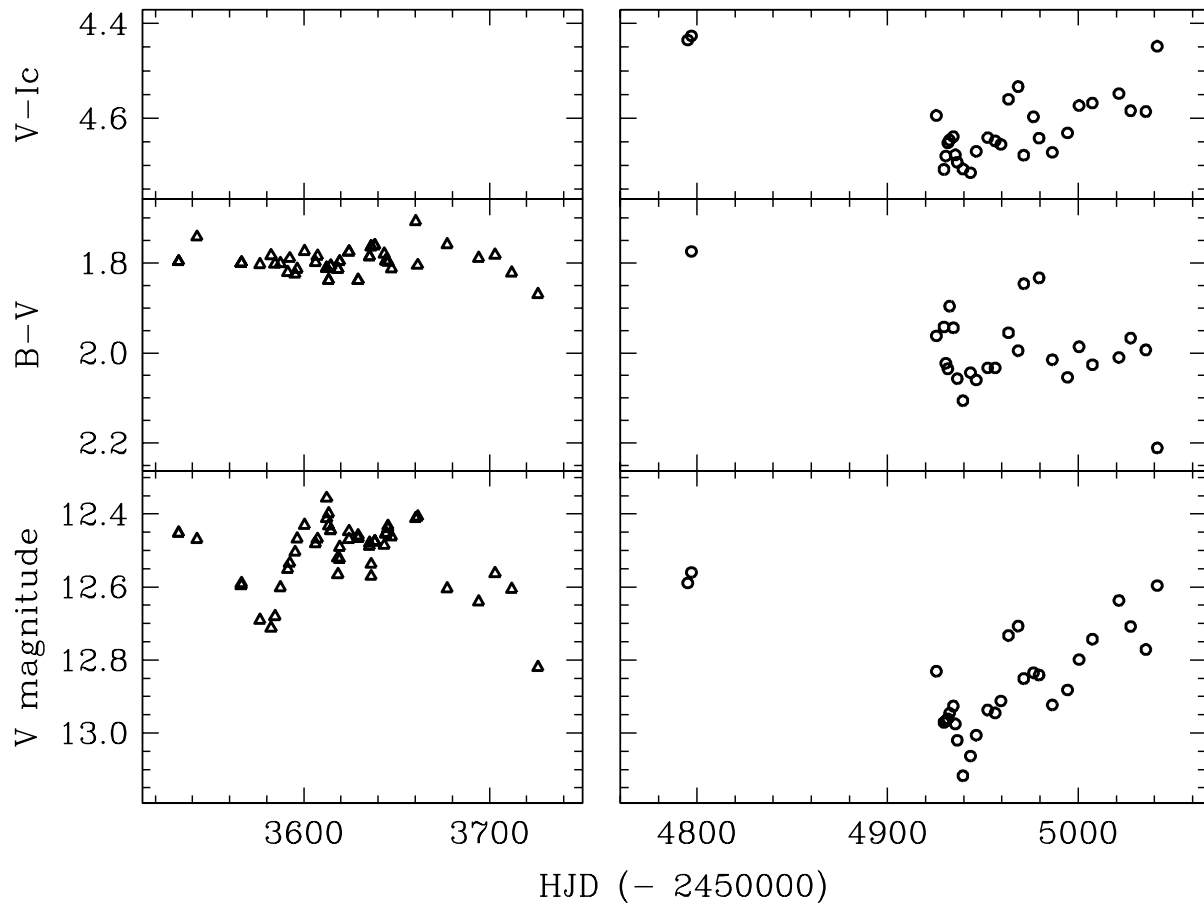
Our  $BVR_cI_c$  photometry of IRAS 19015+1625 is presented in Table 1 (available electronic version only through the IBVS website as 5896-t1.txt) and in Figure 1. It was obtained with (a) the 0.42-m ARAR telescope in Bastia (Ravenna, Italy; identified as R120 in Table 1), equipped with an Apogee Alta 260e CCD camera, 512×512 array, 20  $\mu\text{m}$  pixels  $\equiv 1''.83/\text{pix}$ , field of view of 16'×16' and Schuler  $UBVR_cI_c$  filters; and (b) the AAVC 0.30-m telescope in Cembra (Trento, Italy; identified as R030 in Table 1). The CCD is an SBIG ST-9, 512×512 array, 20  $\mu\text{m}$  pixels  $\equiv 1''.72/\text{pix}$ , with a field of view of 13'×13'. The  $B$  filter is from Omega and the  $VR_cI_c$  filters from Custom Scientific. IRAS 19015+1625 has been observed for a total of 78 nights: 49 in 2005 and other 49 in 2009.

IRAS 19015+1625 is a quite red star, as illustrated by the following mean values of the data in Table 1:  $\langle V \rangle = 12.64$  (dispersion 0.20 mag),  $\langle B - V \rangle = +1.86$  (0.11),  $\langle V - R_c \rangle = +2.13$  (0.10), and  $\langle V - I_c \rangle = +4.61$  (0.08). The corresponding mean values measured by Henden and Munari (2000) are:  $\langle V \rangle = 12.26(\pm 0.06)$ ,

$\langle B - V \rangle = +1.92(\pm 0.01)$ ,  $\langle V - R_c \rangle = +1.85(\pm 0.03)$  and  $\langle V - I_c \rangle = +3.90(\pm 0.10)$ , from three distinct observations collected on 1999 Oct 2, 6 and 13.

