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The System of RS Sagittari

by

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ABSTRACT

We report new photoelectric times of minimum light of RS Sgr. A period study of all available individual times of minimum light gives a small or negligible variation of the period. Absolute dimensions were derived from recent measures of the lines of the fainter component. RS Sgr appears to be a semidetached Algol-like system. Taken for granted that the period variation is real RS Sgr is thought to be a post mass exchange object probably in the slow phase of evolution.

1. Introduction

RS Sgr= h5036a= SAO 209959= HD 167647(B5) is a very bright southern eclipsing binary, in the lower limit of the naked eye visibility, that called the attention of astronomers since the past century. It was, among others, an interesting object to observe from the ground-based stations placed by northern observers in the south. This fact enabled that RS Sgr was included in many studies from the beginning of the century. RS Sgr has two visual companions.

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The purpose of the present work is to make an advanced period study of RS Sgr based upon new photoelectric times of minima in order to determine absolute dimensions of the component based in the recently measures of the lines of the fainter component (Ferrer and Sahade 1986), and to estimate the evolutionary status of this object. It is also intended to cover and actualize previous works made on this object.

2. History[4]

RS Sgr was suspected to be variable by Gould (1879). Its variability was confirmed by Roberts (1895, 1896, 1901) from his eye estimates. He also determined the first times of minimum light of this object and the Algol-type variability.

Further times of minimum light were reported by Pickering (1904), Paddock (1916), Dugan and Wright (1939), Redman (1949), O'Connell (1949, 1950), Gaposchkin (1953), Kvíz (1979), Mallama (1981) and De Laurenti and Cerruti (1988).

Photoelectric photometry in narrow and broad bands and colors of the system were reported by Hiltner *et al.* (1969), Crawford *et al.* (1971), Gronbech and Olsen (1976,1977), Schild *et al.* (1983), Garrison *et al.* (1983), Wolf and Kern (1983) and Davison *et al.* (1987).

Spectra, radial velocity curves, rotational velocities and determinations or recalculations of e and ω were reported by Paddock (1916), Sahade (1949), Savedoff (1951), Hiltner *et al.* (1969), Lucy and Sweeney (1971), Levato (1975), Monet (1980), Cucchiaro *et al.* (1980) and Ferrer and Sahade (1986).

Light curves of RS Sgr were reported by Redman (1945) and Gaposchkin (1953). The former one is very accurate, obtained with the Fabry method of stellar photometry; the second – is a mean light curve based on HCO plates.

Photometric orbits were determined by Roberts (1896), Shapley (1915), Baglow (1948), Kopal and Shapley (1936) and Koch *et al.* (1970); while spectrographic orbits were determined by Colacevich (1940), Sahade (1949) and Ferrer and Sahade (1986).

Period studies were made by Dugan and Wright (1939), O'Connell (1949, 1950), Plavec *et al.* (1960), Wood and Forbes (1963) and Kreiner (1971).

Absolute parameters and density of RS Sgr were determined by Kopal and Shapley (1956), Giannone and Giannuzzi (1974), Brancewicz and Dworak (1980) and Budding (1985), while it was included in statistical or theoretical works by De Grève and Vanbeveren (1980), Giuricin and Mardirossian(1981), Guiricin *et al.* (1983a,b) and Giuricin *et al.* (1984a).

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[4] Part of the references is based on data retrieved from SIMBAD, database of the Strasbourg, France, astronomical Data Center.

The system was observed also in far UV by Carruthers and Page (1984) and included in a microwave survey of active stars by Slee *et al.* (1987). Synchronization of the orbit, age and distance determinations were reported by Lesch (1972), Levato (1976) and Giuricin *et al.* (1984b). Finally RS Sgr was reported as a nearest and photoelectrically neglected object by Koch *et al.* (1979) and Dworak (1987).

Works on RS Sgr as of a member of the visual binary h5036, dealing principally with distances and age determinations, were reported by Yavuz (1979), Eggen (1982), and Lindroos (1985, 1986).

