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FURTHER INTERFACES OF VIRTUAL OBSERVATORY TOOLS FOR AMATEUR ASTRONOMERS

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Abstract. Within our goal to ensure that amateur astronomers can access Virtual Observatory (VO) tools, we describe further advancements in the interoperability of VO tools via the SAMP protocol. We incorporate stellar and extra-galactic transients, as reported in Astro-Colibri, and now observed by amateur astronomers within the Pro-Am RAPAS framework. We also include exoplanet transit events from the ExoClocks initiative, enabling better planning and more precise observations and analyses. In addition, we now make available VO subcatalogues tailored to astrometric and photometric acquisition fields. These developments show that the inclusion of VO standards in the tools used by amateur astronomers not only expands the accessibility of professional tools but, more importantly, allows amateur astronomers to use, in a simple way, state-of-the-art tools to enable them to boost their contributions to astronomical research.

Keywords: Virtual Observatory, Amateur astronomy, Pro/am collaborations, Citizen science, Transients, Exoplanets

1 Introduction

WIVONA (We Implement Virtual Observatory Needs of Amateur astronomers) is a project supported by Observatoire de Paris-PSL that aims to provide the amateur community with tools that allow the interfacing of complex Virtual Observatory (VO) protocols with widely-adopted and familiar software such as PRISM* (Savalle et al. 2024).

In this paper we report three recent developments for PRISM that we carried out over the past year, dealing with exoplanet transits, Galactic and extragalatic transients, and access to astrometric and photometric databases.

2 Preparing Observations of Exoplanet Transits

To prepare the observation of an exoplanet transit, the interface first retrieves the updated reference database of stars with known exoplanet transits from ExoClock†(Mallonn et al. 2019). Then it checks the saved filtering parameters (telescope diameter, detectable magnitude difference, and number of dates/times when the transits can be observed). The resulting sets are filtered according to the requested parameters and the presence of observable events. The selected stars are displayed along with key parameters for target selection (priority, host star magnitude, expected magnitude difference). The user can then click on a given row in the table, and a display will show the ephemeris of each possible transit for that host star within the requested time window. Each transit may be accompanied by a summary of its visibility under local conditions, including local ingress and egress times. To initiate the observation, it is possible (and recommended in the absence of a time stamping system for acquisitions) to check the PC time on the first screen and then request telescope pointing by clicking on the sky map. Fig. 1 provides a screen shot of the procedure.

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*https://www.prism-astro.com/
†https://www.exoclock.space/database/planets

