GEOS RR Lyr survey

Alain Klotz professeur Jean-François Le Borgne astronome Institut de Recherche en Astrophysique et Planétologie Toulouse, France **Oirap**



astrophysique & planétologie





Étoiles variables pulsantes à courte période de population I (vieilles étoiles)

Période 0.2-0.8 jour

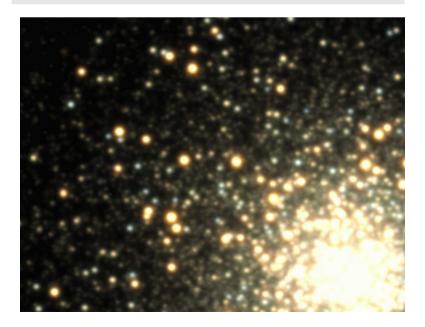
amplitude 0.3 à 2 magnitudes <Mv> +0.6 m (L ~ 50 Lo)

T 7400K – 6100K

Type spectral A2-F6 III < log g > 2.5 - 3.0 [Fe/H] -2.5 - 0.0

Masse ~0.7 Mo

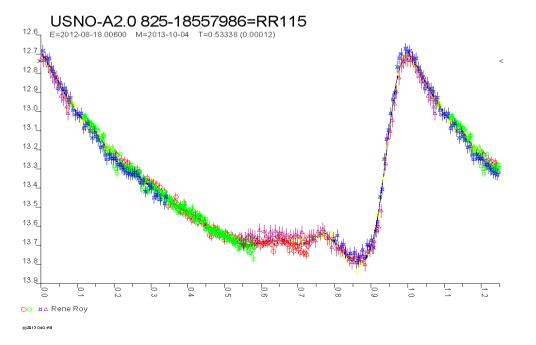
Rayon $\sim 4-6 \text{ Ro}$



2 sous-groupes: **RRab** et les **RRc**

RRab: pulsent dans le mode radial fondamental, courbe de lumière asymétrique

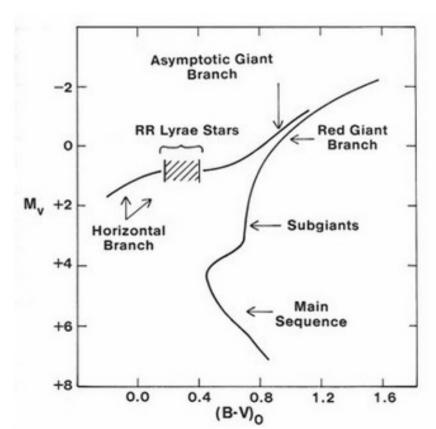
RRc: pulsent dans le mode du premier harmonique, courbe de lumière presque sinusoïdale avec une amplitude inférieure à 0.8 magnitude.

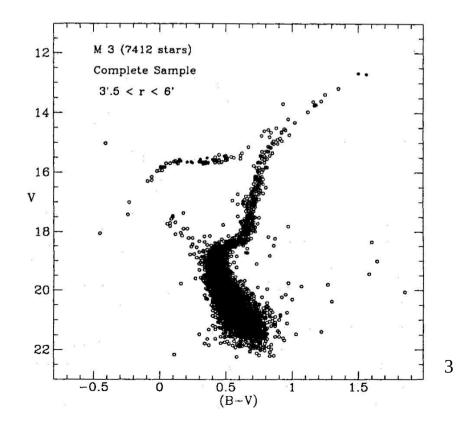


Évolution stellaire

Intersection de la « branche horizontale » et de la bande d'instabilité dans le diagramme d'Hertzsprung–Russell.