3. Observations and Period Study

Observations were made by MADL at the El Leoncito Station of Felix Aguilar Observatory (San Juan, Argentina) in 1985 and 1986. Observations were secured with the 76 cm reflecting telescope, UBV standard set of filters, refrigerated RCA 31034A photomultiplier and photon counting techniques. Measurements followed the usual symmetrical pattern in alternate sequences variable-comparison star and sky readings. SAO 209978 and SAO 209916 were used as comparison and check stars, respectively. Differential magnitudes listed in Table 1 were determined taking into account extinction coefficients. The polygonal line method (Guarnieri *et al.*, 1975; Ghedini, 1982) was used to determine the times of minimum light and their associated standard deviations. These minima are depicted in Table 2 together with the rest of the minima found in the literature. Sometimes a crucial aspect in the calculation of least squares is the knowledge of the standard error to single observation. In the case of older visual and photographic observations the task turns out to be very difficult. One may assigne typical dispersion values to visual, photographic and spectrographic times of minimum, but a large spread in time and method of observation prevents us from using this method for RS Sgr. On the other hand, dispersion can be estimated by assigning unity weight to all observations (and as a by-product to reject "bad" points).

Fortunately Dugan and Wright (1939), hereinafter DW, and O'Connell (1949), hereinafter DO, gave weights to his times of minima based on the observations defining them. Thus we prefer to choose the historical weighting of minima and do not reject any point. We use the scale that DO gave to his own observations and the DW weights shifted by DO. We change only three weight estimates (10, 1 and 40) made by DO in the minima of Roberts (1896), Wendell (1909) and Redman (1949), respectively. We consider these values to be overestimated and we turn them to 2, 0.3 and 10 respectively: The mean light curve of Roberts based on 247 observations was obtained by visual observations; DW, referring to the data of Wendell, spoke about two

Table 1

Individual Observations of RS Sgr

HJD 2440000+	Δ*v*	Δ*b*	Δ*u*
6296.4876	-0.010	-0.021	-0.084
.4897	-0.006	-0.018	-0.072
.4958	0.006	0.004	-0.052
.4980	0.018	0.012	-0.045
.5041	0.030	0.025	-0.021
.5064	0.028	0.027	-0.041
.5129	0.051	0.041	-0.027
.5151	0.032	0.028	-0.032
.5211	0.032	0.018	-0.041
.5240	0.016	0.012	-0.048
.5327	-0.027	-0.027	-0.076
.5355	-0.027	-0.025	-0.066
.5418	-0.041	-0.055	-0.110
.5437	-0.053	-0.016	-0.122
.5515	-0.099	-0.120	-0.193
.5546	-0.099	-0.125	-0.213
.5607	-0.134	-0.157	-0.249
.5628	-0.149	-0.178	-0.259
.5699	-0.199	-0.222	-0.323
.5720	-0.207	-0.221	-0.323
.5794	-0.239	-0.268	-0.384
.5814	-0.260	-0.285	-0.400
.5875	-0.298	-0.330	-0.446
.5894	-0.312	-0.342	-0.455
6622.5408	-0.302	-0.341	-0.516
.4520	-0.300	-0.338	-0.515
.5445	-0.318	-0.314	-0.474
.5457	-0.279	-0.313	-0.477
.5546	-0.254	-0.255	-0.430
.5557	-0.252	-0.263	-0.424
.5605	-0.239	-0.240	-0.385
.5614	-0.224	-0.236	-0.354
.5686	-0.196	-0.194	-0.314
.5697	-0.184	-0.179	-0.337
.5721	-0.162	-0.170	-0.307
.5733	-0.171	-0.182	-0.292
.5838	-0.089	-0.128	-0.241
.5850	-0.114	-0.130	-0.234
.5877	-0.109	-0.115	-0.205
.5888	-0.105	-0.114	-0.195
.5951	-0.063	-0.067	-0.148
.5965	-0.081	-0.088	-0.174
.5989	-0.044	-0.056	-0.130
.5999	-0.032	-0.053	-0.120
.6078	-0.031	-0.047	-0.097
.6091	-0.016	-0.012	-0.099
.6117	-0.017	-0.016	-0.079
.6158	-0.008	-0.008	-0.039
.6271	0.026	0.024	-0.012
.6283	0.030	0.025	-0.020
.6307	0.085	0.092	-0.015
.6325	0.023	0.007	-0.020
.6441	0.017	0.017	-0.014
.6455	0.026	0.013	-0.005
.6486	0.008	0.004	-0.025
.6496	0.025	0.008	-0.024

short runs of observations not well distributed in time; Although the mean light curve of Redman is very accurate and based on about 600 observations we consider 10 to be a good estimate of the weight.

