Impact of the ASAS-SN survey and the Moscow's photographic plates archive on the nature of the emission line star HBHA 1704-05*)

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1. A neglected emission-line star HBHA 1704-05

2. Discovery of the outburst by the ASAS-SN survey

3. HBHA 1704-05 as a symbiotic star in outburst

4. 1962 – 1995 light curve from the Moscow's plates archive:
   (i) 1968 – 1990 nova-like outburst
   (ii) periodic variability – orbital elements

5. Conclusions

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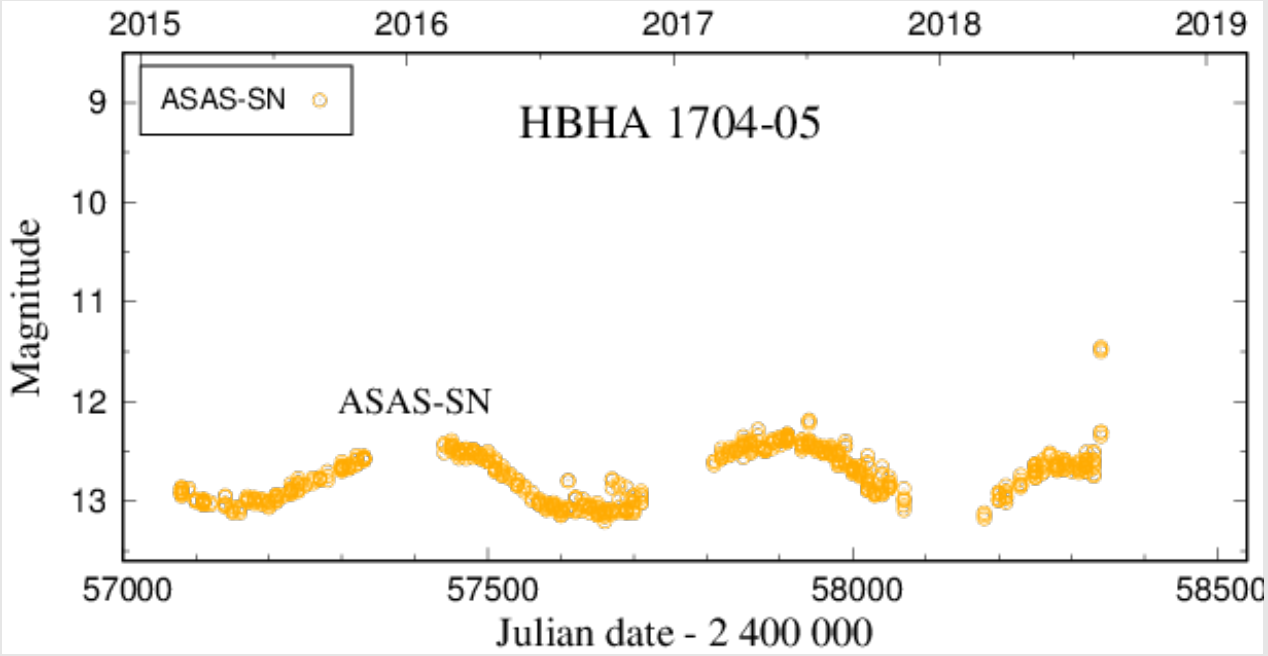
Neglected emission-line star HBHA 1704-05 and its 2018 outburst

Kohoutek & Wehmeyer (1999): HBHA 1704-05 as an emission-line star

VSX: ASASSN-V J195442.95+172212.6 19 54 42.95 +17 22 12.7 (2000)
Var. type: SR+ZAND, Period: 418-d, Mag. Range: 10.7 – 13.2 V

August 2018: The All Sky Automated Survey for SuperNovae (ASAS-SN) indicated rapid brightening:



Munari et al., Atel #11937 on Aug. 2018: M-type features, TiO bands + blue continuum + strong emissions of HI, HeI, HeII, OIII ⟶ previously unknown symbiotic star in outburst.