Branche horizontale: combustion de l'hélium



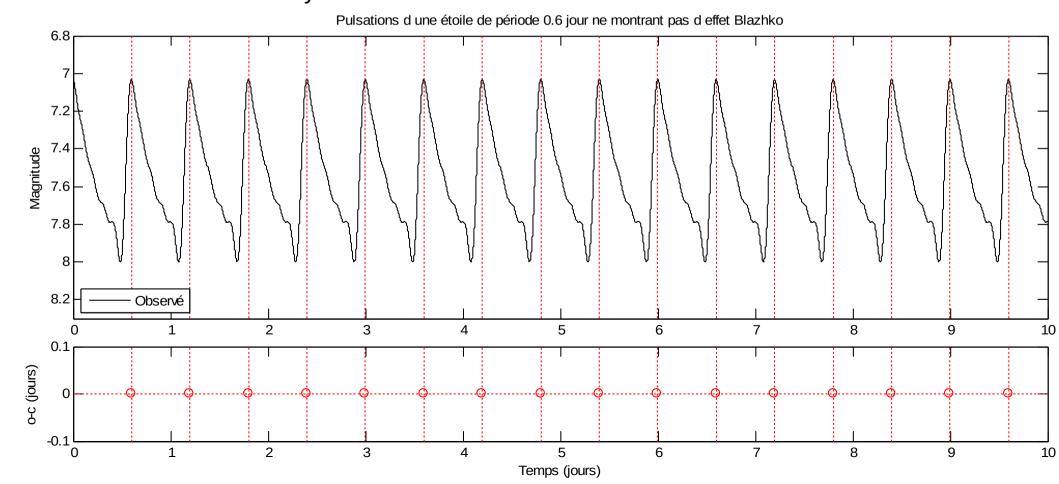


Pulsations

Variation du diamètre de la photosphère. Variation de la température de surface (onde de choc).



Williamina Fleming Découverte de l'étoile RR Lyr

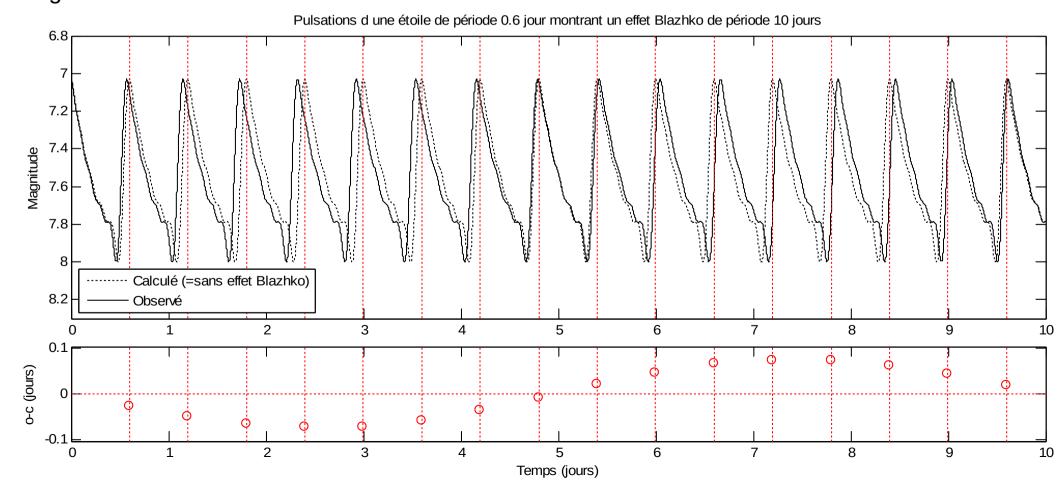


Effet Blazhko

Variation d'amplitude et de période: pulsation doublemode et effet Blazhko (Blazhko, 1907).

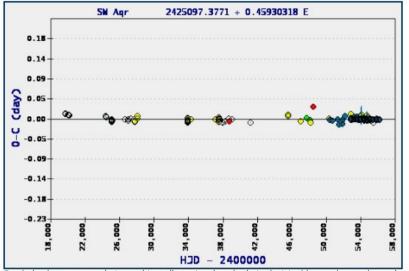


Сергей Николаевич Блажко Sergei N. Blazhko



GEOS RR Lyr Database

169 maximums



Symbol colors: green: photographic; yellow: visual; red: photoelectric; bleu: ccd; no color: unknown

Plot O-C as function of	• нјр	Oycle number	Submit
	200000000000000000000000000000000000000		