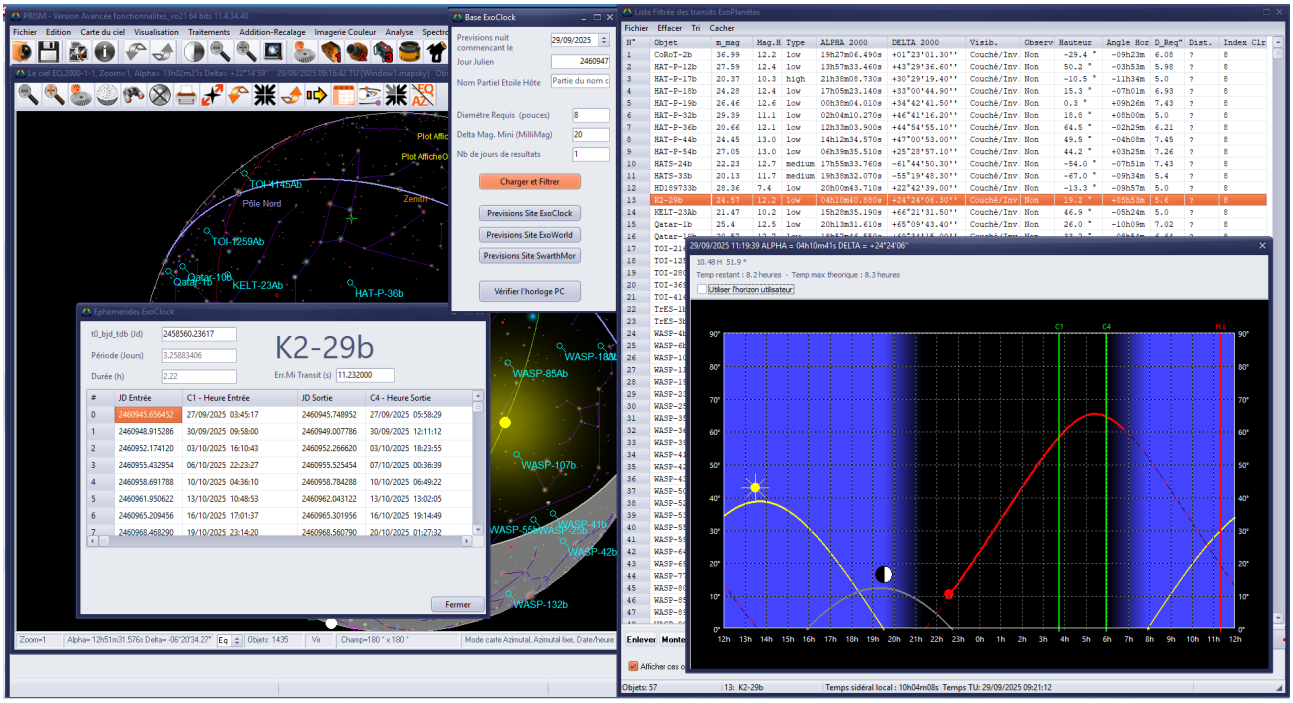

Fig. 1. Screen shot of the exoplanet transits interface. Top right: list of possible targets given the constraints (observing setup, local observing conditions). Top left (in the background): global sky view with the targets. Bottom left: once a possible target is selected by clicking on the list, the known properties of the transit are shown. Bottom right: visibility plot of the selected target.

3 Querying the Black Hole Target Observation Manager database

BHTOM (Black Hole Target Observation Manager [‡]) is a web platform designed to coordinate a telescope network, enabling seamless collaboration and efficient data management between professional and amateur astronomers (Wyrzykowski 2024). It features a powerful form interface to query targets for which follow-up observations are requested by researchers. These targets are also available through an API, which we have hence used to build a form to extract the objects of interest in PRISM, as show in Fig. 2. This allows the amateur astronomer to use a very simple interface to ensure a very efficient and quick access to the targets to be observed, leaving the nitty-gritty aspects to the underlying code.

4 Querying the VO using Python Scripts

A python scripting facility has been integrated within PRISM using `Python4Delphi`. Our software automatically detects the Python platform installed on the computer. Once the user installs the packages `astropy`, `astroquery` and `pyvo` using `pip`, they are available on the Python console.

[‡] https://bh-tom2.astrolabs.pl/

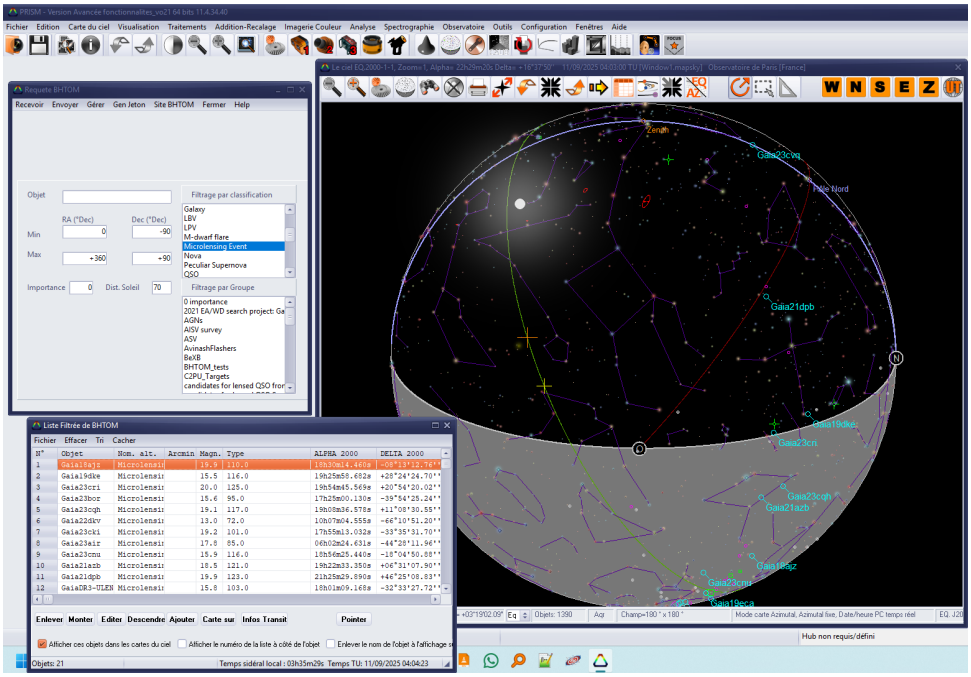

Fig. 2. The new BHTOM interface in PRISM. Targets can be filtered by position, distance to the Sun, type, importance, grouping. It is also possible to locate a particular object by name. After the request is sent to the BHTOM API, the targets can be found in the PRISM Objects List and then displayed on the sky map. The telescope is then pointed automatically to the selected target.