Times of minima before 1955, not included in previous period studies, are: The first historically detected, of unknown observer, used by Pickering (1904) to calculate phases of his own observations, to which we give weight 0.3; The first published time of minimum light of RS Sgr announced by Roberts (1895), to which we give weight 0.3; A determination by Roberts (1901) from a visual mean light curve based on 512 observations, to which

Table 2

Times of minima and residuals for parabolic and linear ephemeris

Ref.	Min	Band	HJD 2400000+	(sigma)	E	(w)	(O-C)	(O-C)'
1	I	vis.	10000.850	(0.333)	-7433.0	(0.3)	-0.0049	-0.0285
2	I	vis.	13334.504	(0.050)	-6053.0	(2.0)	0.0043	-0.0119
2	I	vis.	13339.338	(0.333)	-6051.0	(0.3)	0.0070	-0.0092
3	I	ph.	13742.754	(0.200)	-5884.0	(0.5)	0.0036	-0.0118
4	I	ph.	14491.631	(0.333)	-5574.0	(0.3)	0.0184	0.0045
5	I	ph.	14822.584	(0.333)	-5437.0	(0.3)	0.0226	0.0093
3	I	ph.	14878.130	(0.200)	-5414.0	(0.5)	0.0079	-0.0053
2	I	vis.	15023.085	(0.033)	-5354.0	(3.0)	0.0218	0.0089
3	I	ph.	15554.499	(0.200)	-5134.0	(0.5)	-0.0148	-0.0267
3	I	ph.	16641.568	(0.100)	-4684.0	(1.0)	-0.0039	-0.0139
3	I	ph.	17438.745	(0.100)	-4354.0	(1.0)	-0.0028	-0.0114
6	I	spec.	18397.821	(0.400)	-3957.0	(0.2)	0.0464	0.0393
3	I	ph.	18501.681	(0.050)	-3914.0	(2.0)	0.0319	0.0251
5	I	ph.	19298.874	(0.333)	-3584.0	(0.3)	0.0490	0.0433
3	I	ph.	19540.399	(0.050)	-3484.0	(2.0)	0.0055	0.0002
3	I	ph.	20410.053	(0.100)	-3124.0	(1.0)	0.0131	0.0090
3	I	ph.	21400.503	(0.100)	-2714.0	(1.0)	0.0324	0.0296
3	I	ph.	22656.642	(0.100)	-2194.0	(1.0)	0.0154	0.0141
3	I	ph.	23405.488	(0.050)	-1884.0	(2.0)	-0.0009	-0.0013
7	I	ph.	26934.796	(0.025)	-423.0	(4.0)	-0.0081	-0.0053
7	I	ph.	27246.424	(0.016)	-294.0	(6.0)	-0.0034	-0.0004
7	I	ph.	27640.178	(0.025)	-131.0	(4.0)	-0.0060	-0.0028
7	I	ph.	28021.860	(0.050)	27.0	(2.0)	-0.0022	0.0013
7	I	ph.	28345.568	(0.020)	161.0	(5.0)	0.0041	0.0078
7	I	ph.	28741.728	(0.020)	325.0	(5.0)	-0.0082	-0.0043
7	I	ph.	29113.764	(0.050)	479.0	(2.0)	0.0123	0.0165
8	I	ph.	29478.498	(0.012)	630.0	(8.0)	-0.0220	-0.0177
9	I	ph.	29483.348	(0.010)	632.0	(10.0)	-0.0034	0.00097
7	I	ph.	29500.258	(0.033)	639.0	(3.0)	-0.0032	0.0011
7	I	ph.	29869.858	(0.050)	792.0	(2.0)	-0.0029	0.0016
7	I	ph.	30906.182	(0.100)	1221.0	(1.0)	-0.0077	-0.0027
7	I	ph.	31986.003	(0.100)	1668.0	(1.0)	0.0023	0.0075
7	I	ph.	32411.150	(0.033)	1844.0	(3.0)	-0.0112	-0.0059
7	I	ph.	32788.000	(0.100)	2000.0	(1.0)	-0.0080	-0.0026
10	I	VBU	42953.2052	(0.0010)	6208.0	(100.0)	-0.0037	-0.0018
10	II	VBU	43336.0970	(0.0020)	6366.5	(50.0)	0.0021	0.0037
11	I	V	44431.6083	(0.0008)	6820.0	(125.0)	0.0004	0.0010
11	I	B	44431.6087	(0.0009)	6820.0	(111.1)	0.0008	0.0014
12	I	V	46296.5126	(0.0048)	7592.0	(20.8)	-0.0038	-0.0053
12	I	B	46296.5120	(0.0060)	7592.0	(16.7)	-0.0044	-0.0059
12	I	U	46296.5106	(0.0065)	7592.0	(15.4)	-0.0058	-0.0073
12	I	V	46622.6362	(0.0006)	7727.0	(166.7)	0.0024	0.0005
12	I	B	46622.6356	(0.0049)	7727.0	(20.4)	0.0018	-0.0001
12	I	U	46622.6359	(0.0040)	7727.0	(25.0)	0.0021	0.0002

