

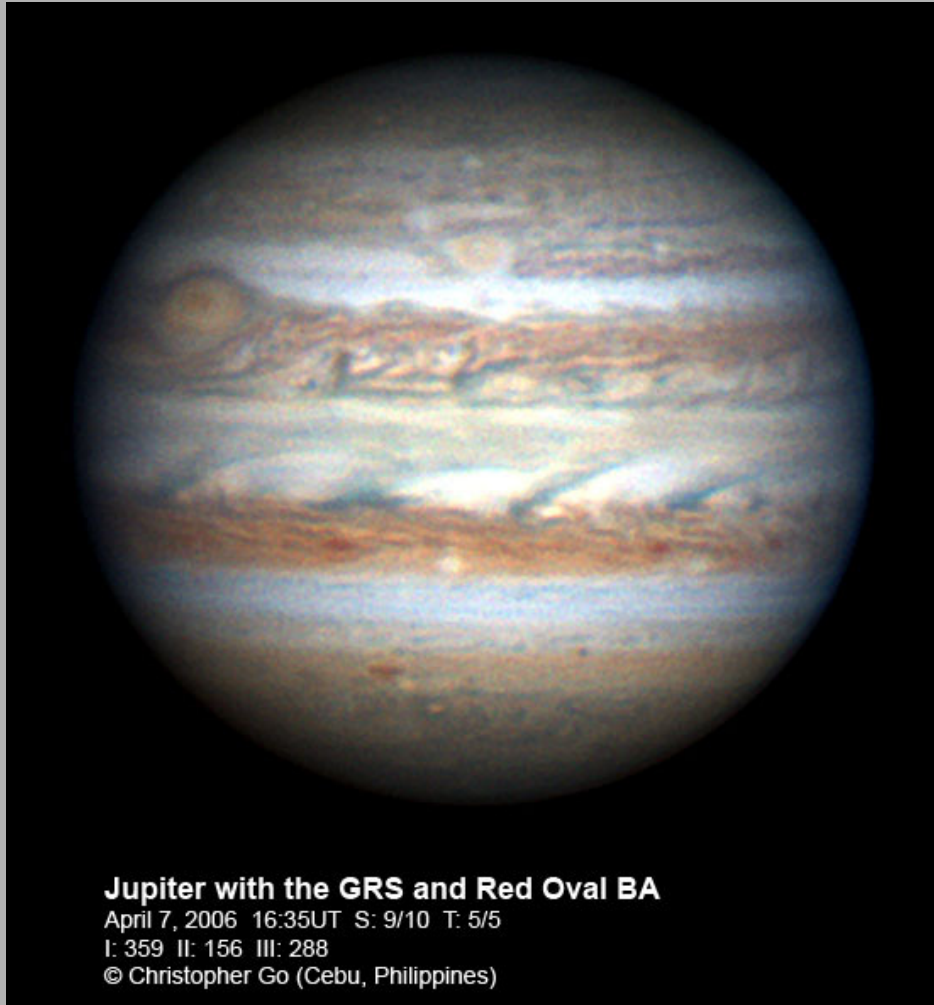
THE COOPERATION BETWEEN AMATEURS AND PROFESSIONALS IN PLANETARY ASTRONOMY

Christophe Pellier

Astronomical nights of Touraine, 7 juin 2013



AN HISTORICAL REVIVAL OF AMATEUR PLANETARY ASTRONOMY

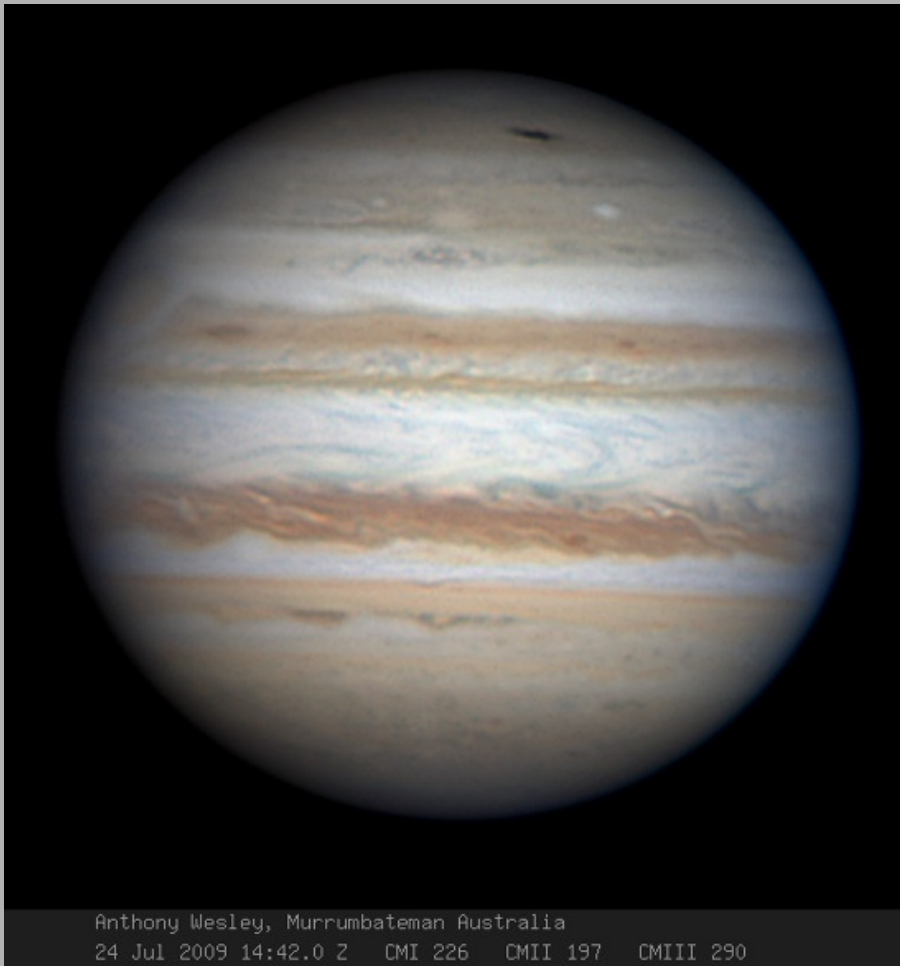


Jupiter with the GRS and Red Oval BA
April 7, 2006 16:35UT S: 9/10 T: 5/5
I: 359 II: 156 III: 288
© Christopher Go (Cebu, Philippines)

Since the 2000's, the amateur world has achieved some crucial observations that has been largely popularized

**Oval BA turning itself into a true Red Spot
(C.Go)**

AN HISTORICAL REVIVAL OF AMATEUR PLANETARY ASTRONOMY



**The « Bird Strike » in
2009 (Anthony
Wesley). First impact
trace image on Jupiter
since Shoemaker-Levy
in 1994**

Anthony Wesley, Murrumbateman Australia
24 Jul 2009 14:42.0 Z CMI 226 CMII 197 CMIII 290

2010 Aug 20 18h22m12s

CM1=336.7 CM2=165.2

Philips Toucam Pro2 Takahashi TA0-150 f1100mm with televue power mate X5

This image is made from 29frames(2sec) by Registax 4 software.



The bright spot on NEBn is possible fireball in Jovian Atmosphere

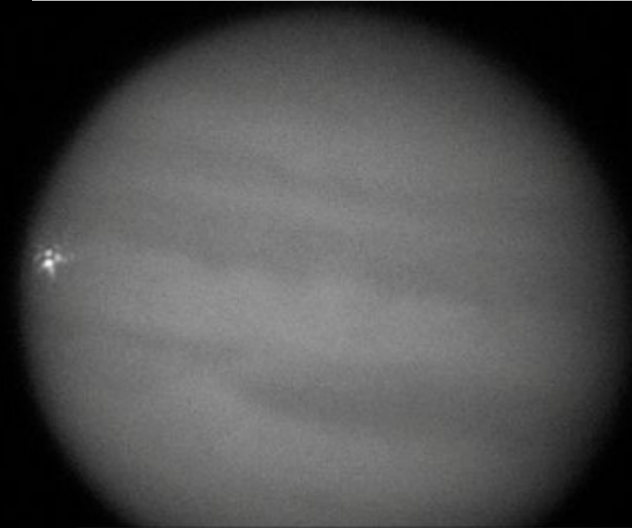
Observer: Masayuki Tachikawa (Kumamoto JAPAN)

Jupiter + Fireball

Anthony Wesley, Broken Hill Australia

3 Jun 2010 20:31.6 Z CM1 299 CMII 33 CMIII 209

**Live recording of
impacts (2010 and
2012) : Wesley,
Tachikawa, Hall**



THE DEVELOPING RELATIONSHIPS BETWEEN THE TWO WORLDS

The events detected by amateurs trigger observations from scientists

The HST imaging the now red Oval BA after the discovery by C.Go en 2006



HST and IRTF (Hawaiï) after the 2009 impact

Pre-existing atmospheric features near the impact site [Compilation by John Rogers, BAA]