Neglected emission-line star HBHA 1704-05 and its 2018 outburst

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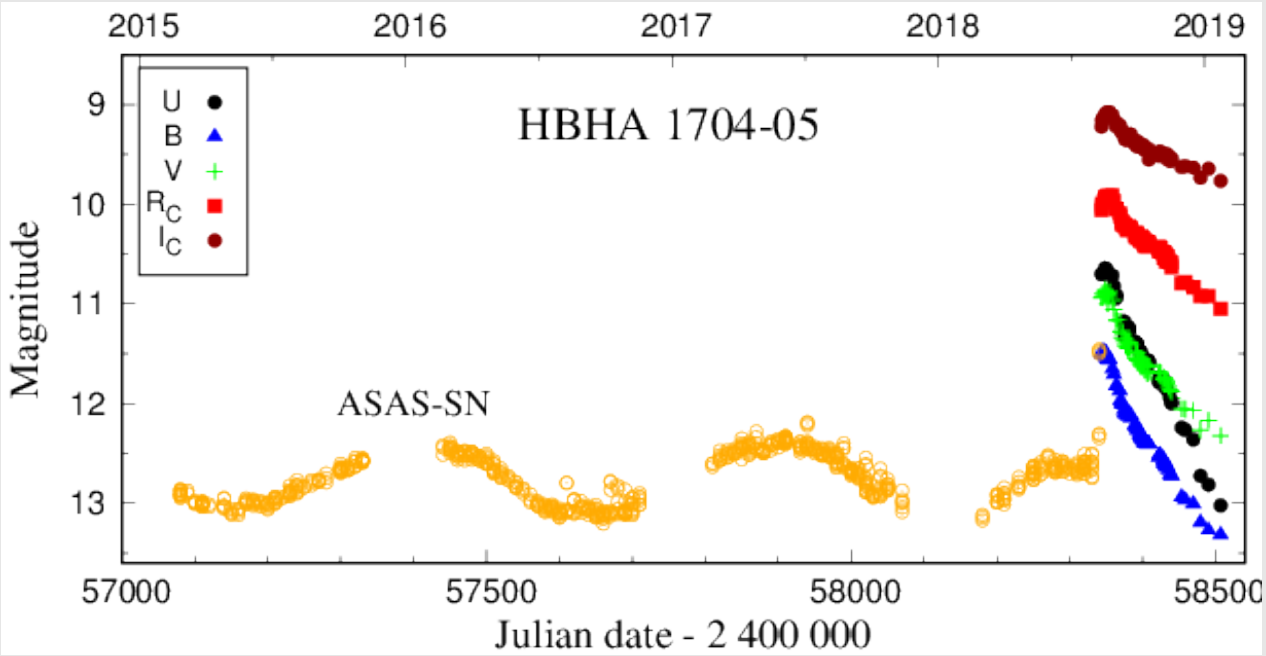
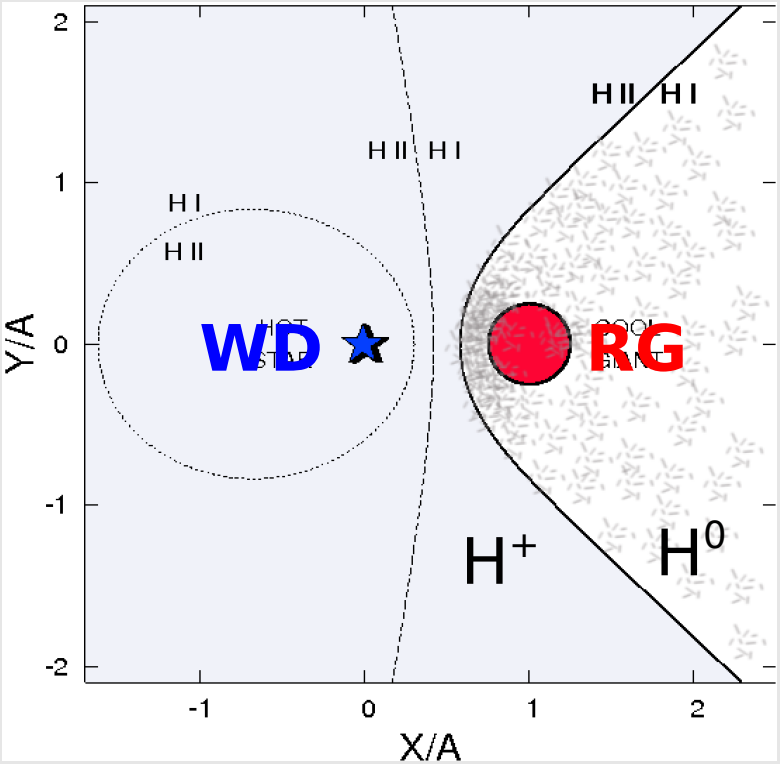


Following high-cadence photometric and spectroscopic observations clarified the nature of HBHA 1704-05 as a symbiotic star in outburst.
$UBVR_CI_C$ photometry – Z And-type outburst

Symbiotic Binaries

The widest interacting binary systems: Cool giant + White dwarf
P ~ 100 x (days - years)