2452893.0260	0.002	-0.002	60517	0
2452902.6721	0.0013	-0.001	60538	0
2452929.3140		0.001	60596	0
2452966.9730		-0.002	60678	0
2453209.4910		0.003	61206	0
2453226.4830	0.005	0.001	61243	0
2453239.8017	0.0013	0.000	61272	0
2453250.3660		0.000	61295	0
2453254.5050	0.005	0.006	61304	0
2453265.9810	0.003	-0.001	61329	0
2453315.5860	0.0013	-0.001	61437	0
2453570.5050	0.005	0.005	61992	0
2453581.5220	0.003	-0.001	62016	0
2453587.4970	0.002	0.003	62029	0
2453598.5200	0.002	0.003	62053	0
2453616.4290	0.002	-0.001	62092	0
2453672.0043	0.0018	-0.002	62213	0
2453729.8760		-0.002	62339	0
2453936.5640	0.002	-0.000	62789	0
2453942.5360	0.002	0.001	62802	0
2453948.5060	0.003	-0.000	62815	0
				-

ebscher et al., 1991	G. Maintz	vis	
parcos,1997	Hipparcos	pe	filter V, not to be used
ebscher et al., 1999	M. Dahm	vis	
erer, Huebscher, 1998a	W. Kleikamp	ccd	
erer, Huebscher, 1998b	W. Kleikamp	ccd	
aschke, 2004, private com.	Rotse	ccd	normal max.
s et al., 2006	Rotse	ccd	normal max.
ebscher, 2001	R. Meyer	vis	
erer, Huebscher, 2002	G. Maintz	ccd	
erer, Huebscher, 2002	W. Kleikamp	ccd	
aschke, 2004, private com.	ASAS	ccd	normal max.
ebscher, 2005b	A. Paschke	ccd	
ebscher, 2005a	R. Meyer	vis	
e Borgne et al., 2008c	N. Butterworth	ccd	Filter V; Data from AAVSO database
amolyk, 2010	G. Samolyk	ccd	V filter
luebscher, 2005b	K. Poschinger	ccd	-lr
enji Hurosawa, 2012	Kenji Hurosawa	vis	
luebscher J., 2005c	R. Meyer	vis	
e Borgne et al., 2005a	Tarot - Calern	ccd	
amolyk, 2010	G. Samolyk	ccd	V filter
luebscher J., 2005c	R. Meyer	vis	
e Borgne et al., 2005a	Tarot - Calern	ccd	
e Borgne et al., 2008c	N. Butterworth	ccd	Filter V; Data from AAVSO database
amolyk, 2010	G. Samolyk	ccd	V filter
e Borgne et al., 2006a	Tarot - Calern	ccd	
e Borgne et al., 2006a	Tarot - Calern	ccd	
e Borgne et al., 2006a	Tarot - Calern	ccd	
e Borgne et al., 2006a	Tarot - Calern	ccd	
e Borgne et al., 2006a	Tarot - Calern	ccd	
e Borgne et al., 2008c	N. Butterworth	ccd	Filter V; Data from AAVSO database
enji Hurosawa, 2012	Kenji Hurosawa	vis	