Anthony Wesley, Murrumbateman Australia
17 Jul 2009 14:52.6 Z CMI 206 CMII 231 CMIII 322

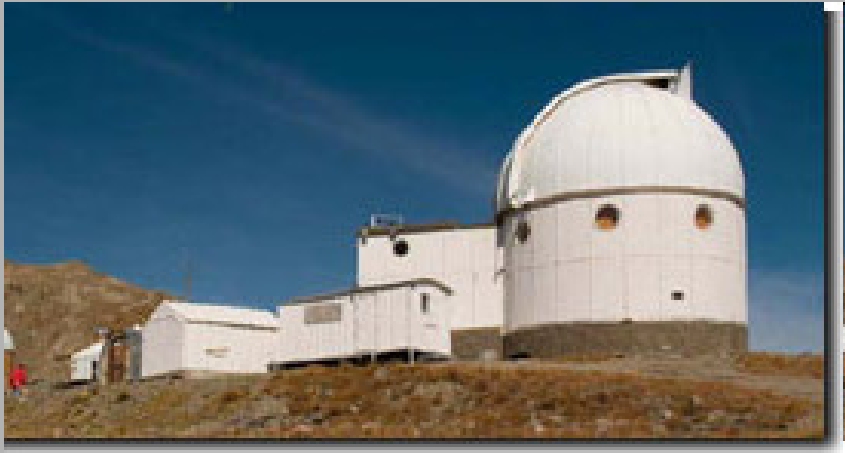
Anthony Wesley, Murrumbateman Australia
19 Jul 2009 16:43.8 Z CMI 230 CMII 239 CMIII 330

2009 July 22, ~13:30 UT
Gemini-N (MICHELLE), Hawaii
Mid-IR: 8.7 um (blue) & 9.7 um (yellow)
Inke de Pater (UC Berkeley), Heidi B. Hammel (Space Science Institute), Travis Rector (University of Alaska Anchorage), Gemini Observatory/AURA

July 23, 2009 ~19h UT
Hubble Space Telescope
Wide Field Camera 3
NASA, ESA, H. Hammel (Space Science Institute), and the Jupiter Impact Team

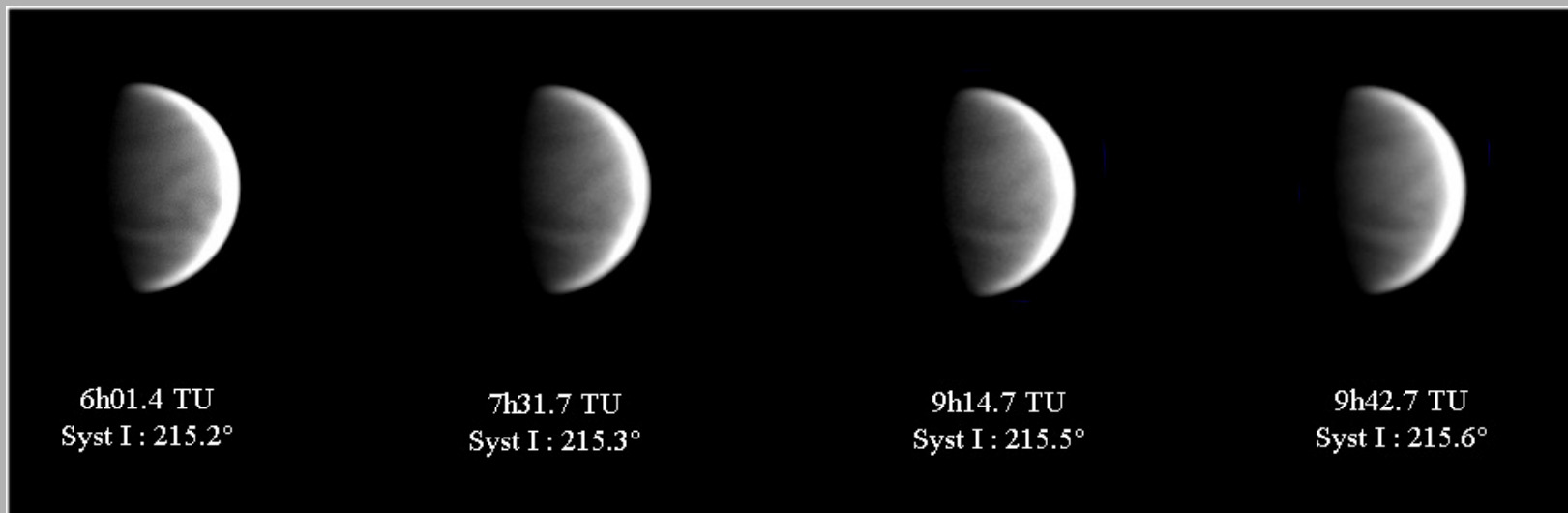
THE DEVELOPING RELATIONSHIPS BETWEEN THE TWO WORLDS

Amateurs now have some access to instrumentations of professional or semipro level



The Saint Véran Observatory,
Astroqueyras association (60 cm
cassegrain)

IR series of Venus images taken
by Giuseppe Monachino in
september 2012, that lead to
studies of the rotation of the
planet



6h01.4 TU
Syst I : 215.2°

7h31.7 TU
Syst I : 215.3°

9h14.7 TU
Syst I : 215.5°

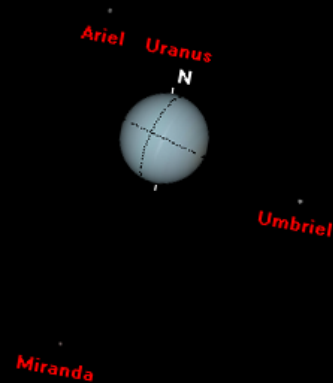
9h42.7 TU
Syst I : 215.6°

THE DEVELOPING RELATIONSHIPS BETWEEN THE TWO WORLDS

Amateurs now have some access to instrumentations of professional or semipro level

Uranus, October 6th 2012

Diam 3.7" - Elev 43°/37° - CM 46.7°/57.8°



D. Vernet - JP Prost, Calern - France
C2PU 1m - i-Nova PLA-Mx

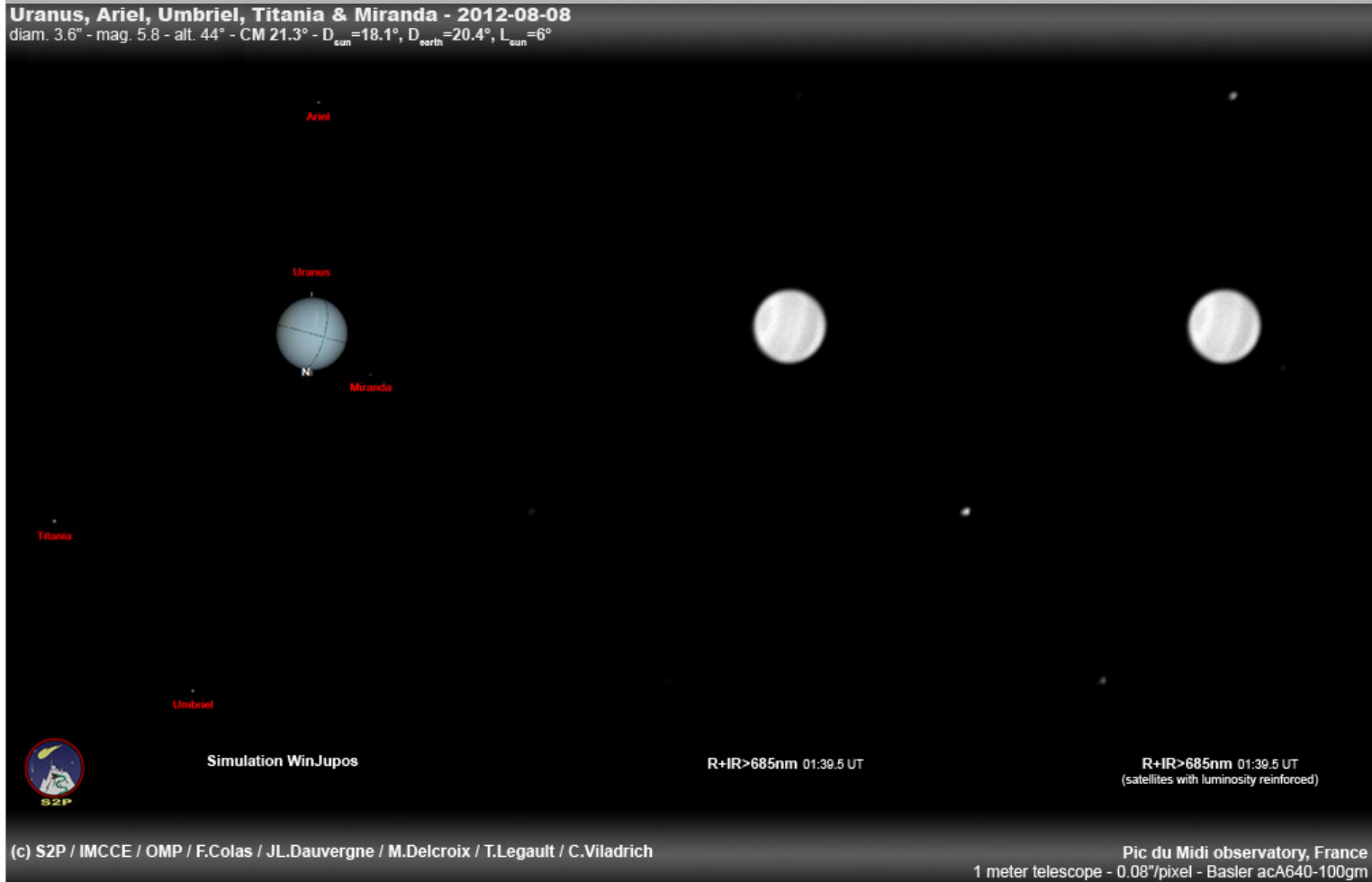
1-meter telescope of
the Calern
Observatory (C2PU)

