

Current status and future upgrades to the Planetary Virtual Observatory (PVOL IOPW) database of Giant Planets observations

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Abstract

The atmospheres node of the International Outer Planets Watch (IOPW) maintains a large database of observations of the Giant Planets under the name Planetary Virtual Observatory Laboratory (PVOL) which is contributed by worldwide amateur astronomers. The database is openly available, offers data searching tools and has become an important research tool for different scientific teams studying the atmospheres of Jupiter and Saturn. Continuous improvements over the last decade in image techniques have resulted in an ever larger amount of high-quality observations with a large scientific return for professionals collaborating with amateur astronomers in different fields of planetary science [2]. We discuss on the current status of the database and future improvements to it. The database is available in the following address:

<http://www.pvol.ehu.es>

1. Introduction

The Giant Planets Jupiter and Saturn have dynamic atmospheres with evolving weather patterns that vary in time in a largely unpredictable way. Studying the recurrent changes and the overall activity of these atmospheres require a nearly continuous monitoring of both planets. Additionally Jupiter and Saturn are also subject to unexpected events such as impacts [3-5], the development of large-scale storms [6, 7] or global atmospheric changes. These can be discovered and/or studied with high-spatial resolution images obtained with amateur equipment. However a global monitoring of the planets cannot be fulfilled by the large telescopes available to the community of professional astronomers since they generally have not the adequate instrumentation to obtain high-

spatial resolution observations and suffer for considerable pressure for time allocation. Monitoring of Jupiter and Saturn are now best performed by the large community of non-professional astronomers operating small telescopes with diameters on the 8-20" range. These observers use a "lucky imaging" technique to achieve images that attain the diffraction limit of the telescope by recording video films of the planet, selecting the best individual short exposure frames, and stack them in a final high-resolution image with a large signal to noise ratio that brings out the fine details in the planet. Reference [2] provides an extensive list of pro-am collaborations in the field of giant planet atmospheres. The IOPW-PVOL database has now been online for about 8 years and contains ~14000 amateur observations of Jupiter and Saturn with some outstanding observations in each observing season. As a result an increasing fraction of professional astronomers now regularly collaborate with amateur astronomers in different fields of planetary science [2].

2. Database description

The PVOL system is programmed using Java for all the background processing, and simple SQL for the queries to the database. The service runs in a Apache-HTTPD 2.0 web server running a MySQL server database system. Individual observers can upload their observations with a code name that identifies the planet, acquisition time and observer or submit their observations via e-mail to the web manager. The database supports searches in terms of planets, time periods, observers and filters. Cylindrical and polar projections are also available in the database and can be searched with the web engine.

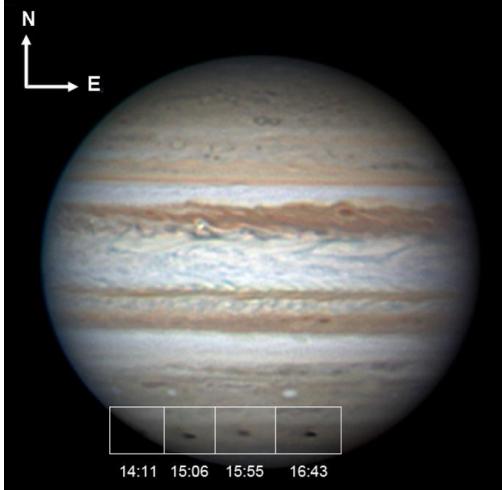


Figure 1: Discovery series of the impact debris obtained on 2009 July 19 by Anthony Wesley from Australia. This series of observations triggered large observing runs with professional telescopes and a renewed interest for amateurs to acquire Jupiter and Saturn observations. It also produced a large interest in the general public and helped to show the power of small telescopes in science.

3. Future upgrades

The ensemble of observations contributed by hundredths of keen observers to the IOPW-PVOL database is a very valuable resource for the study of the atmospheres of Jupiter and Saturn. Continuous monitoring of Jupiter is now essential to characterize the atmosphere before the June arrival to Jupiter (2015). Continuous monitoring of Saturn over the course of the Cassini extended Solstice mission (2014-2017) is also essential. Continuous improvements in imaging techniques argue in favor of establishing a still deeper collaboration with the amateur community and improving the database cover. We estimate the database only covers a 30% of all the valuable Jupiter and Saturn observations attained by amateur observers since many of them contribute their images to astronomical forums, facebook group pages or databases from amateur organizations. Outstanding observations of Mars, Venus and other solar system objects are found in different data repositories like the Venus Active Archive [8]. A centralized database covering these different planets and working in the context of a Virtual Observatory frame could have a larger scientific usability. In this work we will show planned upgrades in the database for the upcoming

years. This include: larger number of contributors, collaborations with other image database, addition of new objects and interactive tools to explore or search the data.

Acknowledgements

The PVOL database is hosted at the Universidad del País Vasco UPV/EHU. This work was supported by the Spanish MICIIN project AYA2012-36666 with FEDER support, PRICIT-S2009/ESP-1496, Grupos Gobierno Vasco IT765-13 and UPV/EHU UFI11/55.

References

- [1] Hueso, R. et al.: The international outer planets watch atmospheres node database of giant-planet images, *Planetary & Space Science*, 58, pp. 1152-1159, 2010.
- [2] Mousis, O. et al: Instrumental Methods for Professional and Amateur Collaborations in Planetary Astronomy. *Experimental Astronomy* (in press).
- [3] Sánchez-Lavega, A. et al.: The impact of a large object on Jupiter in 2009 July. *The Astrophysical Journal Letters*, 715, 2, L155-159, 2010.
- [4] Hueso, R. et al.: First Earth-based detection of a Superbolide on Jupiter. *The Astrophysical Journal Letters*, 721, L129-L133, 2010.
- [5] Hueso, R. et al.: Impact flux on Jupiter: From superbolides to large-scale collisions. *Astronomy & Astrophysics*, 560, A55, 2013.
- [6] Sánchez-Lavega, A. et al.: Depth of a strong jovian jet from a planetary-scale disturbance driven by storms, *Nature*, 451, 437-440, 2008.
- [7] Sánchez-Lavega, A. et al. Deep winds beneath Saturn's upper clouds from a seasonal long-lived planetary-scale storm, *Nature*, 475, 71-74, 2003.
- [8] Barentsen, G. and Koschny, D.: The Venus ground-based image Active Archive : A database of amateur observations of Venus in ultraviolet and infrared light. *Planetary and Space Science*, 56, 1444/1449, 2008.