Tarot - Calern

Tarot - Calern

Tarot - Calern

ccd ccd

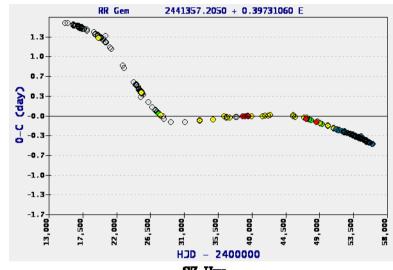
ccd

Le Borgne et al., 2007a

Le Borgne et al., 2007a

Le Borgne et al., 2007a

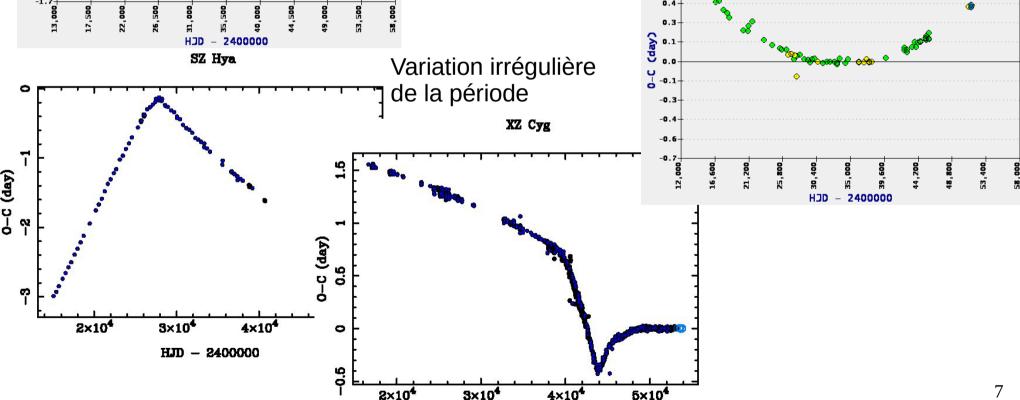
GEOS RR Lyr Database



Variation de période à long terme

Variation parabolique des O-C : La période varie de façon constante

2437872.3900 + 0.46964739 E



-2400000

Analyse historique du suivi photométrique de RR Lyr

RR Lyr: magnitude 7-8, période 0.51 jour Effet Blazhko de période ~39 jours variable

1899-1950 : 102 max visuel + photographique

1950-1989 : 717 max photoélectrique 1982-2003 : 417 max visuel (GEOS)

2003-2008: 40 max CCD

2008-2014 : 333 max CCD Amateurs et VTT

2010-2013 : 1815 max CCD Kepler

Very Tiny Telescope

Instrumentation : VTT, Design : Alain Klotz

Camera CCD Audine kaf400 Téléobjectif 135mm F/2.8 Monture équatoriale HEQ5 GOTO Ordinateur portable Script AudeLA pour acquisition et traitements



Publication Pro-Am dans la revue professionnelle MNRAS

The historical vanishing of the Blazhko effect of RR Lyr from GEOS and Kepler surveys

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J. F. Le Borgne, <sup>1,2,3*</sup> E. Poretti, <sup>1,2,3,4</sup> A. Klotz, <sup>1,2,3</sup> E. Denoux, <sup>3</sup> H. A. Smith, <sup>5</sup> K. Kolenberg, <sup>6,7</sup> R. Szabó, <sup>8</sup> S. Bryson, <sup>9</sup> M. Audejean, <sup>10</sup> C. Buil, <sup>11</sup> J. Caron, <sup>12</sup> E. Conseil, <sup>13</sup> L. Corp, <sup>3,14</sup> C. Drillaud, <sup>13</sup> T. de France, <sup>14</sup> K. Graham, <sup>14</sup> K. Hirosawa, <sup>15</sup> A.N. Klotz, <sup>3</sup> F. Kugel, <sup>12</sup> D. Loughney, <sup>16</sup> K. Menzies, <sup>14</sup> M. Rodríguez, <sup>17</sup> and P. M. Ruscitti <sup>18</sup>
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¹Université de Toulouse; UPS-OMP; IRAP; Toulouse, France

²CNRS: IRAP: 14, avenue Edouard Belin, F-31400 Toulouse, France

³GEOS (Groupe Européen d'Observations Stellaires), 23 Parc de Levesville, 28300 Bailleau l'Evêque, France

⁴INAF-Osservatorio Astronomico di Brera, Via E. Bianchi 46, 23807, Merate (LC), Italy

⁵Michigan State University, Department of Physics and Astronomy, East Lansing, MI 48824, USA

⁶Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge MA 02138, USA

Instituut voor Sterrenkunde, K.U. Leuven, Celestijnenlaan 200D, 3001 Heverlee, Belgium

⁸Konkoly Observatory, MTA CSFK, Konkoly-Thege Miklós út 15-17, H-1121 Budapest, Hungary

⁹NASA Ames Research Center, Moffett Field, Mountain View, CA 94035, USA

¹⁰ Observatoire de Chinon, Astronomie en Chinonais, Mairie, Place du Général de Gaulle, 37500, Chinon, France

¹¹Observatoire de Castanet-Tolosan, 6 place Clémence Isaure, 31320, Castanet-Tolosan, France

¹²Observatoire Chante-Perdrix, Dauban, 04150 Banon, France

¹³ AFOEV (Association Française des Observateurs d'Etoiles Variables), Observatoire de Strasbourg 11, rue de l'Université, 67000 Strasbourg, France

¹⁴AAVSO (American Association of Variable Star Observers), 49 Bay State Rd., Cambridge, MA 02138, USA

¹⁵Variable Star Observers League in Japan (VSOLJ), 405-1003 Matsushiro, Tsukuba, Ibaraki 305-0035, Japan