A low resolution, absolutely fluxed spectrum of IRAS 19015+1625 was obtained on 2009 July 28.99 UT, with the AFOSC imager+spectrograph of the Asiago 1.82m telescope. The spectrum is presented in Figure 2, that illustrates its perfect match with the M6III template spectrum taken from the reference atlas of Fluks et al. (1994), reddened by  $E_{B-V} = 0.9$ .

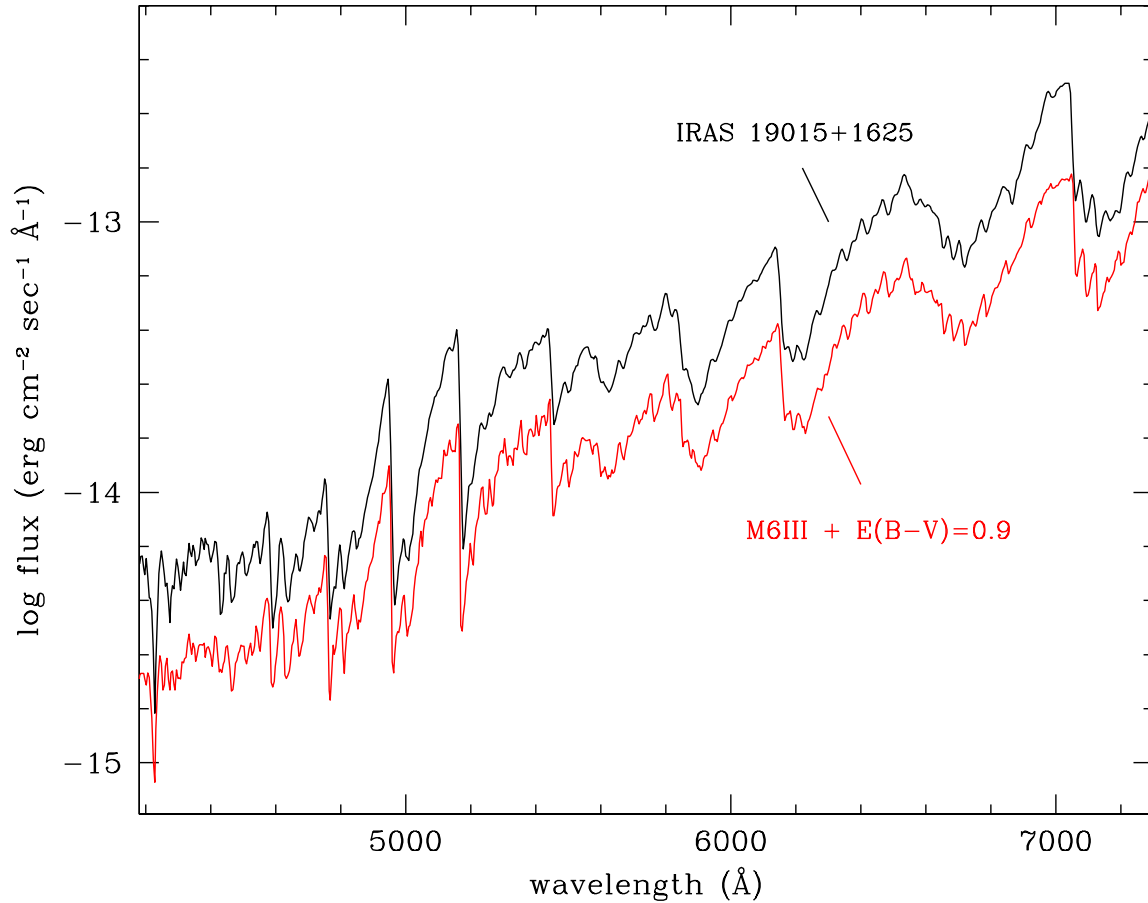
The amount of reddening affecting IRAS 19015+1625 seems contradictory defined. The fit to the observed spectrum requires precisely  $E_{B-V} = 0.90$ , while the match with the observed  $V - I_c$  (see below) indicate  $E_{B-V} = 1.05$ . Conversely, the  $\langle B - V \rangle = +1.86$  color when compared with intrinsic colors of M giants (Lee, 1970) corresponds to  $E_{B-V} = 0.28$ . Similarly, the 2MASS colors of IRAS 19015+1625 ( $K_s = 4.01$ ,  $J - K = +1.463$ ,  $H - K_s = +0.453$ ), when compared with the intrinsic colors of M6III stars in the 2MASS system ( $J - K_s = 1.25$ ; Straižys and Lazauskaite, 2009, with extrapolation scaled according to Lee, 1970) results in  $E_{B-V} = 0.37$  (following Fiorucci and Munari, 2003 for a standard  $R_V = 3.1$  reddening law).