References: 1) Unknown; 2) Roberts 1895, 1896, 1901; 3) Dugan and Wright 1939; 4) Pickering 1904; 5) Wendell 1909; 6) Paddock 1916; 7) O'Connell 1949; 8) Gaposchkin 1953; 9) Redman 1945; 10) Kvíz 1979; 11) Mallama 1981; 12) De Laurenti and Cerruti 1988.

we give weight 3; A determination by Pickering (1904) published in DW's work and based on few scattered observations, to which we assign a weight of 0.3; Spectroscopic determination by Paddock (1916) to which we give weight 0.25, and determination by Gaposchkin (1953) from a mean photographic light curve based on 600 observations to which we give weight 8. The weights of the photoelectric times of minimum are related to their published standard deviation by weight $= 1/(10 \cdot \sigma)$.

All previous studies of the period of RS Sgr are based on photographic and visual observations. The last set of used observations was obtained in the forties. Although O'Connell (1949) concluded that the period of RS Sgr has decreased, the other period studies, *i.e.* Plavec *et al.* (1960), Wood and Forbes (1963) and Kreiner (1971), did not find evidences to support this concusion. Now we have at our disposal these minima together with the photoelectric ones determined by Kvíz (1979), Mallama (1981) and the authors (De Laurenti and Cerruti, 1988). Taking into account that the first observations were done in the past century we can give an improved period study based on 15160 cycles.

Table 2 lists the available times of minimum light with their associated standard deviations, cycles and weights. The columns labeled (O-C) and (O-C)' in Table 2 refer to residuals from linear and parabolic least squares solutions. They are also shown in Fig. 1.