Images of the IR belts
on Uranus in 2012, by
Jean-Pierre Prost and
David Vernet

THE DEVELOPING RELATIONSHIPS BETWEEN THE TWO WORLDS

Amateurs now have some access to instrumentations of professional or semipro level

Uranus, Ariel, Umbriel, Titania & Miranda - 2012-08-08
diam. 3.6" - mag. 5.8 - alt. 44° - CM 21.3° - $D_{sun}=18.1^\circ$, $D_{earth}=20.4^\circ$, $L_{sun}=6^\circ$



1 meter telescope of the Pic du Midi observatory

Again images of belts on Uranus in 2012, by a team composed by both amateurs and scientists (names on the set)

THE DEVELOPING RELATIONSHIPS BETWEEN THE TWO WORLDS

Some forums to meet and develop some common projects

The pro/am school of the CNRS and AUDE association at La Rochelle (every 3 years)

This is a forum of common projects on various topics. In 2012, for the first time, a session about the giant planets has been opened. We listened to orals from a scientist (Ricardo Hueso Alonso, Pais Vasco university), a science journalist (Jean-Luc Dauvergne, Ciel et Espace magazine) and one amateur (Marc Delcroix, President of SAF planetary observations commission)



THE DEVELOPING RELATIONSHIPS BETWEEN THE TWO WORLDS

Some forums to meet and develop some common projects

The 4th pro/am CNRS & AUDE School led in 2012 to a common project especially interesting under the direction of Olivier Mousis, scientist at the Besançon observatory : the writing of an article describing every possible field of cooperation between professionals and amateurs in planetary astronomy.

Co-written by almost 60 co-authors from both communities, it has been submitted to ***Experimental Astronomy***, a journal whose purpose is to publish papers dedicated to methods and instruments of scientific research in astronomy.

THE DEVELOPING RELATIONSHIPS BETWEEN THE TWO WORLDS

Some forums to meet and develop some common projects

The EPSC (European Planetary Science Congress) is a planetary science congress that gather every year scientists from Europe and from the rest of the world. Since 2012 (Madrid) a session has opened dedicated to amateur planetary astronomy.

This year (2013) the EPSC will take place in London. Orals will be (main speaker only) : Pro/am collaborations in planetary astronomy (F.Colas), Ground-based observations of Venus in near IR (C.Pellier), Digital daylight observations of planets with small telescopes (M. Kardasis), Jupiter's North equatorial belt (J.Rogers), Jovian impact flashes detection with DeTeCt (M.Delcroix), Low-phase-angle photometry of some Themis-family members and other asteroids (R.Miles)



A TOUR ON THE POTENTIAL OF EACH PLANET

Not all planets are equally interesting...

Here is a brief tour on their respective potential, and of the work actually in progress on them

VENUS

Venus is difficult to observe from Earth.

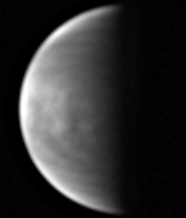
One space orbiter : Venus Express

Possibles observations:

- Long-term survey of cloud structures
- Rotation calculations in various wavelengths
- Thermal emission surface imagery and identification

Cooperation works in progress : none but some amateurs studies are conducted. An amateur oral will be performed at EPSC 2013

Venus - 28 March 2012 - $d = 23.9$ arcsec - Alt = 55°
Schuller UV filter

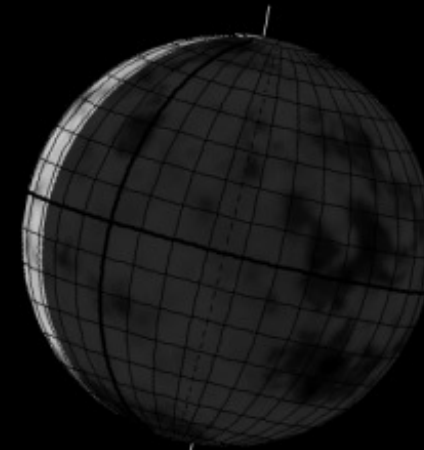
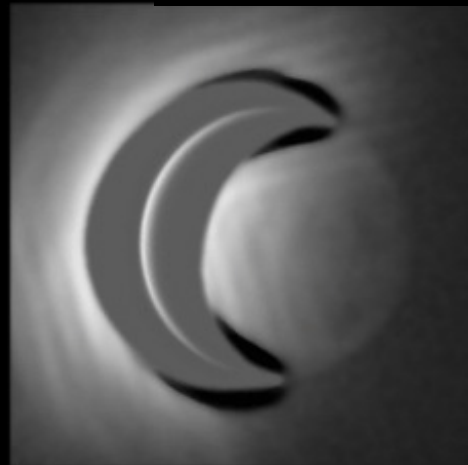


16:44:15 UT
 $I = 213.5^\circ$ - $II = 191.0^\circ$

S
WE
N

Takahashi TOA150 - F/D = 29 - Baader FFC
Basler 640 - gain = 700 - exposure = 7500 x 25 ms

Christian Viladrich



24 mai 2012 - $L1 = 325^\circ$

MARS

Mars is highly studied by scientists and benefits from most of the space exploration.

The potential of cooperation is therefore very weak, because professional tools don't need Earth-based instrumentations.

None the less, the article to be published in Experimental Astronomy encourages amateur to continue the historical survey from the ground for comparisons aims. Possibles observations are:

- Global survey of important dust activity
- Long-term survey of polar caps
- The monitoring of some particular phenomena (like the « high altitude cloud » of 2012).

Cooperation work in progress: none

MARS

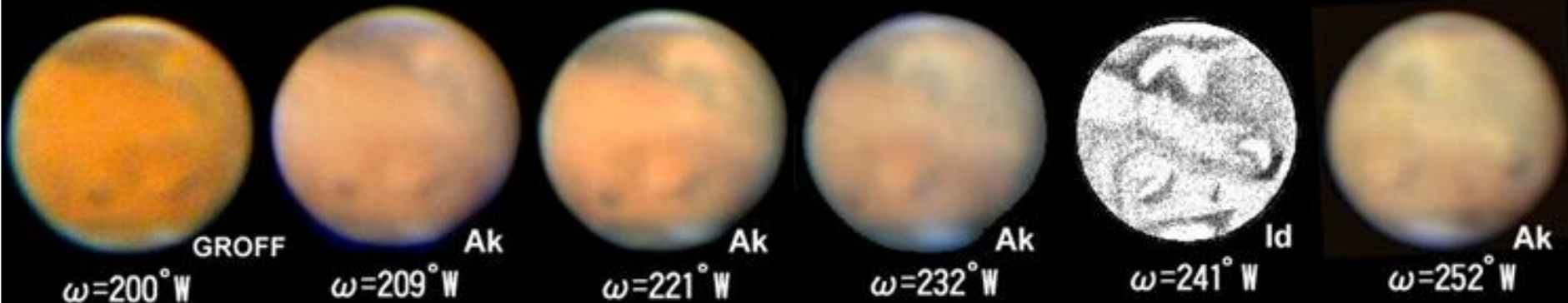


W. Jaeschke / 20 March 2012 / 2:51ut

*The « high altitude cloud »
observed in 2012
by W. Jaeschke*

*Start of the 2001 global storm –
rotation of dust clouds showing
no evolution during the period*

Dust cloud at M Cimmerium on 29 June 2001: Images by De GROFF, AKUTSU & ISHADOH



JUPITER

Without surprise, Jupiter is the planet that shows the best potential.

