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Impact detection on Jupiter through amateurs' processing of their own videos using DeTeCt

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Since 2010, amateur astronomers have discovered six flashes in Jupiter caused by the entry of small bodies in Jupiter's atmosphere [1-5]. The last of these impact flashes was discovered thanks to a pro-am collaborative project called "DeTeCt". This project is based on a software tool released to the amateur community that allows the observers themselves to analyze their video observations.

The software DeTeCt performs differential photometry to find sudden brightness variations, generates a detection image and a report. The detection image allows the users to do a quick look of the analysis and the reports and detection images are sent to two of us (MD, SS) for in depth analysis and statistics of the positive and negative detections. In this work we will see the latest evolutions of the project presenting the new features in the software, details of the detection algorithm and changes in the methodology of the statistical analysis.

DeTeCt v3.2.3.2020062:	3_x64 Analysis of Jupiter/Saturn videos to find impact flashes	- 🗆 X
File Preferences Help		
File selection and process	automation	
Select folder recursively	or Select file auto processing auto exit when done then shutdown PC	Max instances: 12/12
Impact detection		
Detect impact		
Check detection images,	send results	
File processing		
Processing improvement:	G:\work\Impact\tests\data_set\bugs\broken_ser\2016-05-15-2249_8-MD-IR685.ser 16566 frames @ 25 fps (0s duration)	Date from: acquisition log
AS! session		V SER timestamps FITS
Progress	Duration provaced (Intelly 4575c	_ me date into
Total (55/223) File		
Execution full log	Processing time: 1266.2s (file) 1423.9s (total)	12/12 instances
2020-06-24 05:41:54 - V/A 2020-06-24 05:41:54 - 2020-06-24 05:43:32 - 2020-06-24 05:43:32 - 2020-06-24 05:43:32 - 2020-06-24 05:43:32 - 2020-06-24 05:43:32 - 2020-06-24 05:43:32 - 2020-06-24 05:44:32 - 2020-06-24 05:44:08 - 2020-06-24 05:42:08 - 2020-06-24 05:42:0	RNDNG: low probability impact in detection image but no impact detected by the algorithm. - 03_10_472 - Impact Jupiter ani duration) RNDNG: low probability impact in detection image but no impact detected by the algorithm. - GoveBarlow@io3.avi is duration) RNDNG: low probability impact in detection image but no impact detected by the algorithm. - Jupiter_0001.fit duration) RNDNG: low probability impact in detection image but no impact detected by the algorithm.	

Fig. 1: New GUI in the DeTeCt software.

This project has accumulated data acquired over 17 years of Jupiter observations. The total time covered by the videos analyzed is equivalent to 5 full months of observations. This has been possible only thanks to the active participation of a hundred of amateur astronomers worldwide. The accumulated time analyzed in the project allows a more accurate estimation of the impact frequencies on Jupiter [4]. The project website (http://www.astrosurf.com/planetessaf/doc/project_detect.php) maintains up to date results of the statistical analysis, and provides the software to download.