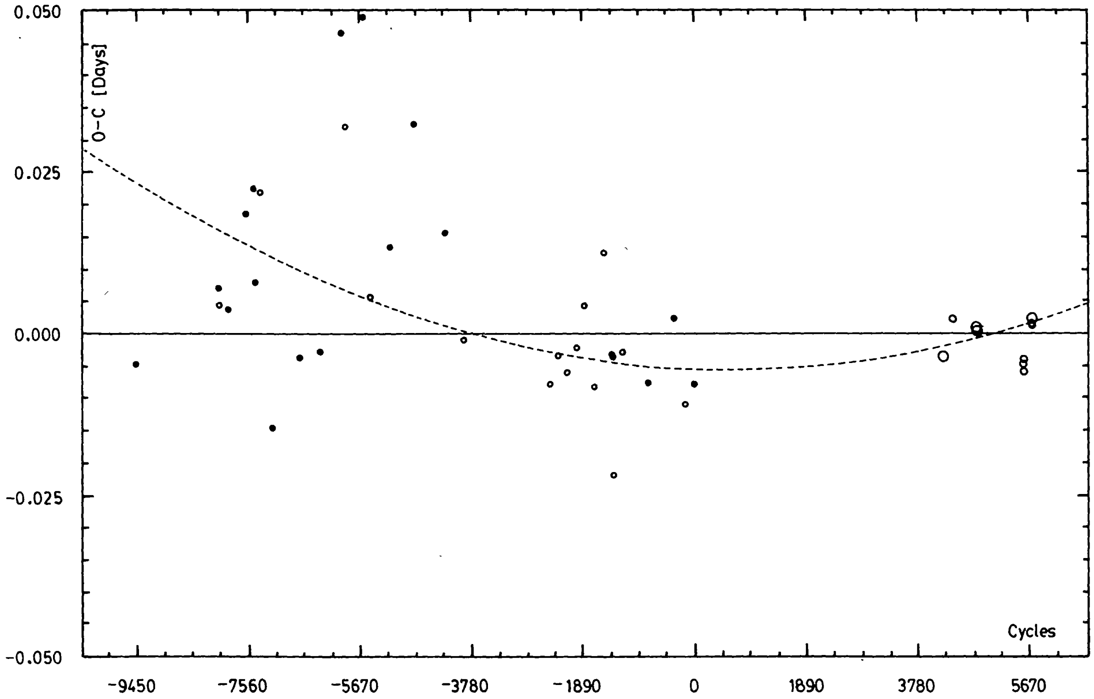

Fig. 1. Behavior of the O-C residuals for linear and parabolic ephemerides. A larger diameter of a circle in the diagram denotes a larger weight.

The second order least squares fit yields

$$\begin{array}{rllll}\text{Min I} = & \text{HJD } 24427956.6352 & + \; 2.41568311\,E & + & 2.86\cdot10^{-10}E^2 \\ & \pm0.0019 & \pm0.00000047 & & \pm0.74\cdot10^{-10}\text{m.e.}\end{array}$$

The mean error for unit weight is 0.017 in the parabolic solution and 0.020 in the linear solution. The coefficient of E^2 is about three times its mean error so formally the inclusion of this term is justified. The period of RS Sgr has increased by about $0.87\cdot10^{-5}$ in the cycles covered by the observations.

4. Absolute Dimensions

The determination of absolute dimensions is straightforward when we deal with double lined eclipsing binaries. From the spectrographic (Ferrer and Sahade 1986) and photometric (Kopal 1956) orbital elements we derived semi-mayor axis of the orbits, masses and radii in solar units. The error of K_2 was estimated from Figure 4 of Ferrer and Sahade (*op. cit.*). We adopted $6.957\cdot10^5$ km for the solar radius.

Effective temperatures of the components were inferred from their spectra (Schmidt-Kaler 1982). Also the effective temperature of the less massive component was obtained from the effective temperature of its mate and the radio of the intensities of the components corrected from reflection (Koch *et al.* 1970). It was obtained a value of 10350 K thus implying a spectral type B9.5 for the less massive component, about two subclasses earlier than the spectral type listed in Table 3.

In Table 3 are displayed the absolute dimensions of RS Sgr together with the spectrographic and photometric orbits and related parameters characterizing their evolutionary status. These parameters are the current luminosities of the components minus the luminosities at the theoretical ZAMS for $X = 0.71$, $Z = 0.02$ (Iben 1967) for current mass and current effective temperature. Also the current radii of the components minus the radii at the theoretical ZAMS for the same chemical composition as above (Plavec 1968) for current mass, are given. Between brackets are given the differences between the ZAMS and the TAMS (end of core hydrogen burning) at the point under consideration.

5. Discussion and Conclusions

In Fig. 2 we compare the relative dimensions of the components of RS Sgr with their corresponding critical equipotential surfaces (Plavec and Kratochvil 1964). The percentage of the Roche lobe fillings are 69% and 86% for the more massive and less massive components, respectively. From the δ's values quoted in Table 3 it is inferred that the more massive component,