The context is important : there is currently no orbiter around Jupiter, and ground-based observations are the only possible ones. Their importance is strengthened by the coming arrival of JUNO in 2015.

Jupiter is a planet whose climate knows a few cycles several terrestrial years-long, but unexpected events are not rare.

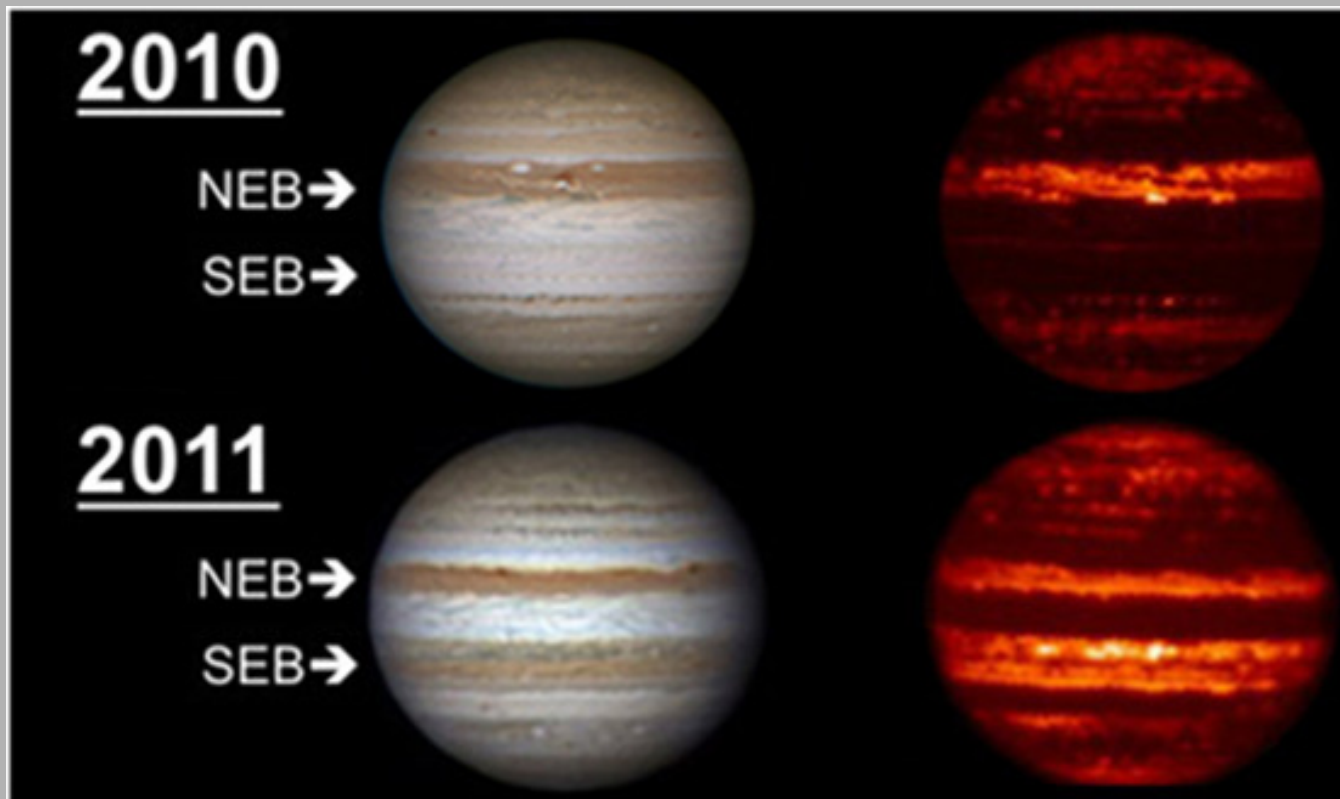
There are several cooperation works already published or still in progress. Some studies by John Rogers, director of the Jupiter section of the BAA, are published in scientific journals (Nature, Icarus).

JUPITER

Long-term cycles : the fading and revival of the SEB

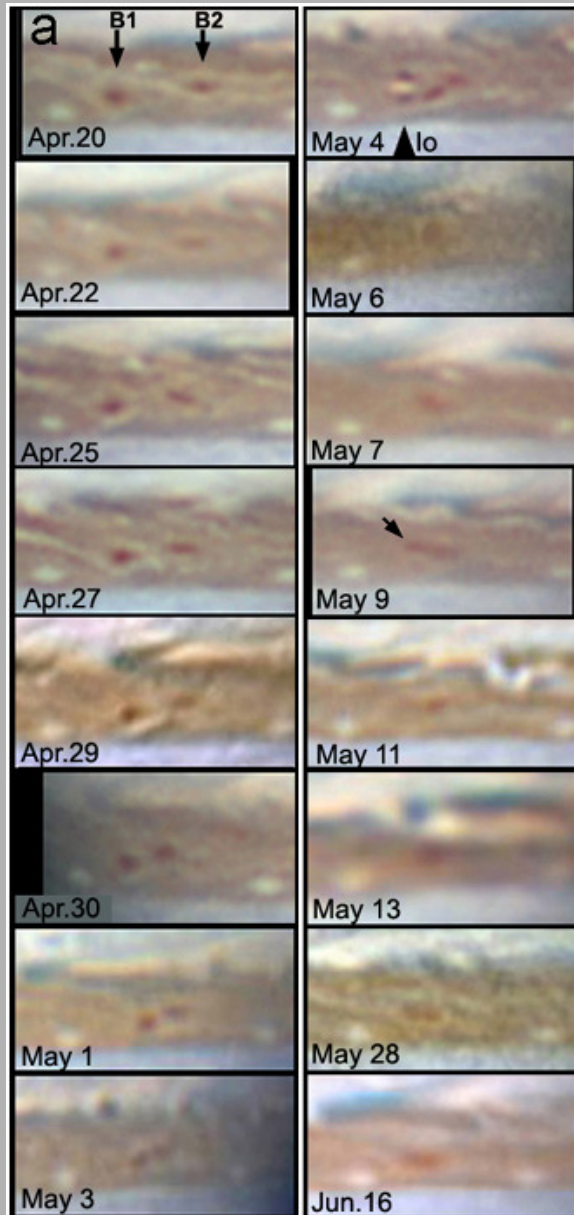
Example in Icarus : « Jovian Temperature and Cloud Variability during the 2009-2010 Fade of the South Equatorial Belt » (2011)

Fletcher L.N, Orton G.S, Rogers J.H, Simon-Miller AA, de Pater I, Wong M.H, Mousis O, Irwin PGJ, Jacquesson M, Yanamandra-Fisher



There are other cycles whose study is fed with amateur data : the NEB, NTB...

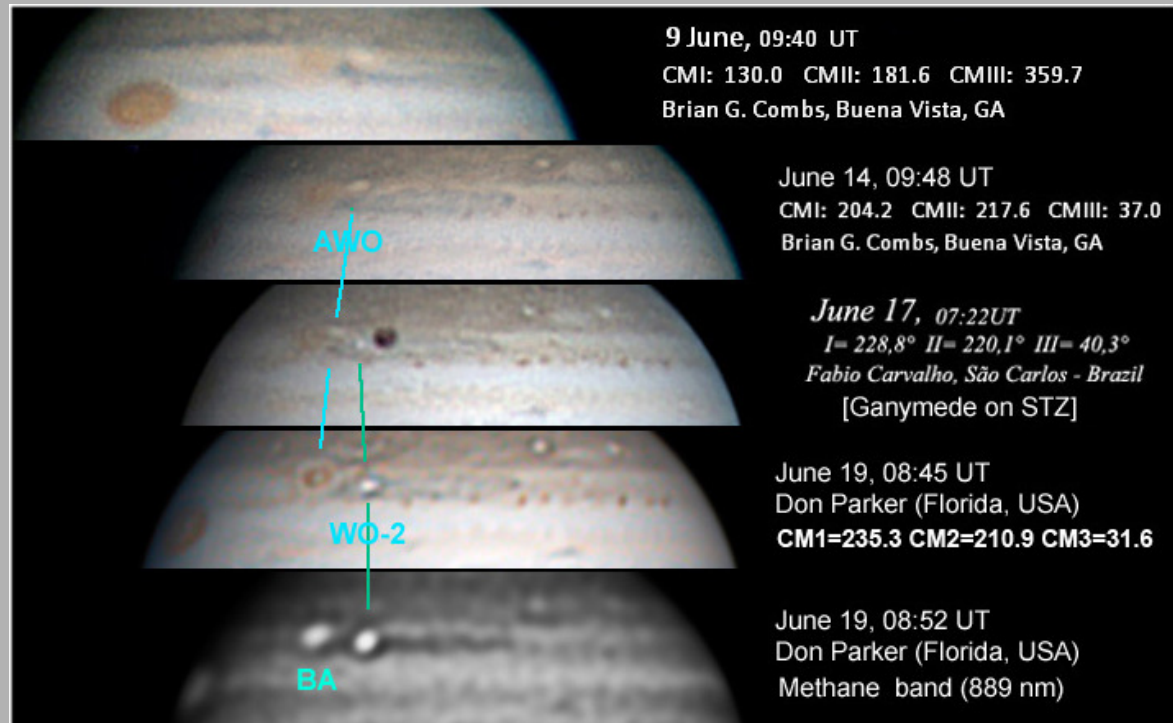
JUPITER



The dynamic of individual structures

Icarus : « Merging circulations on Jupiter: observed differences between cyclonic and anticyclonic mergers » (2006)