Basic interaction: Mass loss from the RG + Accretion by the WD



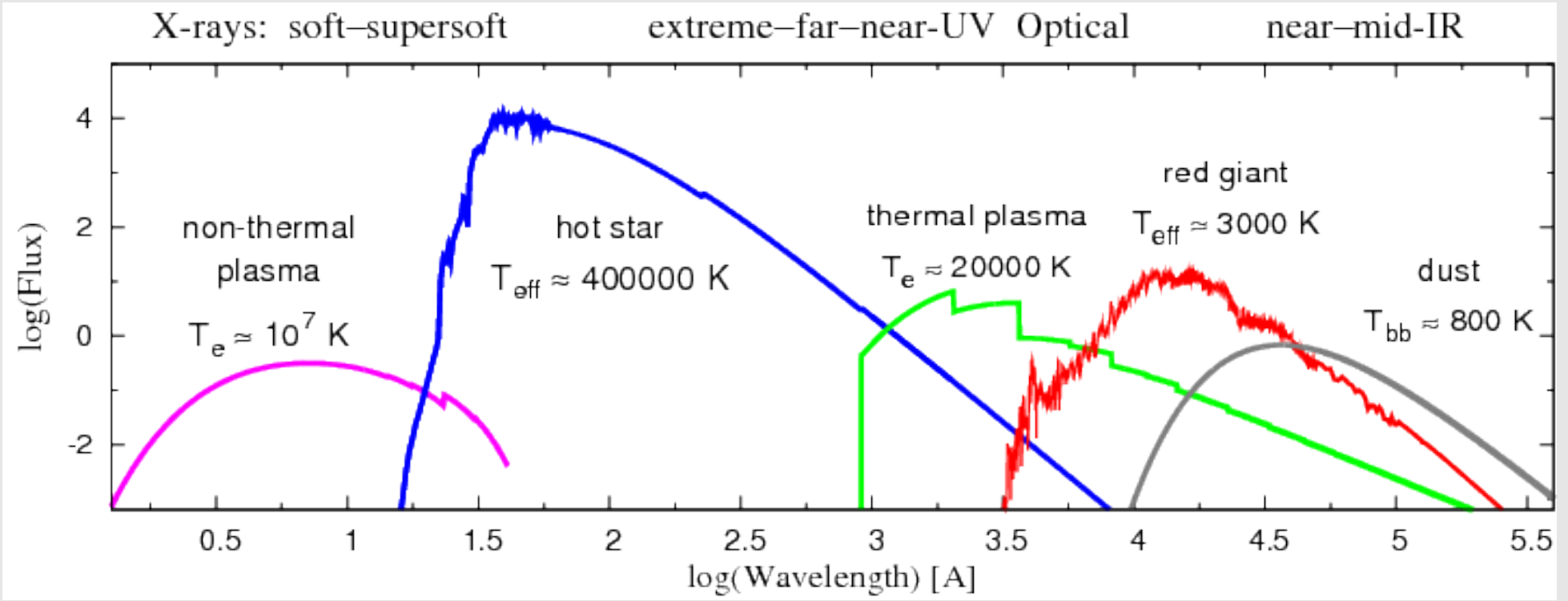
Seaquist et al. 1984, ApJ, 284, 202

Accretion from the RG wind
(at 10^{-8}–10^{-7} M_{Sun}/yr)
==>
Hot & Luminous WD
==>
Ionization of the RG wind
==>
Symbiotic nebula