¹⁶The British Astronomical Association, Variable Star Section (BAA VSS), Burlington House, Piccadilly, London, W1J 0DU, United Kingdom

¹⁷Alberdi 42 2F, 28029 Madrid, Spain

¹⁸ Osservatorio Astronomico B. Occhialini, Via G. Garibaldi 17, 67041 Aielli (AQ), Italy

Contribution totale 1899 – 2013 et variation de la période de pulsation

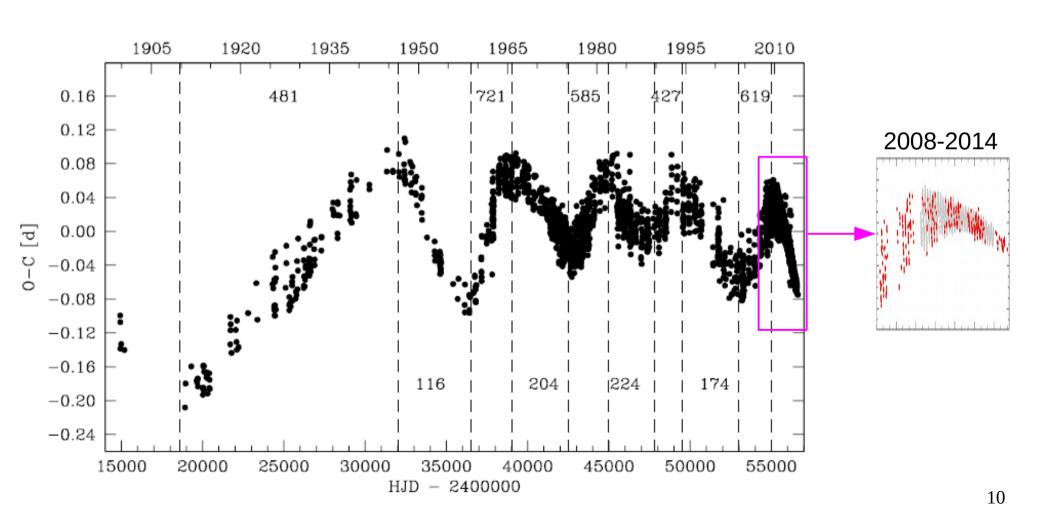


Figure 1. Historical behaviour of the period variations of RR Lyr. The numbers are the last three digits of the pulsational period calculated in each interval.

Contribution amateur entre 2008 – 2013 et disparition de l'effet Blazhko

Table 1. Observers and observing instruments.

Observer	Telescope	Detector
Maurice Audejean	Reflector 320mm	CCD
Christian Buil	Reflector 280mm	CCD^a
Emmanuel Conseil	Reflector 150mm	DSLR
Laurent Corp	Photographic lens	CCD
Eric Denoux	VTT	CCD
Eric Denoux	Reflector 280mm	CCD
Christian Drillaud	Refractor 70mm	DSLR
Thibault de France	Refractors 60mm and 80mm	CCD
Thibault de France	Reflector 130mm	CCD
Keith Graham	Reflector 200mm	CCD
Kenji Hirosawa	Photographic lens	DSLR
Alain and Adrien N. Klotz	VTT	CCD
F. Kugel and J. Caron	Photographic lens	CCD
F. Kugel and J. Caron	Refractor 80mm	CCD
Jean-François Le Borgne	VTT	CCD
Des Loughney	Photographic lens	DSLR
Kenneth Menzies	Reflector 317mm	CCD
Miguel Rodríguez	Refractor 60mm	CCD
Paolo Maria Ruscitti	Reflector 130mm	DSLR
Horace A. Smith and coll.	Reflector 600mm ^b	CCD

^aSynthetic photometry from low resolution spectra using Shelyak Alpy 600 spectrograph.