Rogers JH, Mettig H-J, Cidadão A, Sherrod PC, and Peach D



JUPITER

**Planetary impact flashes detection with DeTeCt software project/
Projet de détection de flash d'impacts planétaires avec le logiciel DeTeCt**

by/par [Marc Delcroix](#)



Currently 0 impact detection out of

Total 20 observers for a total observing duration of 6d 1h 41m 0,174s (7826 videos) from 2006/04/14 to 2013/04/11

Observer Trevor Barry (Australia) : duration of 1d 14h 43m 54,053s (2424 videos) from 2009/07/07 to 2012/12/30
Observer Marc Delcroix (France) : duration of 1d 9h 20m 0,851s (1393 videos) from 2006/04/14 to 2013/03/09
Observer Pascal Bayle (France) : duration of 0d 16h 47m 53,999s (1006 videos) from 2012/11/30 to 2013/03/03
Observer Paul Rolet (France) : duration of 0d 12h 43m 46,999s (442 videos) from 2012/09/07 to 2013/03/09
Observer Pascal Lemaire (France) : duration of 0d 10h 46m 55,768s (573 videos) from 2012/08/01 to 2013/02/16
Observer Flavius Isac (France) : duration of 0d 7h 47m 23,231s (546 videos) from 2011/08/12 to 2013/02/17
Observer Christophe Pellier (France) : duration of 0d 7h 38m 53,628s (311 videos) from 2012/02/20 to 2013/01/16
Observer Manos Kardasis (Greece) : duration of 0d 5h 12m 58,533s (323 videos) from 2010/06/09 to 2013/04/11
Observer Xavier Dupont (France) : duration of 0d 4h 21m 56,647s (220 videos) from 2012/08/16 to 2012/11/14

impacts

The permanent monitoring of the planet can lead to the detection of impact on the planet – they have been surprisingly numerous over the last years.

The DeTeCT project conducted by Marc Delcroix and Ricardo Hueso Alonso will try to evaluate the frequency of impacts, and makes available to amateurs a software that automatically detect flashes on recorded videos

SATURN

Saturn is the good surprise of the past decennium.

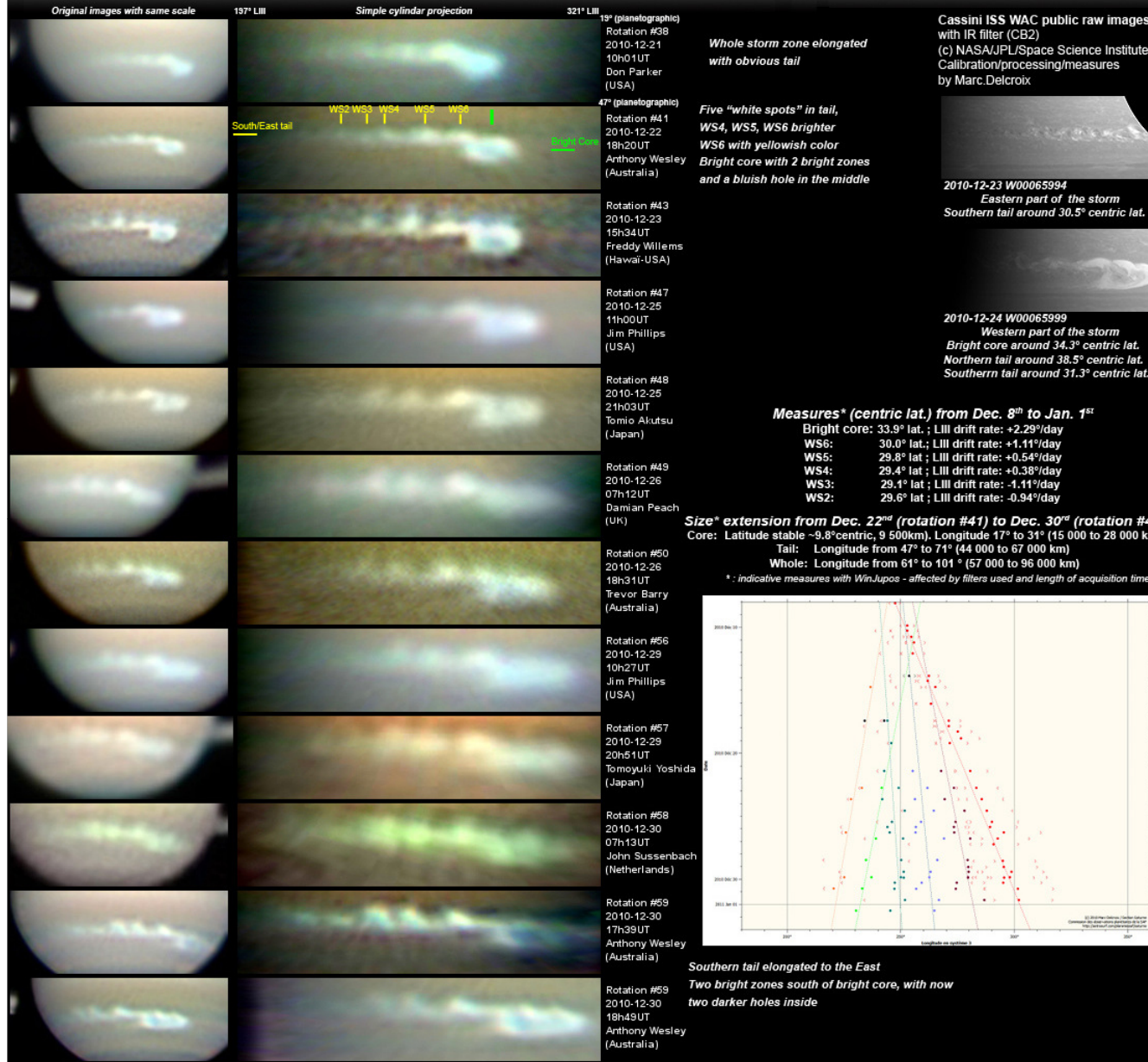
The planet as been long viewed as very little active, but it has been showing for the last 11 years a constant activity sometimes even spectacular, thanks to the always improved amateur images and to the presence of the Cassini orbiter since 2004.

Amateur data is good enough to follow in detail the big storms, and scientists are still asking for a global monitoring from Earth.

SATURN

Saturn's 2010 Giant North Tropical Storm evolution - December 21st-December 30th, 2010

images sent to author, or from SAFI/ALPO Japan, compiled/scaled/reprocessed on 2011/01/10 by Marc Delcroix, Société Astronomique de France (delcroix.marc@free.fr - <http://astrosurf.com/planetessaf/saturne>)



Evolution of the Great 2010-2011 storm on amateur images.

All phases of the storm are visible on amateur data, from the start to the end.

Compiled and analysed by Marc Delcroix

LE POTENTIEL DE CHAQUE PLANETE : SATURNE

Many science articles have been published about this storm with an important use of amateur material.

