ULTRA FAST EVOLUTION OF SAKURAI's OBJECT

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ABSTRACT. We model theoretical spectral energy distributions of the "born-again" V4334 Sgr for our grid of hydrogen-deficient model atmospheres with a range of T_{eff} = 4000-5000 K anf log g = 1.0 - 0.0. These SED's are compared with the observed in 1997-1998 spectra of V4334 Sgr. In that way we determine T_{eff} of Sakurai's object for the years, and parameters of interstellar + circumstellar reddening in the frame of self-consistent approach.

Key words: post-AGB stars: V4334 Sgr: stellar evolution: model atnospheres: SED

In many ways, the existence of irregular hydrogen-deficient (Hd) variables remains puzzling. R CrB is the most well-known member of the post-AGB group. Sakurai's object (SO, V4334 Sgr) provides another, extreme case of stellar evolution.

It has been firmly established that the most abundant elements in atmosphere of V43334 Sgr are helium and carbon (see table 1).

Opacities.

In the photosphere of V4334 before 1997 ($T_{eff} > 7000$ K), the continuum opacity was governed mainly by a bound-free absorption of C atoms. There the situation was quite different from the case of solar-like atmospheres. Later opacity above the photosphere of V4334 Sgr with $T_{eff} < 6500$ K was determined, to a large extent, by absorption of molecules consisting of C, N and O (Pavlenko, Yakovina & Duerbeck 2000).

Table 1: Abundances of H, He, C, N, O (scaled to $\sum N_i = 1$) in atmospheres of R CrB and, V4334 Sgr(Asplund et al. 1998) and the Sun (Anders & Grevesse 1979).

	R CrB	Sakurai	the Sun
H	-4.03	-2.42	-.04
He	-0.01	-0.020	-1.05
C	-2.01	-1.62	-3.48
N	-2.13	-2.52	-3.99
O	-2.73	-2.02	-3.11

Model atmospheres and SEDs of Sakurai's object.

We computed a grid of model atmospheres of R CrB-like stars and Sakurai's object of T_{eff} = 7000-4000 K, log g = 0 - 1 (Pavlenko & Yakovina 1994, 2000, Pavlenko, Yakovina & Duerbeck 2000). Opacity sampling treatment was used to take into account atomic and molecular absorption. We used JOLA as a model of absorption by electronic band systems of diatomic molecules.

Fits of theoretical SEDs to observations in 1997 - 1998 ones allow us to determine T_{eff} and E_{B-V} of Sakurai's object at the latest stages of its evolution (Pavlenko & Duerbeck 2001). In 1996-1999 T_{eff} of SO was reduced from 7000 K (Asplund et al. 1998) down to 5200 K (Pavlenko & Duerbeck 2000). Due to the high sensitivity of molecular densities of C_2 and CN to temperature in the atmosphere of SO its molecular bands intensities were changed drastically both in IR and optical regions (Fig. 1). Identification of the main molecular features in SO spectrum is given in Fig. 2a. Fig. 2b shows a fit to observed spectrum of SO in August 1998. For the time the photosphere of SO was engulfed by a dusty envelope (E_{B-V} =1.3!). Later SO was completely covered by the dust (Duerbeck 2001).

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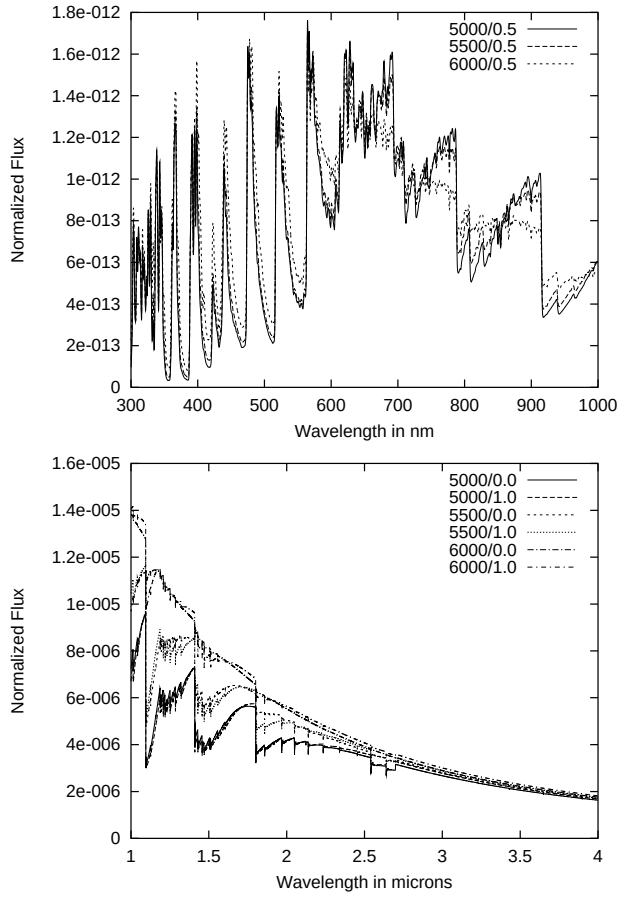

Figure 1: Dependence of optical and IR SEDs of V4334 Sgr on T_{eff} .

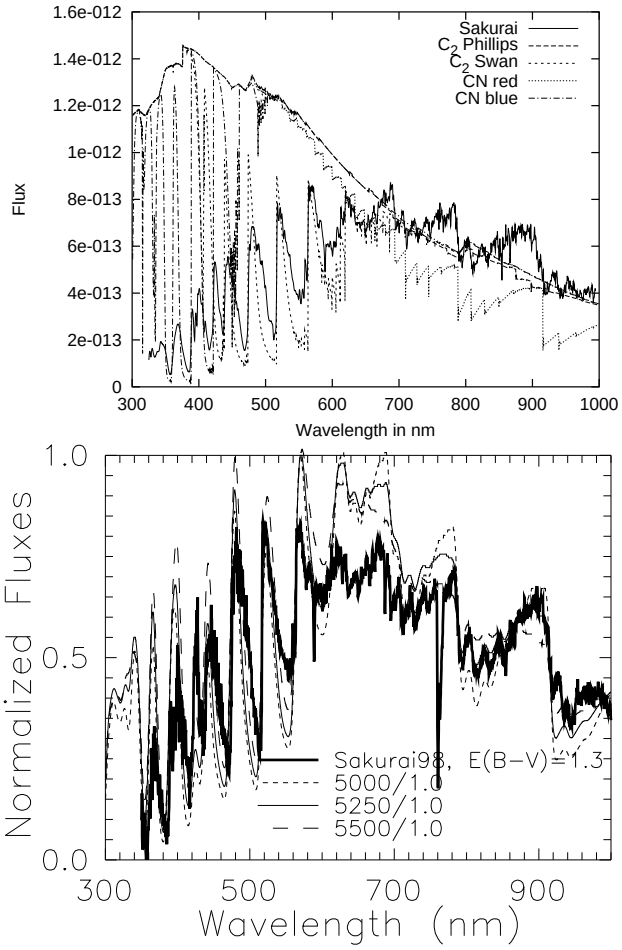

Figure 2: Identification of the molecular band systems that govern the SED of V4334 Sgr in 1997 (top). Fits to the SED of V4334 Sgr in August, 1998 (from Pavlenko & Duerbeck 2000) (bottom).