Symbiotic binaries - composite continuum

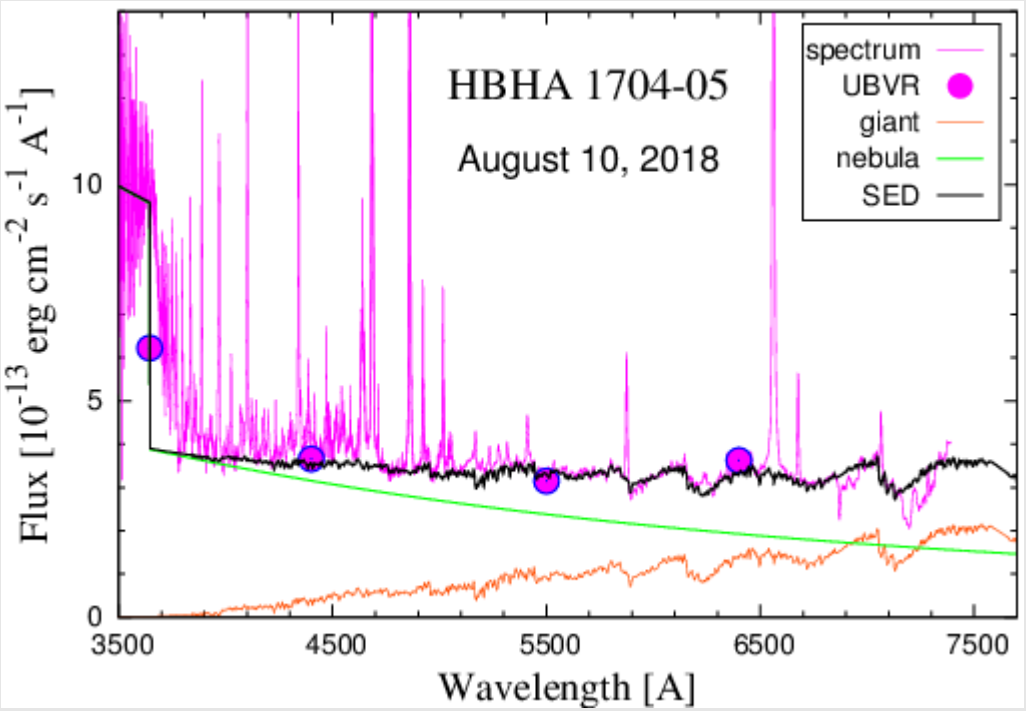
The spectrum consists of different components of radiation

$$F(\lambda) = F_H(\lambda) + F_N(\lambda) + F_G(\lambda) + F_D(\lambda)$$



Aim: disentangling the composite spectrum to obtain physical parameters of individual components of radiation

HBHA 1704-05 as symbiotic binary: spectroscopic confirmation



Model SED:

$F_H(\lambda)$ – negligible in opt.