Screen-shot of a *Nature* paper in 2011 : « Deep winds beneath Saturn's upper clouds from a seasonal long-lived planetary-scale storm »

RESEARCH LETTER

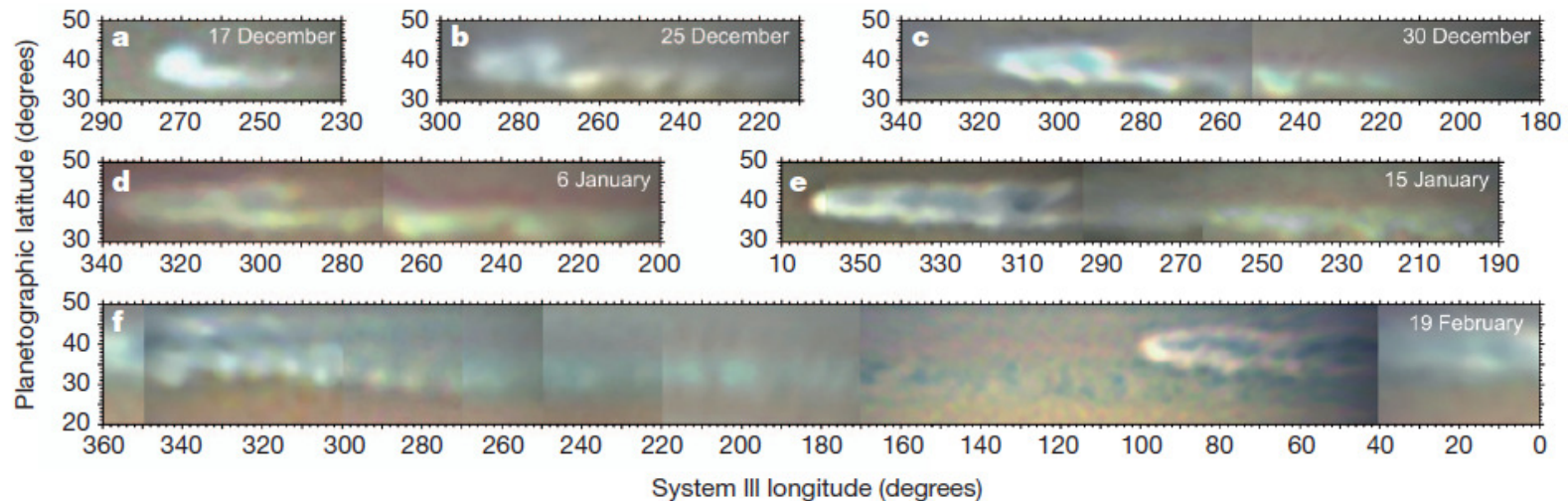


Figure 2 | Expansion of the storm clouds and the planetary-scale disturbance. Maps were made by assembling images from different observers (see Supplementary Information). The storm head moved westward (left in the maps), and showed a bow shape consistent with the meridional zonal wind profile. a–c, The bright clouds forming the southern branch of the disturbance (between latitudes 38° and 30° N, in a region of cyclonic vorticity) progressed eastward. Later on 22 December, a northern branch developed (latitudes 40° to 45° N, anticyclonic vorticity), which also progressed eastward (d, e). In about two months the disturbance encircled the planet, and the southern branch

elements, moving in the opposite direction, encountered the head of the storm on 29 January, 4° southward in latitude (f). The eastward expansion in longitude of the disturbance's central branch (between latitudes 40° and 42°) formed dark spots, one of which was persistent (probably an anticyclonic vortex) at latitude $41.9^\circ \pm 1.3^\circ$ (s.d.) with a size of $\sim 4,000$ km (System III longitude 308° in e). Small bright spots in the southern part of the disturbance at latitudes 35° to 38° N showed a periodic distribution with a dominant zonal wavelength of $15.7^\circ \pm 3^\circ$ (b–f) and survived for a maximum of approximately two weeks.

URANUS

15 septembre 2012



Dia 3,7"
Mag 5,7
Alt 46°
De +19,2°



23H45
87,7°



23H57
91,9°



simulation

IR 685

Pascal Bayle, Lavergne
sc 355, f/d=2.8
pla-mx

Uranus is the new frontier of amateur astronomy : we are now observing belts without doubts, and maybe the biggest storms could be accessible as well



Uranus in infrared

T1M / PIC DU MIDI OBSERVATORY

August 10 th 2011 at 2h40




HOW TO PARTICIPATE ? THE EQUIPMENT

- The instrument : ideally 300 to 400 mm, 250 mm is a minimum. But most of observations can be made with smaller instruments.
- The camera : a b&w camera is better, with filters, but a color cam will work for most of topics.
- Filters : a LRGB set, a R+IR and/or an IR-pass. UV and CH4 filters can be used for advanced observers.
- Softwares : all the best ones can be downloaded for free on the web. Registax, Avistack, Autostakkert, and WinJupos




HOW TO PARTICIPATE ? THE AMATEUR NETWORKS

The SAF Committee of planetary observations : a webpage, and a Yahoo group



The screenshot shows the homepage of the SAF Committee of planetary observations. At the top, there is a navigation bar with links: "Accueil planetessaf", "Ressources", "Acquisition et traitement", and "Soumettre vos images" with a UK flag icon. The main content area features a welcome message in French: "Bienvenue sur le site de de la commission des observations planétaires de la Société Astronomique de France !". Below this, it states: "Vous trouverez sur ce site les observations des planètes qui nous sont parvenues, les rapports produits, des informations diverses, ainsi que des conseils en acquisition et traitement. Bon surf, et n'oubliez-pas de nous soumettre vos images!". There are six main sections, each with a planet image and a label: "section VENUS" (Venus), "section MARS" (Mars), "section JUPITER" (Jupiter), "section SATURNE" (Saturn), "URANUS, NEPTUNE et PLANETES NAINES" (Uranus, Neptune, and Dwarf Planets), and "OCCULTATIONS, ECLIPSES et PASSAGES" (Occultations, Eclipses, and Passages). At the bottom, there is a link to the SAF website: "La commission des observations planétaires, qu'est-ce que c'est?", a call to join the Yahoo group: "rejoignez le groupe de discussion Yahoo Planetes-SAF pour échanger et partager vos images !", and a "nouveautés du site..." section with two entries: "06/04/2013 Présentations et photos de la réunion de la commission des observations planétaires 2013 du 23.03.2013 NEW!" and "16/11/2012 Détectez des impacts sur vos vidéos planétaires, et participez à un projet d'estimation de fréquence de ses impacts, avec le logiciel DeTeCt et son tutorial par M.Delcroix NEW!".

*commission des
OBSERVATIONS
PLANÉTAIRES de la SAF*

Accueil planetessaf Ressources Acquisition et traitement Soumettre vos images 


Bienvenue sur le site de de la commission des observations planétaires de la Société Astronomique de France !

Vous trouverez sur ce site les observations des planètes qui nous sont parvenues, les rapports produits, des informations diverses, ainsi que des conseils en acquisition et traitement. Bon surf, et n'oubliez-pas de nous soumettre vos images!

section VENUS *section MARS* *section JUPITER*

section SATURNE *URANUS, NEPTUNE
et PLANETES NAINES* *OCCULTATIONS,
ECLIPSES et PASSAGES*

[La commission des observations planétaires,
qu'est-ce que c'est?](#)

rejoignez le groupe de discussion
Yahoo Planetes-SAF pour échanger
et partager vos images ! 

nouveautés du site...

06/04/2013 [Présentations et photos de la réunion de la commission des observations planétaires 2013](#) du 23.03.2013 **NEW!**
16/11/2012 [Détectez des impacts sur vos vidéos planétaires, et participez à un projet d'estimation de fréquence de ses impacts, avec le logiciel DeTeCt et son tutorial](#) par M.Delcroix **NEW!**

<http://fr.groups.yahoo.com/group/planetes-saf/>

HOW TO PARTICIPATE ? THE AMATEUR NETWORKS

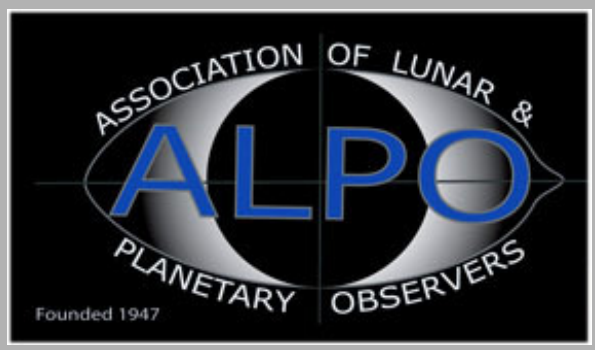
Welcome to the Communications in Mars Observations



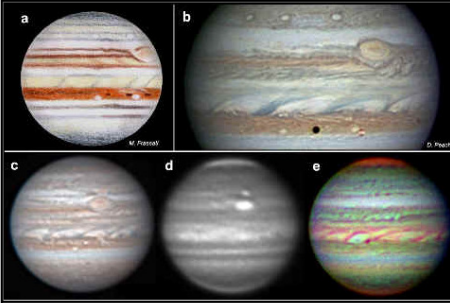
CMO
 Issued by
 the International Society of the Mars Observers
 (ISMO)

Many amateur groups are doing an excellent work dedicated to planetary observations apart of the SAF.

Reading and following their work give access to a high level of information particularly adapted to amateurs



BRITISH ASTRONOMICAL ASSOCIATION
 JUPITER SECTION



Some recent views of the giant planet (all with south up):

(a) Drawing by Mario Frassati (Italy), 2002 Jan.12. Visual observers can still record interesting changes on the planet. At this time there was notable colour in the NEB (reddish) and northern (27.8 deg) beltwidth. The Great Red Spot is over the north pole edge.