**Figure 1.** The light curve of IRAS 19015+1625 from our 2005 (left panels) and 2009 (right panels) observations. Formal errors (Poissonian noise + uncertainty in the slope of the instantaneous color correction from local to Henden-Munari systems) do not exceed the size of the symbols.

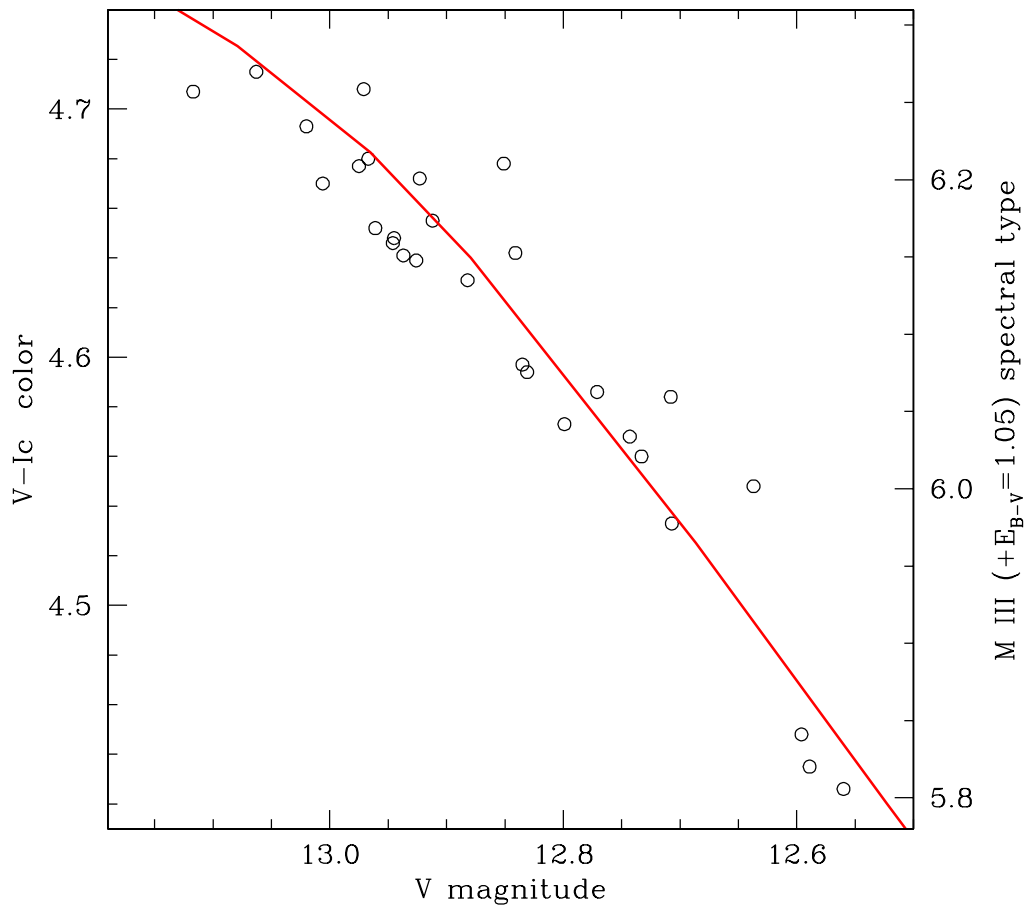
The light-curve of IRAS 19015+1625 in Figure 1 is characterized by a limited amplitude and color variation, with a pattern highly reminiscent of multi-periodic SR vari-

ables, similar to IRC-10443 that we have recently investigated (Munari et al., 2008). A Fourier analysis shows that a shorter, about 50-day periodicity is clearly present in IRAS 19015+1625 superimposed with a longer one, unconstrained with the present set of data, possibly of the order of 250 days.



**Figure 2.** The absolutely fluxed spectrum of IRAS 19015+1625 for 2009 July 28.99 UT. The spectrum of a M6III star from the atlas of Fluks et al. (1994), reddened by  $E_{B-V} = 0.90$ , is plotted for comparison. The match is essentially perfect.

A pulsating nature of the observed variability is supported by Figure 3, that shows how the variability in the V band is strictly correlated with the  $V - I_c$  color. When IRAS 19015+1625 is brightest, the color is the bluest, and when the star is faintest, the color is the redder, which is the behaviour of a black-body that expands and contracts at constant luminosity. The continuous line in Figure 3 represent the locus of MIII giants (with the actual excursion given of the right-hand ordinate axis) reddened by  $E_{B-V} = 1.05$  (for a standard  $R_V = 3.1$  reddening law) and scaled to the mean observed brightness for IRAS 19015+1625.



**Figure 3.** Variability of IRAS 19015+1625 on the  $V/V - I_c$  plane from our observations. The line represents the locus of Fluks et al. (1994) spectra of class III M giants (see spectral scale at right), reddened by  $E_{B-V} = 1.05$ .

#### References:

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