[Added in proof: Dr. Brian Mason has kindly informed the author of a recently discovered speckle component to HD 206267, which may represent the contaminating star A3. This component was observed at the 4-m at KPNO in 1994 September with a separation of 0·091″ at position angle 71°·8; it has been designated CHARA 212 Aa.]

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AG PEGASI: WILL ACCRETION BEGIN SOON?

By Radoslav K. Zamanov and Nikolai A. Tomov
National Astronomical Observatory Rozhen, Bulgaria

AG Pegasi is a symbiotic star which underwent a nova-like eruption in the middle of the 18th century. As a result of a thermonuclear runaway on the surface of a white dwarf, considerable mass loss from the hot component has been observed during the last century. This hot wind interacts with the wind of the red giant[1,2,3]. The hot-component luminosity has decreased during the last decade, and on this basis we predict that the colliding-winds stage will end, and accretion from the stellar wind will recommence, about the year 2001.

AG Peg is a binary system consisting of an M3 giant and a compact secondary, most probably a low-mass white dwarf. The star erupted in the mid-1850s and its brightness has subsequently slowly declined. Observations[4,5] reveal a composite spectrum: one component resembles a Wolf-Rayet star (WN6 type), and the other an ordinary M3 giant. During most of the 20th century the WN star has maintained a constant bolometric luminosity ($\sim 3000 L_{\odot}$) whilst gradually increasing in temperature. This has led to the conclusion[6] that the object experienced a classical nova eruption in the 18th century, and that it is the slowest nova ever recorded[3]. Its behaviour is in agreement with theoretical predictions for a hydrogen flash on a low-mass white dwarf.

As a result of its high luminosity, the erupting object loses mass at a rate of 10^{-6}–$10^{-8}\,M_{\odot}\,\mathrm{yr}^{-1}$, with a wind velocity of $\sim 900\,\mathrm{km\,s^{-1}}$. The hot wind collides with the low-velocity wind of the red giant. However, during the last decade the hot wind has considerably weakened as the hot-component luminosity faded[3]. At the same time, spectral line profiles, in the optical[8,9,10] as well as in the ultraviolet region[1,3], have indicated a wind velocity of about 900 km s^{-1}. We will assume that the velocity of the hot component's wind remains unchanged while the luminosity decreases. This is in agreement with calculations[11] which show that the wind velocities in classical novae depend weakly on the luminosity.

Various empirical formulae relating the mass-loss rate to luminosity have been proposed. Following Barlow & Cohen[12] we will use the relation

$$\dot{M} = \alpha L/(vc) \tag{1}$$

where $\dot{M}$ is the mass-loss rate, L the luminosity, v the wind velocity, and c the speed of light. The dimensionless parameter α is of the order 0·1–0·5.

The mass-loss rate of the hot component in AG Peg is expected to decrease as its luminosity fades.

A criterion distinguishing colliding winds from stellar-wind accretion in detached binary systems has been proposed[13]. Applying this criterion, accretion from a stellar wind onto the white dwarf in AG Peg will begin when its mass-loss rate falls to

$$\dot{M}_{\mathrm{h}} \leqslant \frac{R_{\mathrm{a}}^{2}\, v_{\mathrm{rel}}^{2}\, \dot{M}_{\mathrm{g}}}{2\, d^{2}\, v_{\mathrm{h}}\, v_{\mathrm{g}}} \tag{2}$$

Here $\dot{M}_{\mathrm{g}}$ is the mass-loss rate of the cool giant, v_{g} is the velocity of its wind, d is the distance between the components, v_{h} is the hot wind's velocity, v_{rel} is the relative velocity of the white dwarf to the giant's wind, and R_{a} is the accretion radius of the white dwarf,

$$R_{\mathrm{a}} = 2G\, M_{\mathrm{wd}}\, v_{\mathrm{rel}}^{-2}. \tag{3}$$

We adopt the following parameters[10]:

$$d = 630 R_{\odot}, \quad e = 0, \quad P = 820^{\mathrm{d}}, \quad M_{\mathrm{wd}} = 0{\cdot}7\, M_{\odot}.$$

We will also adopt a mass-loss for the primary of $2 \times 10^{-7}\,M_{\odot}\,\mathrm{yr}^{-1}$ (ref. 14), and a wind velocity of 10 km s^{-1}, which is typical for red giants[15].

Using Eqn. (2) we conclude that the colliding winds stage in AG Peg will finish when the mass-loss rate of the secondary weakens to $\dot{M}_{\mathrm{h}} \leqslant 1{\cdot}2 \times 10^{-9}\,M_{\odot}\,\mathrm{yr}^{-1}$, which corresponds (Eqn. 1) to a luminosity of about 200 $L_{\odot}$ (for $\alpha = 0{\cdot}25$–$0{\cdot}35$).

The luminosity of the hot component in AG Peg has been estimated several times. We will use the values[14] derived using the Zanstra method (the He II λ1640-Å line flux). The data are valid for a distance of 800pc (see ref. 3) and are plotted in Fig. 1.

On the basis of a linear fit we estimate that the luminosity of the hot compo-

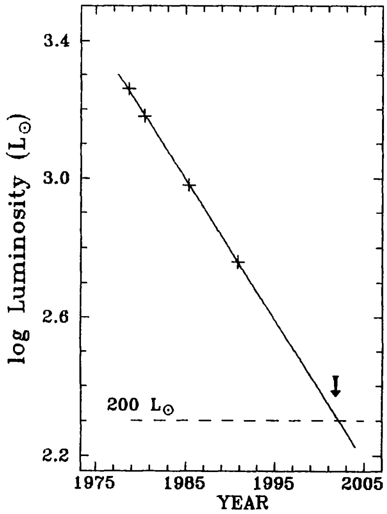

FIG. 1

The decreasing luminosity of the hot component[14] in AG Peg. The solid line is the best linear fit between L and time. The arrow indicates the moment when accretion will probably begin, when $L \simeq 200\ L_\odot$.

nent will fall to $200 L_\odot$ near the year 2001. Because of the uncertainties of the fit we consider reasonable limits to be 1999–2004. At about this time we expect that the colliding-winds stage will finish and the process of accretion will begin. Since the red giant does not fill its Roche lobe, accretion from its wind will occur at a rate of $\leqslant 10^{-8}\ M_\odot\ yr^{-1}$.

After the end of the colliding-winds stage, there may be a possibility of observing the early stages of disc formation, as well as the 'flip-flop' instability of the accretion. The possibility of steady hydrogen burning, at least at the end of the accretion, cannot be excluded. In the case that the white dwarf is magnetic we suppose that 'propeller' action may be realized for a short time.

In the next few years AG Peg may give a unique opportunity to observe the type of interaction between the components in a binary system change — from a scenario of colliding winds to one of accretion from a stellar wind. Such a transition has never been observed and surprises are possible.

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