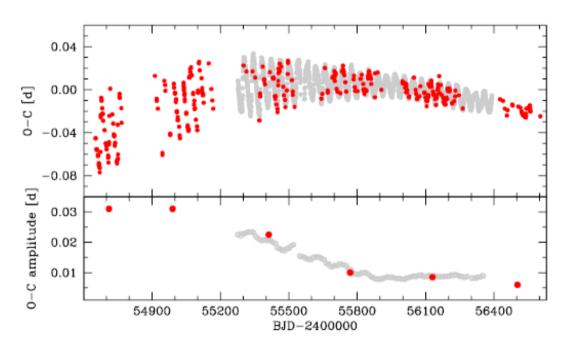


Figure 4. The changes in the Blazhko effect of RR Lyr from 2008 to 2013. Top panel: VTT (red filled circles) and *Kepler* (grey circles) O-Cs showing the strong decrease in amplitude.

^bTelescope at the Michigan State University campus Observatory (East Lansing, Michigan, USA) operated by H. Smith, with the help of Michigan State University students Charles Kuhn, James Howell, Eileen Gonzales, and Aron Kilian.

Contribution amateur entre 2008 – 2013 et disparition de l'effet Blazhko

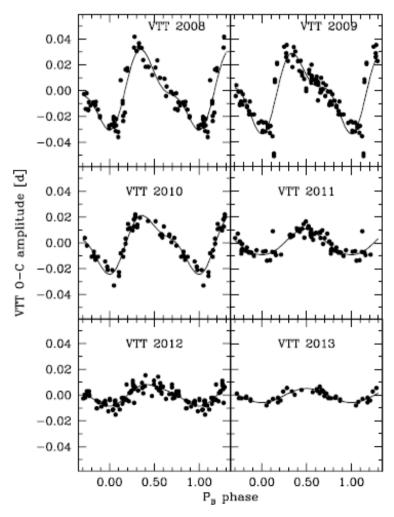


Figure 5. The decreasing amplitude of the O-C curves in the VTT data from 2008 to 2013.

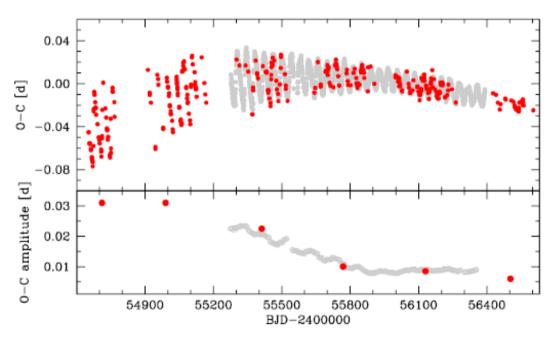
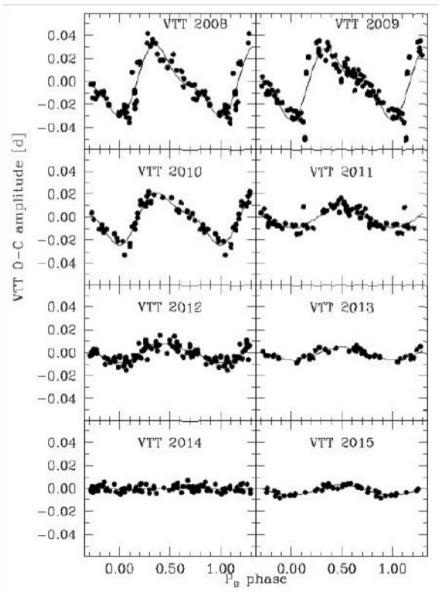


Figure 4. The changes in the Blazhko effect of RR Lyr from 2008 to 2013. Top panel: VTT (red filled circles) and *Kepler* (grey circles) O-Cs showing the strong decrease in amplitude.

Contribution amateur en 2014- 2015 et la réapparition de l'effet Blazhko



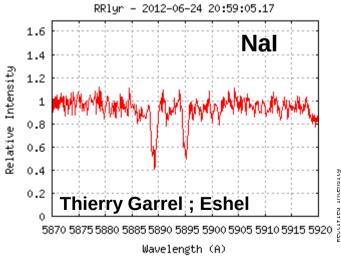
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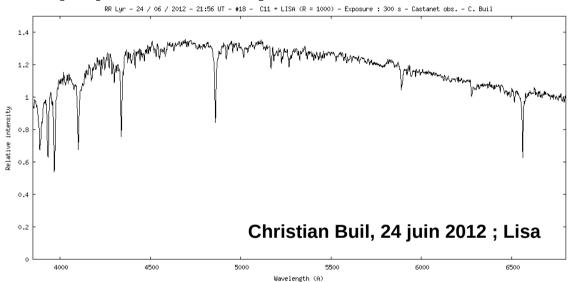
Suivi photométrique et spectroscopique de RR Lyr

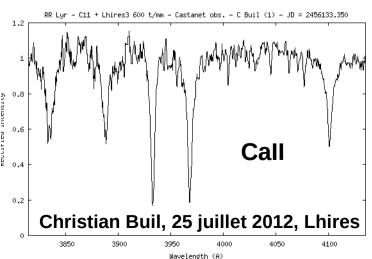
2012 : Spectroscopie

Variation de la température effective pendant la pulsation

Raies métalliques.