Table 3

Parameters characterizing the systems of RS Sgr and u Her

Quantity	RS Sgr	Ref	u Her	Ref
$\mathcal{M}_1[\mathcal{M}_\odot]$	7.18±1.50		7.6±0.2	1
$\mathcal{M}_2[\mathcal{M}_\odot]$	2.41±0.35		2.8±0.1	1
$R_1[R_\odot]$	5.11±0.39		5.1±0.2	1
$R_2[R_\odot]$	4.10±0.31		4.2±0.3	1
$T_{\mathrm{eff}1}[^\circ K]$	15400±1500		20500±1500	2
$T_{\mathrm{eff}2}[^\circ K]$	8970±900		13550±1100	2
$a[R_\odot]$	16.06±1.02		14.66	3
$a_1[R_\odot]$	4.03±0.06		3.74	3
$M_{\mathrm{bol}1}$	-3.18±0.57		-4.2	4
$M_{\mathrm{bol}2}$	-0.30±0.57		-2.6	1
K_1 [km/s]	83.8±1.25	5	95.6±1.4	3
K_2 [km/s]	250±20	5	263±3	3
e	0.04±0.016	5	0.056±0.015	3
$\mathcal{M}_2/\mathcal{M}_1$	0.335±0.032		0.36±0.01	1
SpT_1	B5V	5	B2.5V	6
SpT_2	A2V	5	B5	6
P[days]	2.41568		2.0510	1
i[deg.]	82.5±0.6	7	78.20±0.36	2
r_1	0.318±0.004	7	0.329±0.019	2
r_2	0.255±0.003	7	0.286	2
r_{cr}	0.279		0.286	
Coef. E^2	$+(2.86\pm0.74)\cdot10^{-10}$		$+(1.32\pm0.72)\cdot10^{-10}$	4
$d\mathcal{M}_1/dt[\mathcal{M}_\odot/y]$	$+4.33\cdot10^{-8}$		$+3.2\cdot10^{-8}$	4
$\Delta M_{\mathrm{bol}1}$[eq.T_{eff}]	-2.04(1.63)		-1.17(1.86)	
$\Delta M_{\mathrm{bol}2}$[eq.T_{eff}]	-2.69(1.72)		-2.33(1.63)	
$\Delta M_{\mathrm{bol}1}$[eq.mass]	+0.62(0.63)		-0.12(0.56)	
$\Delta M_{\mathrm{bol}2}$[eq.mass]	-0.74(0.50)		-2.47(0.44)	
ΔR_1[eq.mass]	+2.23(2.77)		+2.12(2.94)	
ΔR_2[eq.mass]	+2.65(0.86)		+2.61(1.02)	

References: 1) Giuricin and Mardirossian, 1981; 2) Kovachev and Seggewiss, 1974; 3) Provoost, 1980; 4) Kreiner and Ziółkowsky, 1978; 5) Ferrer and Sahade, 1986; 6) Olson, 1968; 7) Kopal and Shapley, 1956.

taking into account errors in bolometric magnitude and effective temperature, may be seen as a main sequence star near the TAMS. Also taking into account errors in mass, it obeys the $M - L$ relation and it radius is comparable with the radius of a normal main sequence star. On the other hand the less massive mate is farther from the main sequence in the subgiant

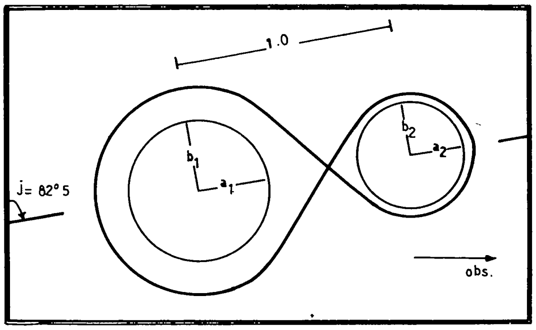

Fig. 2. Classical ellipsoidal model for RS Sgr (Koch *et al.* , 1970). Also is shown the section of the Roche critical surface for q=0.335.

region; taking into account errors in bolometric magnitude and mass, it also appears to obey the $M - L$ relation and its radius, compared with a main sequence star of the same mass, is about two solar radii in excess.

Therefore we deal with a system where the more massive component is well inside its Roche lobe and looks like a normal main sequence star, while its mate, less massive and cooler, nearly fills its Roche lobe and being overluminous and oversized appears to be more evolved than its companion. (We will do not discuss in this paper the undersize subgiant phenomenon, probably a modern photometric solution would render a contact configuration for this component). We conclude therefore that RS Sgr may be classified as a massive Algol-like or sd system with a hot secondary, although the less massive component do obey the $M - L$ relation and is of smaller size than its companion, thus producing a transit at primary eclipse instead of an occultation.

The small variation of period deduced above, $\mathrm{dlnP/dt} = 3.58 \cdot 10^{-8}\mathrm{y}^{-1}$, corresponds to the time scale of period changes of $2.79 \cdot 10^{7}$ years. The amount of mass transferred per year in the conservative case from the less massive component onto the more massive one, derived according to Kreiner and Ziółkowski's (1978) formula, is listed in Table 3.