Welcome to the BAA Jupiter
 Here you'll find a wealth of information on the largest Planet. You'll also find guides and in-depth publications regarding Jupiter.
 If you are looking for an introduction to Jupiter, click here.
 For advice on observing Jupiter, click here.
 For recent Jupiter weather reports, click here.
 Looking for most recent images of Jupiter, click here.
 For definitive published reports click here.
 For section publications click [PUBS](#).
 For maps of the Jovian Moons click here.

LAST UPDATE

BAA British Astronomical Association **MARS SECTION** *Director* Richard McKim

Welcome The BAA Mars Section is the oldest body in the world for the collection and publication of observations of the Red Planet. It was founded in 1892 by E. Walter Maunder, the 'father' of the Association. Past Directors of the Section have included E.M. Antoniadi, W.J. Steavenson, B.M. Peek and R.L. Waterfield. The present Director has been responsible for the collection and analysis of all observational work since the apparition of 1979-80. On this site you will find the BAA's observational programme for Mars, and information about past and present oppositions of the planet. The site also contains several maps of Mars, orthographic graticules for positional measurements, an observational report form, and a detailed list of Section publications. Visual and photographic observations should be sent by post to the Section Director while CCD images should be e-mailed to him. This website is maintained by [R.A. Marriot](#), and a link to the BAA's website is included below. (Text and images on this site are the copyright of their originators, and should not be reproduced without prior permission.) Good observing!

Programme
 Maps
 Graticules
 Report form
 Bibliography
 Historical notes
 Beagle 2
 Section Directors

List of reports, 1892-1999
 Apparitions, 1892-2012

Dr Richard McKim
 Cherry Tree Cottage
 16 Upper Main Street
 Upper Benfield
 Peterborough PE8 5AN
 Great Britain
richardmckim@btinternet.com




HOW TO PARTICIPATE ? THE AMATEUR NETWORKS

The JUPOS project measures the drift of cloud features on Jupiter. Analysed mostly by John Rogers, director of the BAA Jupiter section

This is an amateur project with truly scientific results.

Overview

- [Home / About JUPOS](#)
- [Project history](#)

People

- [List of Observers](#)
- [List of Measurers](#)
- [Contributors' gallery](#)

Great Red Spot

- [GRS longitude \(Sy. 2\)](#)

Important to know


- [Image requirements](#)
- [dss. auf Deutsch](#)
- [Tips for Observers](#)
- [Tips for Measurers](#)

Downloads

- [Project documentation](#)
- [WinJUPOS software](#)
- [Positional data files](#)

Drift charts & movies

- [Recent drift charts](#)
- [Older drift charts](#)

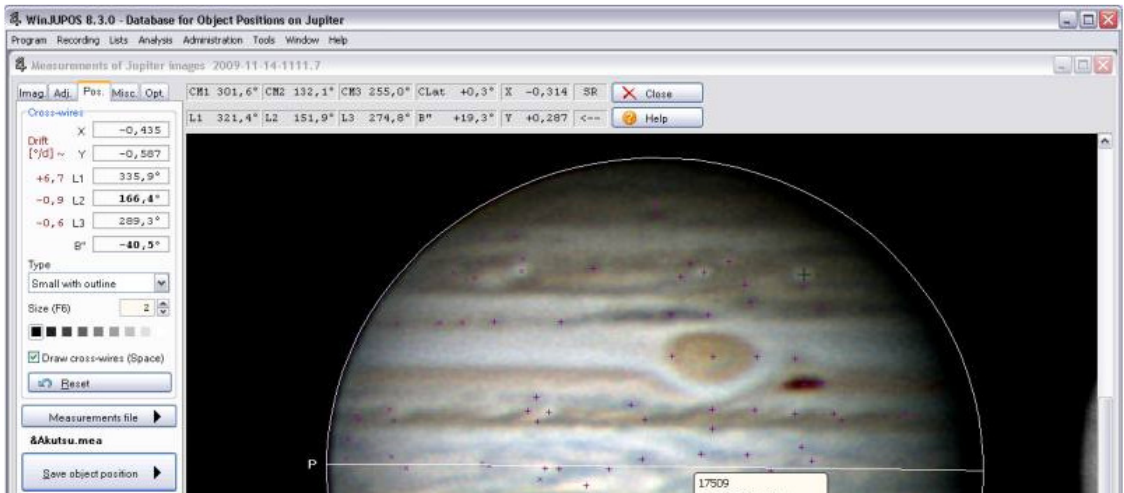


JUPOS - Database for Object Positions on Jupiter

Last update: 2013 April 27 - [Whats's new?](#) - [Organizational change](#)

About JUPOS

The atmosphere of the giant planet Jupiter presents cloud systems even to the Earth-bound observer equipped with a smaller telescope. These cloud pattern of movements which largely depends on planetographic latitude, that is for example, on whether they are situated near Jupiter's equator or not. The aim of JUPOS is to collect precise positions of jovian cloud features, to analyse them in drift charts, and to examine if and how their movements. JUPOS is an amateur-astronomical project.



WinJUPOS 8.3.0 - Database for Object Positions on Jupiter

Program Recording Lists Analysis Administration Tools Window Help

Measurements of Jupiter images: 2009-11-14-1111.7

CM1	301,6°	CM2	132,1°	CM3	255,0°	CLat	+0,3°	X	-0,314	SR	
L1	321,4°	L2	151,9°	L3	274,8°	B*	+19,3°	Y	+0,287	<--	Help