$F_N(\lambda)$ – green

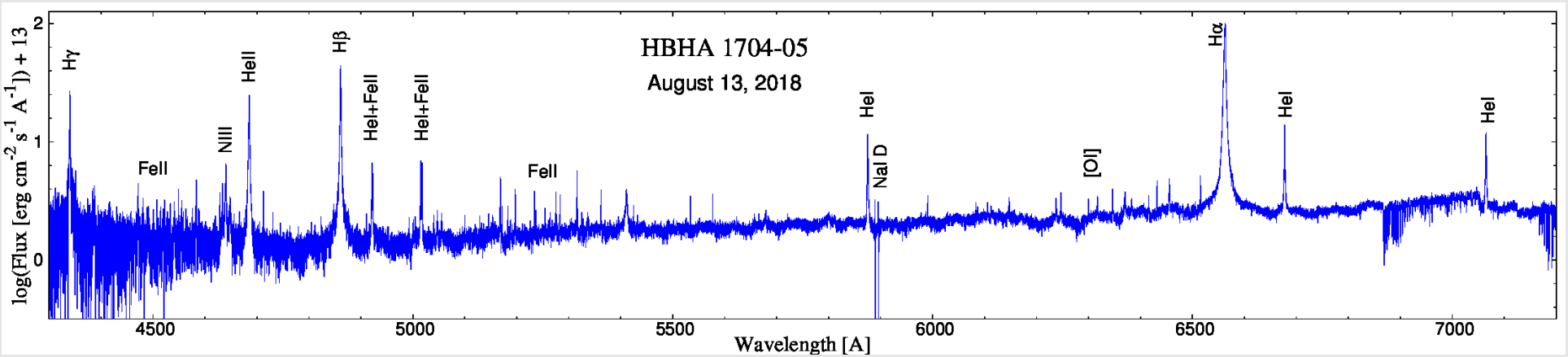
$F_G(\lambda)$ – orange

Giant: M2.6 III $L_G = 1100\,(d/3.6\,kpc)^2\,L_{Sun}$,

$T_{eff} = 3600$ K, $R_G = 87\,(d/3.6\,kpc)\,R_{Sun}$

Nebula: $EM \sim 1.1\times10^{61}\,(d/3.6\,kpc)^2$ cm^{-3},

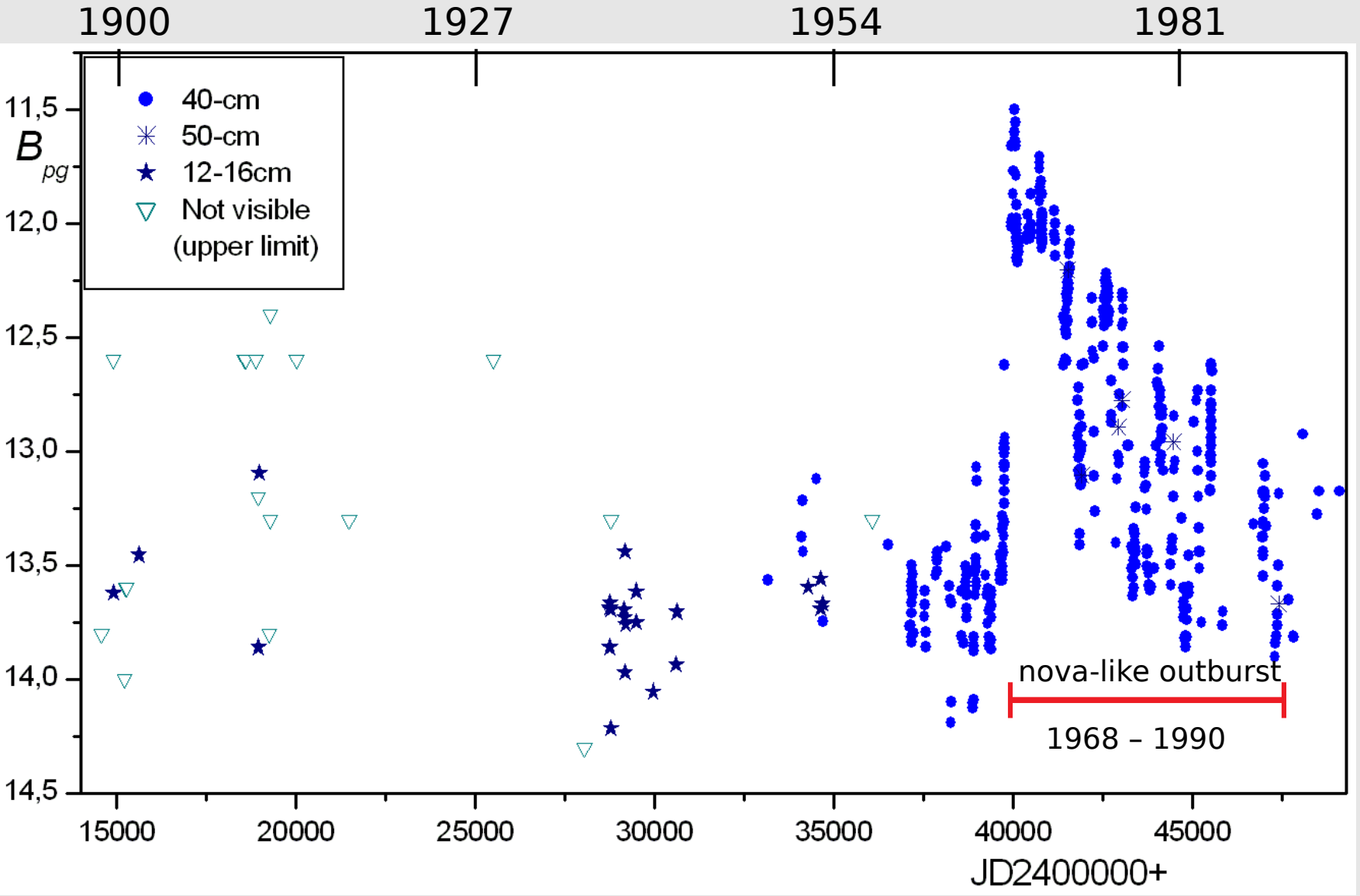
$T_e \sim 43000$ K



Optical spectrum of HBHA 1704-05 obtained by 1.3 m telescope at the Skalnate Pleso observatory on August 13, 2018 (R ~ 35000). The strongest emission lines are of HI, HeI and HeII 4686 A + fain features of FeII, TiII. CrII, [OI] 6300, Raman OVI.