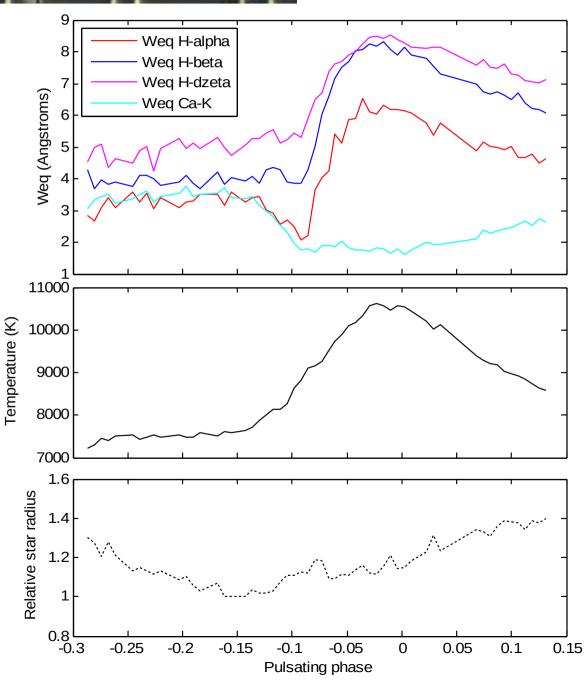








GEOS RR Lyr Survey



Contribution totale 1899 – 2014 et non correlation pulsation / Blazhko

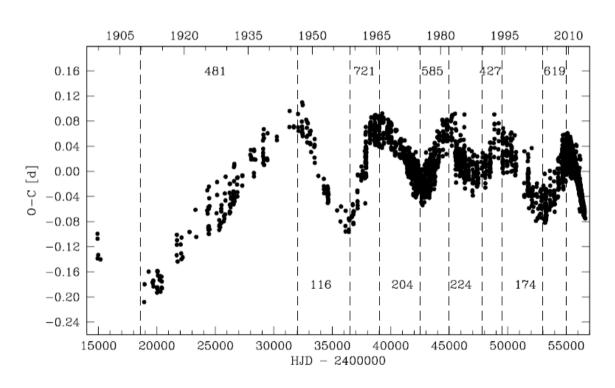


Figure 1. Historical behaviour of the period variations of RR Lyr. The numbers are the last three digits of the pulsational period calculated in each interval.

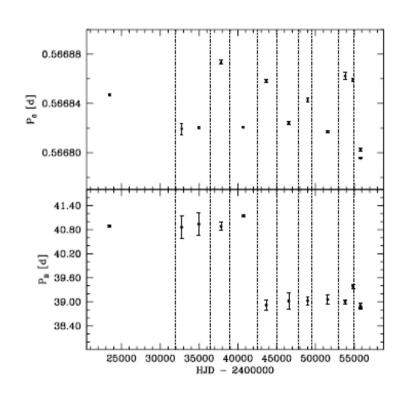


Figure 6. Uncorrelated variations of the pulsation period P_0 (top panel) and of the Blazhko period P_B (bottom panel). Time interval are the same as in Fig. [1]

http://rr-lyr.ast.obs-mip.fr/

Blazhko de l'étoile RR Lyr

Comment faire dans la pratique?

Pointer le champ RRLyr en début de nuit avec un grand champ (~2°) Pas besoin de filtre

Choisir un temps de pose pour que ça ne sature pas (quelques sec.) Faire la photométrie différentielle de l'étoile RRLyr

Evoyer le fichier texte (Jour julien, magnitude) à : jean-francois.leborgne@irap.omp.eu

Merci de votre contribution.