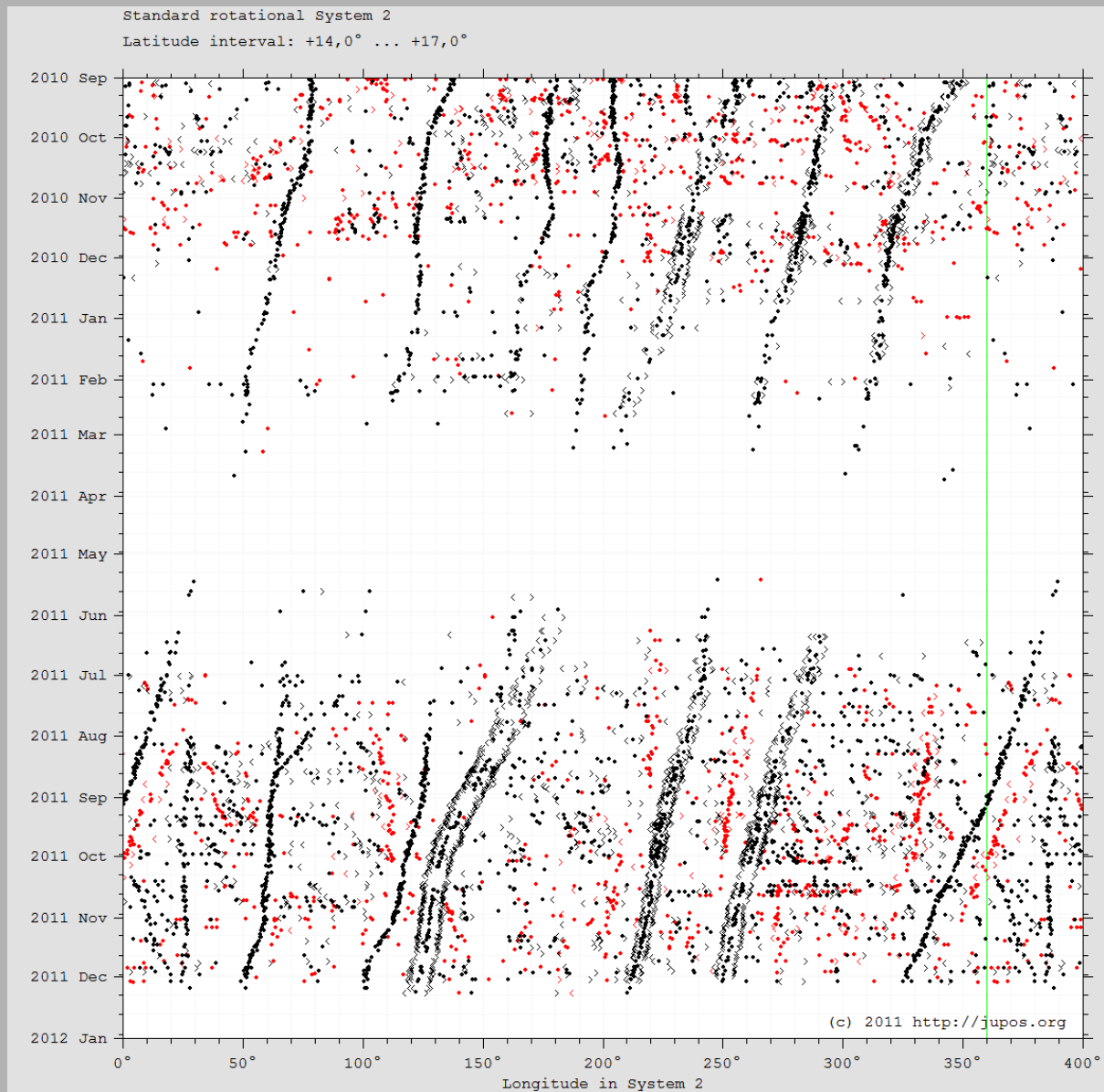
Drift [°/d] X: -0,435 Y: -0,587

+6,7 L1: 335,9°
-0,9 L2: 166,4°
-0,6 L3: 289,3°
B*: -40,5°

Type: Small with outline
Size (F6): 2
 Draw cross-wires (Space)
Reset

Measurements file: Akutsu.mea
Save object position

HOW TO PARTICIPATE ? THE AMATEUR NETWORKS



***Exemple of Jupos
drift chart (NEB
barges, 2010-2011)***

HOW TO PARTICIPATE ? THE AMATEUR NETWORKS

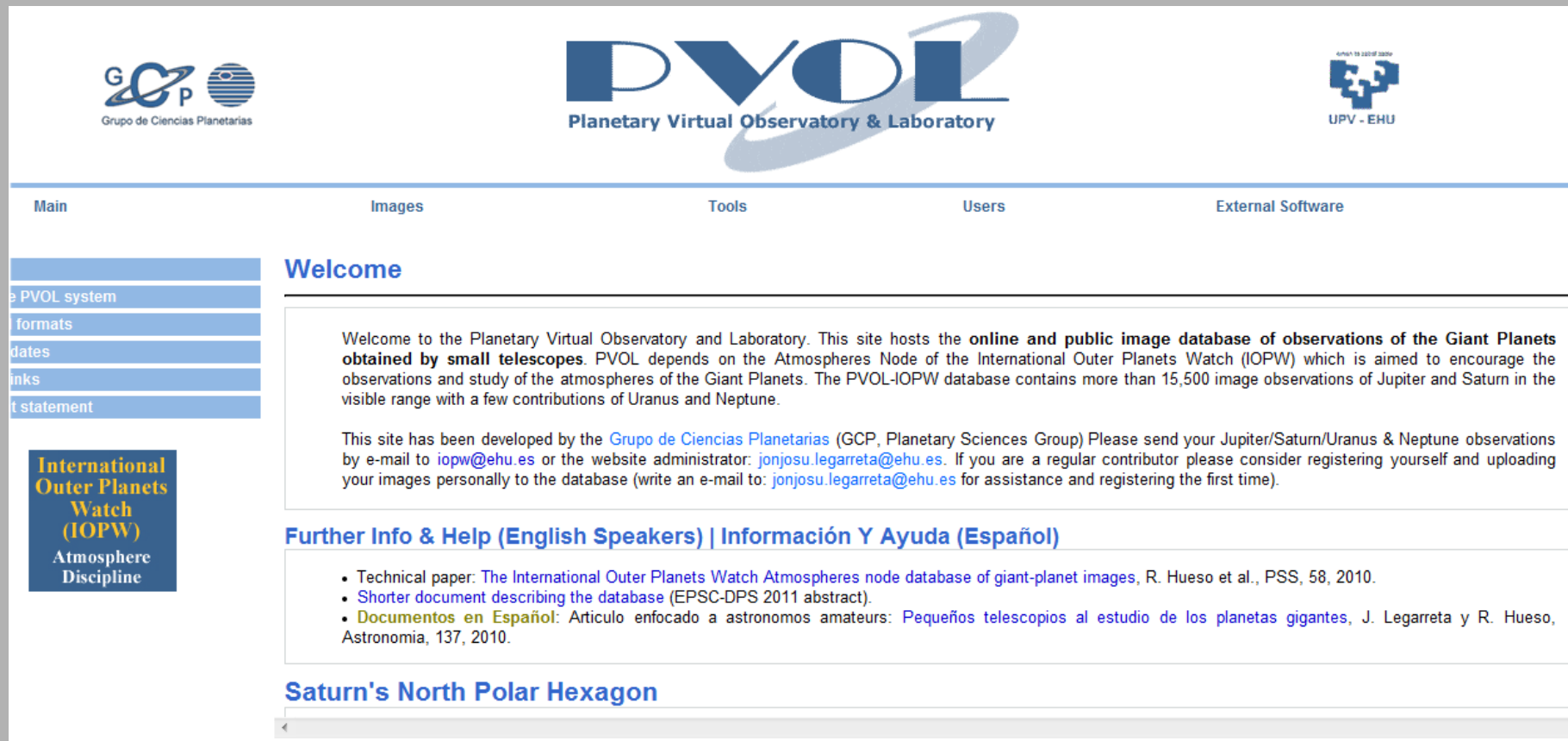
The screenshot shows a Facebook interface. At the top, the Facebook logo and search bar are visible. The user's profile, Christophe Pellier, is shown in the top right. The main content area displays a large image of Saturn with its rings, dated 2/6/2013 UT 20.44. Below the image, the group name 'Astronomy Planetary Imaging' is visible, along with navigation tabs for 'À propos', 'Évènements', 'Photos', and 'Fichiers'. A post by Ascanio Trivisano is shown, featuring a link to a postimg.org image and the text 'Reworked and revised in color!!!'. Below the text is a smaller image of Saturn and a link to 'View image: 2013 06 02 2049 new2 postimg.org'. The left sidebar contains navigation options like 'Favoris', 'Groupes', 'Applications', and 'Pages'.

On Facebook : the group « Astronomy Planetary Imaging » gathers amateur from all around the world, and the most engaged scientists in the cooperation

HOW TO PARTICIPATE ? THE PVOL PROJECT ON GAS GIANTS

The « Planetary Virtual Observatory & Laboratory » is an image gallery that upload amateur images on the gas giants.

It is maintained by the Planetary science group at the University of Pais Basco in Spain. Some work has been presented at the EPSC.



The screenshot shows the homepage of the Planetary Virtual Observatory & Laboratory (PVOL). At the top, there are three logos: the Grupo de Ciencias Planetarias (GCP) logo on the left, the PVOL logo in the center, and the UPV-EHU logo on the right. Below the logos is a navigation bar with links for Main, Images, Tools, Users, and External Software. On the left side, there is a vertical menu with links for the PVOL system, formats, dates, links, and a statement. Below the menu is a blue box for the International Outer Planets Watch (IOPW) Atmosphere Discipline. The main content area features a 'Welcome' section with a paragraph about the site's purpose and a list of resources. The 'Further Info & Help' section includes links to a technical paper, a shorter document, and a Spanish document. The 'Saturn's North Polar Hexagon' section is partially visible at the bottom.

Logo 1: Grupo de Ciencias Planetarias (GCP)

Logo 2: PVOL Planetary Virtual Observatory & Laboratory

Logo 3: UPV - EHU

Navigation: Main, Images, Tools, Users, External Software

Left Menu: PVOL system, formats, dates, links, statement

International Outer Planets Watch (IOPW) Atmosphere Discipline

Welcome

Welcome to the Planetary Virtual Observatory and Laboratory. This site hosts the **online and public image database of observations of the Giant Planets obtained by small telescopes**. PVOL depends on the Atmospheres Node of the International Outer Planets Watch (IOPW) which is aimed to encourage the observations and study of the atmospheres of the Giant Planets. The PVOL-IOPW database contains more than 15,500 image observations of Jupiter and Saturn in the visible range with a few contributions of Uranus and Neptune.

This site has been developed by the [Grupo de Ciencias Planetarias](#) (GCP, Planetary Sciences Group) Please send your Jupiter/Saturn/Uranus & Neptune observations by e-mail to iopw@ehu.es or the website administrator: jonjosu.legarreta@ehu.es. If you are a regular contributor please consider registering yourself and uploading your images personally to the database (write an e-mail to: jonjosu.legarreta@ehu.es for assistance and registering the first time).

Further Info & Help (English Speakers) | Información Y Ayuda (Español)

- Technical paper: [The International Outer Planets Watch Atmospheres node database of giant-planet images](#), R. Hueso et al., PSS, 58, 2010.
- [Shorter document describing the database](#) (EPSC-DPS 2011 abstract).
- **Documentos en Español:** [Artículo enfocado a astrónomos amateurs: Pequeños telescopios al estudio de los planetas gigantes](#), J. Legarreta y R. Hueso, Astronomía, 137, 2010.

Saturn's North Polar Hexagon