With initial mass ratio $\mathrm{q_0} = 1(\mathrm{P_0} = 1.03)$, RS Sgr lies - in the conservative case - in the $\mathrm{M_0} - \mathrm{P_0}$ plane (Giuricin and Mardirossian 1981) between the ZAMS and AB lines implying case A (Paczyński, 1971) of mass transfer. A change from $\mathrm{q_0}=1$ to $\mathrm{q_0}=2$ $(\mathrm{P_0}=1.46)$ shifts the position of RS Sgr toward the AB line, thus suggesting case B or case AB of mass transfer. Allowing for the mass and angular momentum loss from the system we can compute initial parameters for RS Sgr following the Plavec *et al.* (1973) approach with convective envelopes. This model introduces two parameters f and $g = 1/q$ to account for the fractional mass and angular momentum lost from the system. This model appears to be more suitable than others for describing systems of intermediate and high total mass (Guiricin and

Mardirossian 1981). Values for initial total mass and period are listed in Table 4 for various fractions of mass loss and for $q_0=1$ and $q_0=2$:

Table 4

Initial total mass and period for RS Sgr

f	0.1	0.3	0.5	0.7	0.9
$M_0(q_0=1)$	9.84	10.43	11.18	12.16	13.50
$M_0(q_0=2)$	10.02	11.09	12.58	14.82	18.56
$P_0(q_0=1)$	1.03	1.05	1.06	1.07	1.08
$P_0(q_0=2)$	1.40	1.26	1.08	0.87	0.62

For $q_0=1$ all the points fall well inside the band defined by the lines AB and ZAMS in the $M_0 - P_0$ plane and near its conservative value. For $q_0=2$ and for increasing f the values are shifted two the right owing to the increasing masses and to the bottom due to the decreasing periods. The first point falls onto the line AB, the other values in the case A region and only the last value (*i.e.* 18.56, 0.62) falls in the forbidden region *i.e.* below the ZAMS line. Thus RS Sgr, in agreement with Giuricin and Mardirossian (1981) and Giuricin *et al.* (1983a), is thought to be a post mass exchange object probably in the slow phase of evolution and is well represented either by a conservative model or a non conservative model assuming a initial mass ratio $q_0=1$ and also $q_0=2$.

Finally if one supposes that one solar mass is transferred during the slow phase of mass transfer then the time-scale associated with that phase would be $2.31 \cdot 10^7$ years. It would be very useful to compare this lifetime with that calculated in a conservative case A model ending in a configuration such as the actual observed.

Only for the sake of comparison we display in Table 3 parameters describing the system of u Her. This double-lined system have a well established sd nature (Söderhjelm, 1978) with photometric and spectroscopic orbits comparable to that of RS Sgr (primary minimum is also a transit). Their masses, radii and separation are also comparable . They differ in the effective temperatures and related quantities, both components of u Her are shifted to the hotter region by about 5000 K. u Her as RS Sgr is the principal component of a visual double (ADS 10449A). The number of cycles covered by the observations are also comparable (about 18000 for u Her and 15000 for RS Sgr), while the period change of u Her is none or small, as it is the case for RS Sgr (see Table 3). Differences relative to RS Sgr, as deduced from the

δ's values quoted in Table 3, are the following: The more massive component lies well inside the main sequence band and its mate does not obey the $M - L$ relation.

Variable incipient emission is observed in RS Sgr in H_α that suggests "that the system is an interacting binary, caught perhaps in the beginning of the mass outflow stage, before any drastic mass-loss transfer had taken place" (Ferrer and Sahade 1986), thus perhaps in our discussion on RS Sgr we should have considered, in agreement with this observational result, a null change in the period.

Algol-like systems with a B primary and a B or A secondary were searched for in the catalogue of Budding (1984). Systems known to have large period changes are: β Lyr, TU Mon and DM Per (Wood and Forbes, 1963) and V453 Sco (Kreiner and Ziółkowski 1978). On the other hand systems known to have small or no period changes are TW Cas and SV Tau (Kreiner 1971), V Pup, μ^1 Sco, λ Tau and Z Vul (Kreiner and Ziółkowski 1978), SX Aur and AF Gem (Wood and Forbes 1963), and MR Cyg and u Her (Söderhjelm 1978). The period variation of RU Mon and V356 Sgr is not well established. Other massive systems with hot secondaries found in Budding's catalogue are: AH Cep, HS Her, AU Mon, Z Ori and BM Ori. It would be very useful for future investigation to group this category of systems and compare their period changes, spectral features, status of primary minimum, evolutionary status, etc.

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