← → C* ŵ	tessaf/doc/project_cleb	ect.php	
		Impact Projet de	flashes detection with DeTeCt sol detection de flash dimpacts avec le byter <u>blact Detects</u>
Assessments	<u>8</u>	rftware download / téléchar Decementation, 6	gement du logiciel for participating to Tutorial for detection impose / Tutori Presentation of the project (EPSC2013, SA
	seal aldress for debringles	r led in stay Lovel & discore stead imper	deletion & DeTell
	I have fun running the project/developping the software, but it takes a lot of my private time and needs now		
			Donate
J	upiter		
estimation of 15,6 impact	ts per year (absolute	number)	
total excludes 8,638 days	s of simultaneous obs	ervations	
Observer	Duration	Number of videos	Date range
Total : 98 observers	140.094 days	129228 videos	2003/04/18 - 2020/06/11
Zac Pujic (Australia)	19.101 days	//04	2005/02/22 - 2019/07/29
Benito Loyola (USA)	16.341 days	15028	2018/02/17 - 2019/09/24
Michel Jacquesson (France)	16.265 days	2448	2014/03/12 - 2019/10/11
Paul Nowt (France)	15.335 days	12893	2012/09/07 - 2020/06/01
Manos Kardasis (Greece)	9.506 days	8101	2004/02/29 - 2019/11/27
Ciyde Foster (South Africa)	6.006 days	/620	2015/01/30 - 2020/05/02
Parad Control Control (USA)	4.909 days	5860	2013/10/09 - 2016/11/30
Bend Gaenriken (Germany)	4.098 days	5062	2016/03/06 - 2018/06/24
Alan Conet (USA)	3.004 days	2002	2013/10/04 - 2020/05/17
Ramour Dedranakala (reaco)	3.560 days	2012	2000/04/13 - 2020/05/29
Salveur Pedranghelu (France)	3.017 days	0002	2017/00/20 - 2019/10/27
Enanchapper (0.54)	2,044 08/5	2031	2013/09/01 - 2020/00/01
Christenko Dallar (Capros)	2,444 days	2300	2013/11/08 - 2020/03/31
Loso Lais Dessite (france)	2.574 days	2754	2012/02/20 - 2018/07/28
Vaviar Duroot (Crance)	2.155 days	4013	2010/01/00 - 2020/00/01
Marrier Dupolic (France)	2.002 days	1007	2012/08/16 - 2015/04/25
Grant Blair (USA)	1 950 days	1043	2013/06/20 - 2016/06/28
Trever Barry (Australia)	1.815 day	2425	2009/07/06 - 2012/12/30
Michel Miniou (France)	1.571 day	1415	2003/04/18 - 2020/04/22
Dagral Baste (France)	1.494 day	1702	2012/11/30 - 2017/05/21
David Domine (France)	1.450 day	907	2016/02/25 - 2017/04/10
Jean Luc Darrenne (France)	1.435 day	1141	2018/05/04 - 2020/05/22
Torsten Mellenthin (Germany)	1.218 day	1416	2016/01/28 - 2017/06/24
Lammertus de Vries (Spain)	1.171 day	635	2009/08/03 - 2015/05/08
Pic du Midi (Colas Delcroix/Dauvergne/Svlla) (France)	1,164 day	1861	2010/09/29 - 2019/08/16
Jocelyn Serot (France)	1.154 day	880	2014/01/10 - 2019/06/02
Stephane Gonzales (France)	1.131 day	1243	2013/12/20 - 2018/06/03
Martin Lewis (UK)	1.020 day	1509	2015/03/22 - 2019/09/05
Matic Smrekar (Stovenia)	0.956 day	1648	2009/07/29 - 2019/06/10
Arnaud Claisse (France)	0.941 day	842	2014/01/19 - 2016/05/03
Paul Jones (USA)	0.819 day	723	2011/08/29 - 2015/04/05
Philippe Chatelain (France)	0.810 day	60	2017/03/28 - 2019/08/02
Jean Jacques Poupeau (France)	0.759 day	1143	2013/02/05 - 2016/03/23

Fig. 2: Webpage of the project with statistics, estimation of the impact frequency and links to software and tutorial.

Additionally, observational campaigns were organized at Pic du Midi to acquire Jupiter and Saturn videos taking advantage of the excellent seeing of the site of observation. A large number of positive detections is expected based on the combination of an excellent seeing and the large diameter of the telescope (with respect to other observations campaigns, amateur astronomers' telescopes diameters range from 15 to 50cm). The observation campaigns were generally organized around the opposition of Jupiter when the planet was high in the sky. Each night we could acquire at least two hours of video recording of the planet.

The scientific analysis of the different impacts allows to estimate the impact bodies in terms of the released energy and mean mass, which translates in ranges of possible sizes and density. Light curves of the more recent impacts allow to study impact fragmentation and possible densities of the impact body [5].

This project showcases the usefulness of amateur astronomers' observations, who provide unique essential data for this scientific work.

References

[1] Hueso R. et al., 2010, «First Earth-based detection of a superbolide on Jupiter», The Astrophysical Journal Letters, 721, L129-L133.

[2] Hueso R., et al. (incl. M. Delcroix), 2013, «Impact flux in Jupiter: From superbolides to large-scales collisions», Astronomy & Astrophysics, 560, A55.

[3] Hueso R., M. Delcroix et al.,2018a, « Small impacts on the Giant planet Jupiter », Astronomy & Astrophysics 617, A68 pp1-13.

[4] Hueso R., del Rio-Gaztelurrutia, Sánchez-Lavega, Delcroix M. et al. 2018b, « Detectability of possible weather effects on Mars upper atmosphere and meteor impacts in Jupiter and Saturn with small telescopes », Journal of Space Weather and Space Climate, 123,3020-3034

[5] Sankar R. et al. (incl. M. Delcroix) 2020, « Fragmentation modelling of the August 2019 impact on Jupiter », Monthly Notices of the Royal Astronomical Society, 2020