HBHA 1704-05 as symbiotic binary: photometric confirmation

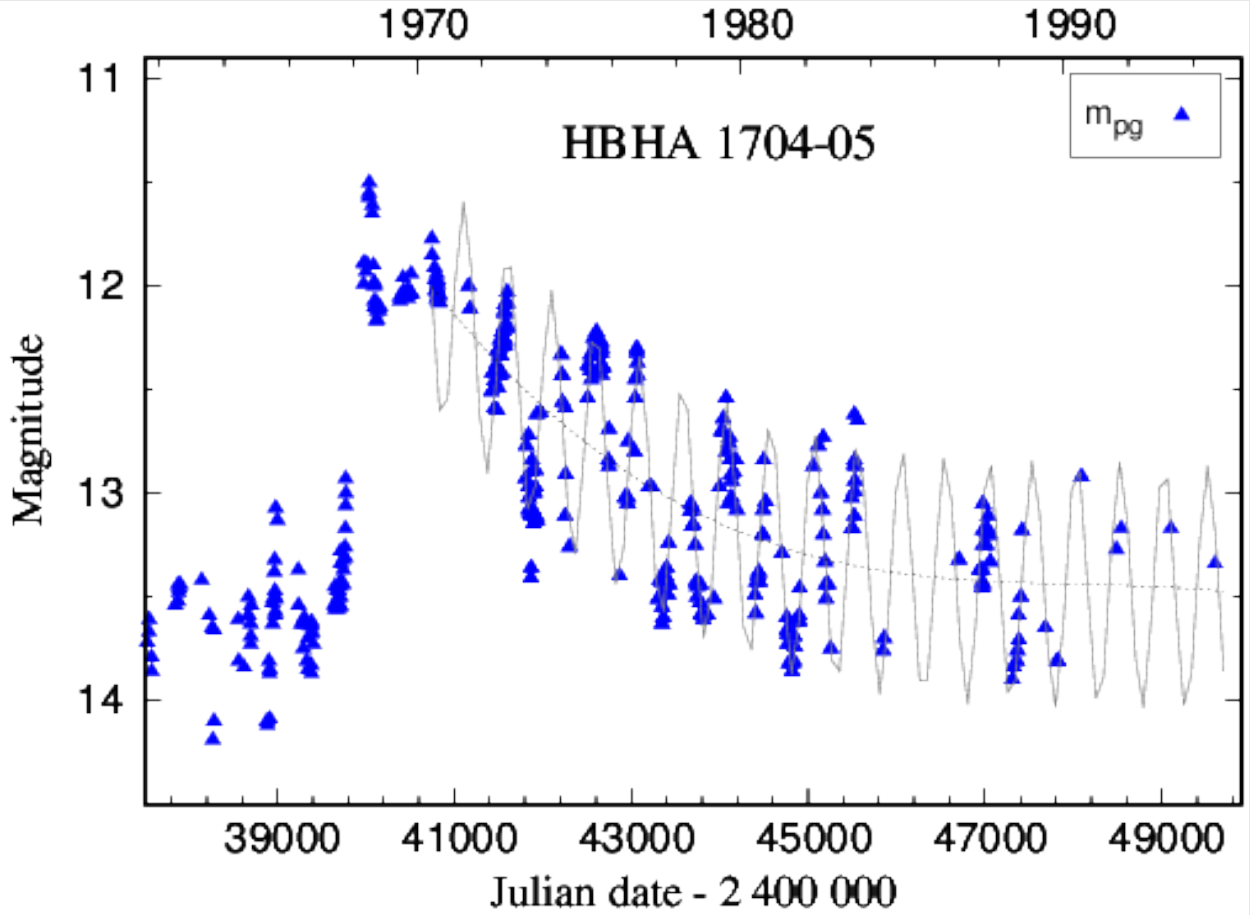
Historical light curve from the Moscow photographic plates archive