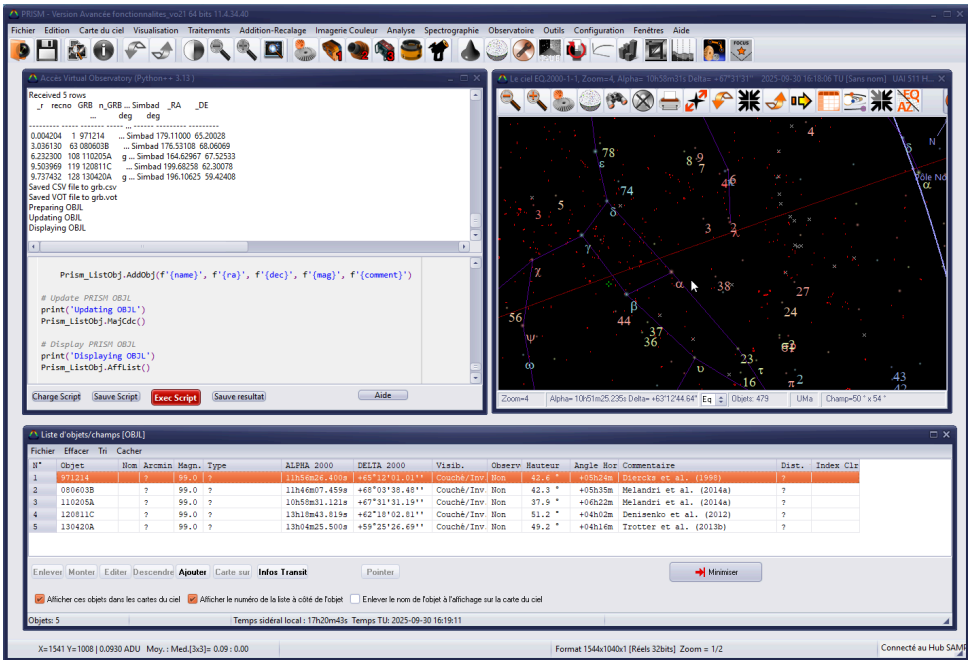

Fig. 3. Screen shot of the scripting interface. The top-left window shows the Python console after the execution of a program listed in the editor window (bottom left). The results are sent to the Object List window (bottom panel) from where they can be inspected, plotted on the sky map, and eventually sent to the mount to be pointed by the telescope.

To show case the capabilities of using Python Scripts within PRISM, we present the following example:

1. Locate resources in the Virtual Observatory (VO) containing datasets related to GRBs using the term "*gamma-ray-bursts*" from the Unified Astronomy Thesaurus (UAT[§]).
2. Query a "*Simple Cone Search*" service from one of these resources to search for objects within a given sky region.
3. Save the results in the formats CSV and VOTable.
4. The selected sources are automatically loaded into the PRISM Object List window, and can be examined and plotted on the sky chart, to select the suitable GRB to be observed.

The results can be seen on Fig. 3. Scripts can easily be debugged locally during the observations thanks to the `Python++` editor available next to the Python console.

By integrating VO queries into an all-in-one observatory control software, amateurs can access existing archives and measurements, increasing their visibility and usefulness.

5 Conclusions

As for our previous interfaces[¶], the current applications follow the open source protocol and are publicly available[‖].

The development of our VO interfaces greatly helps the amateur community to access professional databases and tools. Tutorials and demos have been provided at the S06 session of the SF2A Journées in 2025 on Pro-Am collaborations, as well as at the 2025 Training Event for Amateur Astronomers of the ACME Multimessenger Citizen Science European project[**].

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References

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[§] https://astrothesaurus.org/
[¶] https://github.com/rsav/samp4sharpcap
[‖] https://github.com/rsav/vo4prism
[**] https://citizen-science.sciencesconf.org/