HBHA 1704-05 as symbiotic binary: photometric confirmation

Wave-like orbitally-related variation –

caused by extended partialy optically thick symbiotic nebula

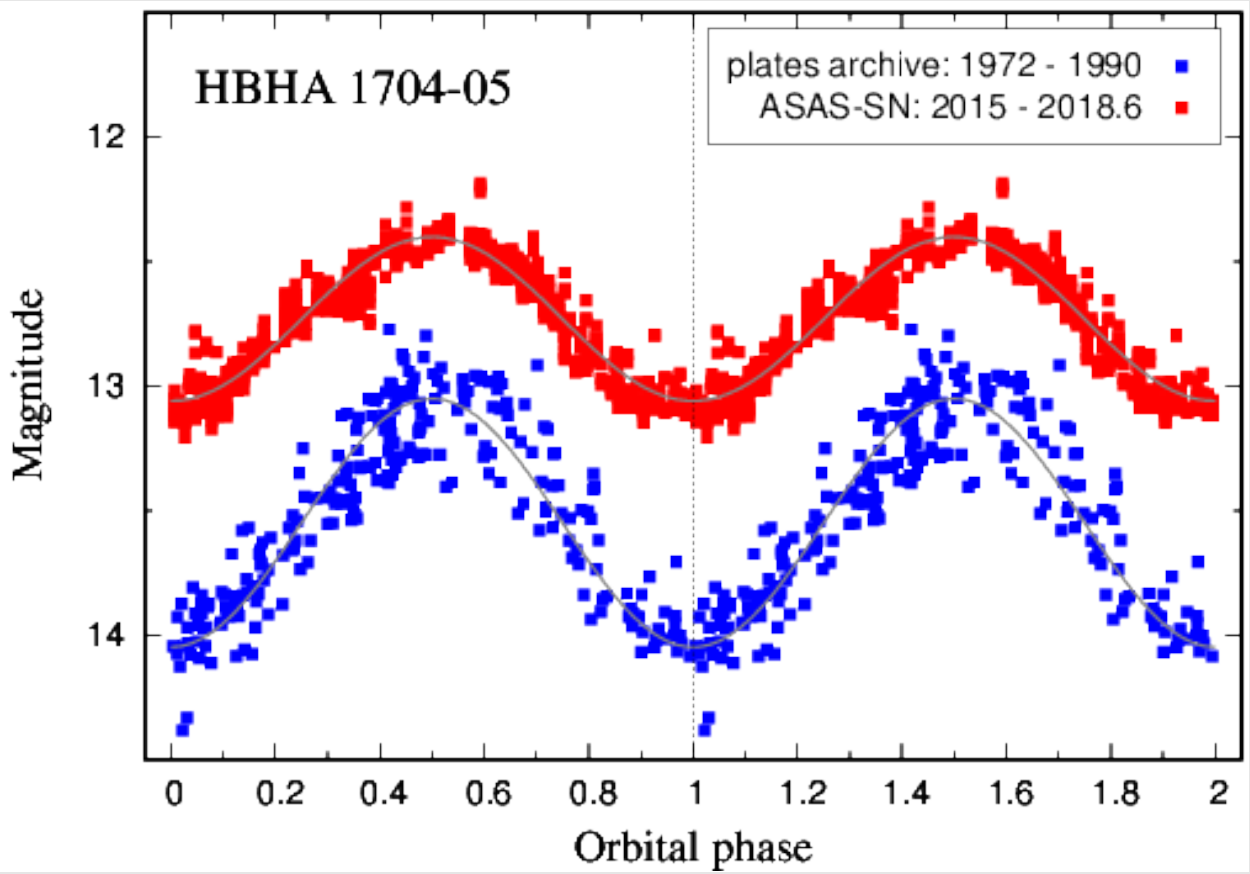


$$JD_{Min} = 2\,440\,855.4 + 495 \times E$$

HBHA 1704-05 as symbiotic binary: photometric confirmation

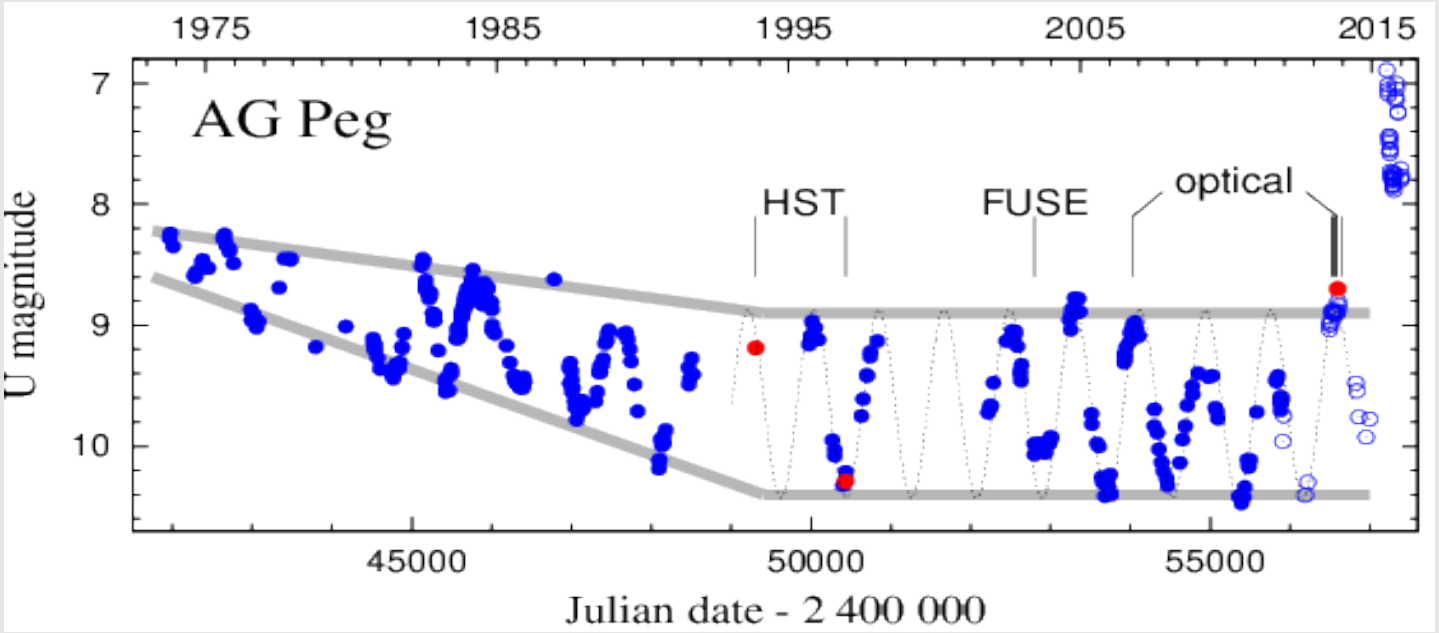
Wave-like orbitally-related variation –

a typical feature of symbiotic stars during quiescent phases



$P_{orb} = 495\,d$, $\Delta V \sim 0.7\,mag$, $\Delta B \sim 1.1\,mag$; $\Delta B > \Delta V$

HBHA 1704-05 as a twin to AG Pegasi

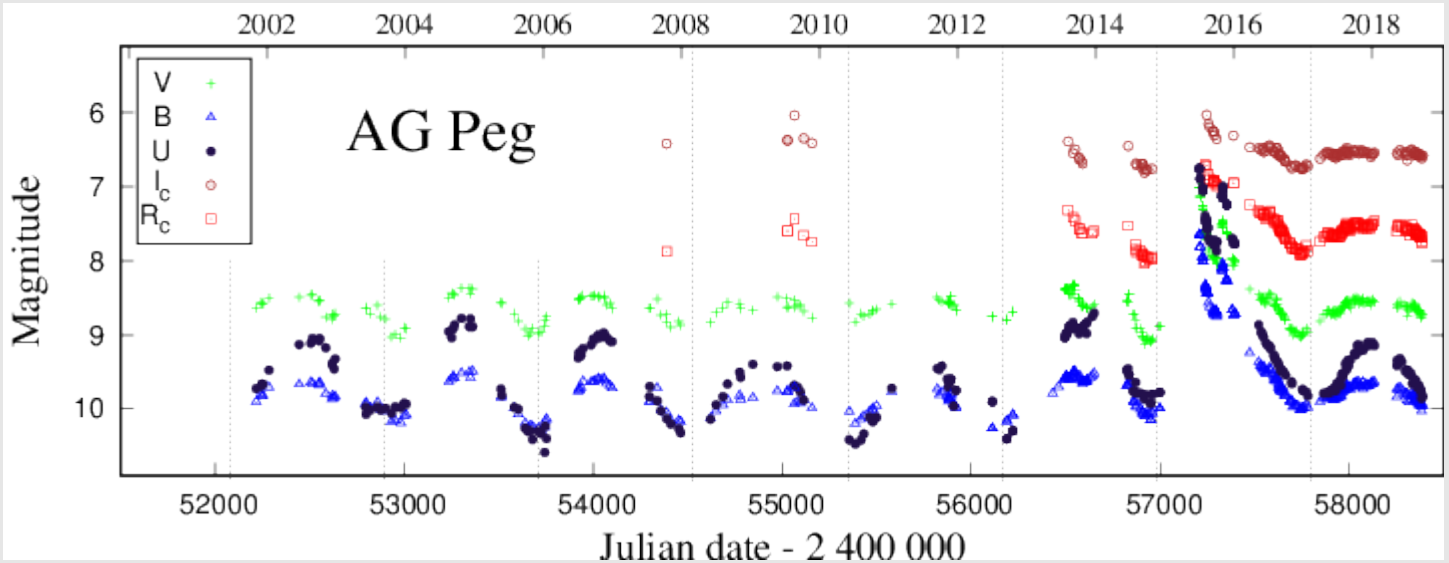


AG Pegasi:

symbiotic star with P_{orb} = 818 days

Fig.: Final stage of the nova-like outburst and 2015 eruption.

(Skopal et al. 2017)



AG Pegasi:
Quiescent phase - wave-like orbitally-related variation.
Z And-type outburst in June 2015.
After 165 years of its nova-like eruption

Sekeras et al. (2019)

Conclusions

The ASAS-SN survey and the Moscow's photographic plates archive confirmed that

(i) HBHA 1704-05 is a symbiotic binary, and revealed its orbital period of ~ 500 days.

(ii) Revealed its nova-like outburst during 1968 – 1990.

(iii) Indicated the wave-like orbitally-related variation in the V and B light curves.

(iv) Showed a strong similarity with other symbiotic Stars. For example AG Pegasi and AG Draconis.

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Thank you for your attention !