VarAstro – frequently asked questions (FAQ)

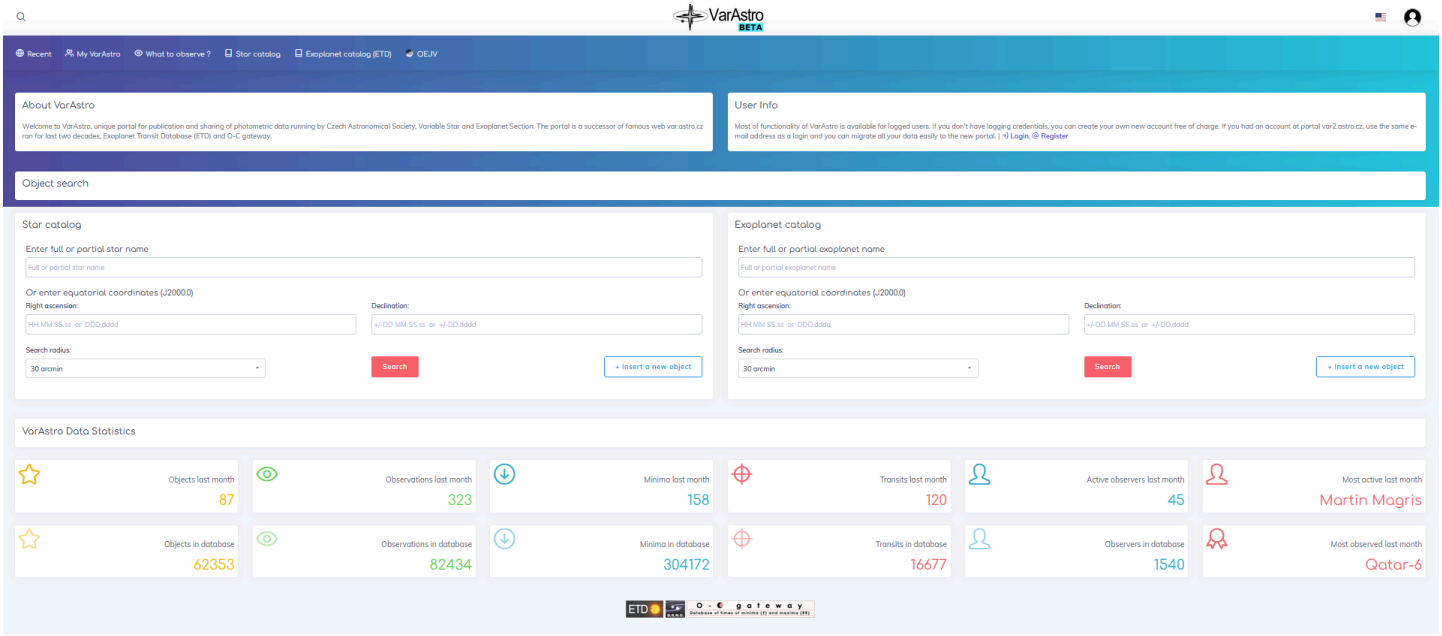
Contents

What is VarAstro?

This is a system for publishing and sharing photometric data operated by the Czech Astronomical Society, Variable Star and Exoplanet Section. The portal builds on several decades of successful operation of the var.astro.cz portal, the Exoplanet Transit Database (ETD) and the O-C gateway.

VarAstro is available at https://var.astro.cz.

On the home page we find a basic description, forms for quick object searches, and last but not least, statistics about objects and user activity.



What are the basic features?

The basis of the system is a catalog of objects – stars and exoplanets.

The catalog can be searched by full or partial name, as well as by coordinates.

In the detail of the found object (star), a list of observations can be displayed. This may be an observation capturing the minimum of an eclipsing binary star, an observation capturing the transit of an exoplanet orbiting its host star, or any other phenomenon - for example, an observation of an eruption.

The user is allowed to upload their photometric observations and pair them with a specific star contained in the catalog.

The photometry must be pre-processed using a suitable software tool, such as Muniwin, SIPS, HOPS or Siril. It is not important which software was used. What is important is the format of the output data stored in the file. If the output is a text format, where the first column is the Julian date (full or reduced) and the second column is the star's brightness value (magnitude or flux), VarAstro will be able to process such a file. In addition to the format described above, VarAstro also supports the AAVSO format.

However, we still recommend using SIPS (https://www.gxccd.com/cat?id=146&lang=409). If astrometry is properly performed during observation processing, SIPS also saves metadata about the observed star when exporting the protocol, including its coordinates. VarAstro is able to use this metadata to pre-fill the data upload form and ideally the user does not have to enter anything manually.

After uploading the photometry, the user is allowed to immediately perform a fit of the minimum, if it is an observation of the minimum of an eclipsing binary star. If it is an observation of an exoplanetary transit, the user is allowed to perform a fit of the transit and connect it to a specific exoplanet from the catalog. The user can of course also upload any other phenomenon, for example an eruption or a maximum of a pulsating star. However, in these cases, VarAstro does not (yet) have any tool that would allow fitting the given phenomenon.

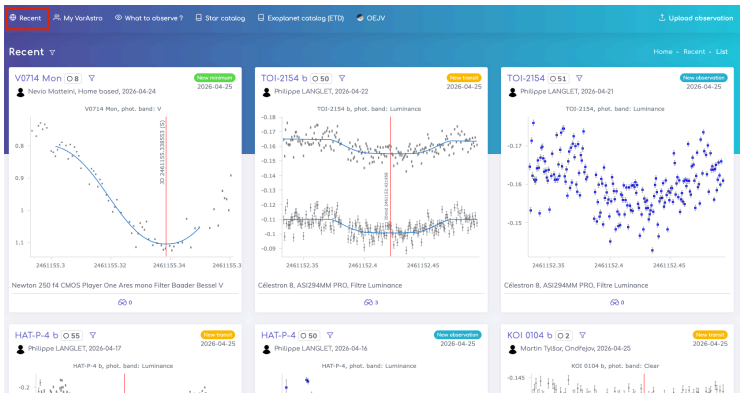
The results, which are the main output of the performed fits, are stored in the database - the time of the minimum, the time of the transit center, and its length and depth.

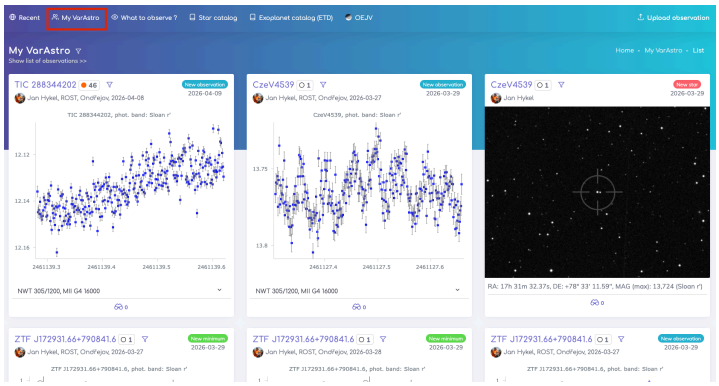
From this data (and from data imported from the original var2 databases), e.g. O-C and TTV diagrams, lists of times of minima of eclipsing binaries or lists of times of midpoints of transits are then created. All are available in the detail of a specific star or exoplanet.

How to view new activity in the system?

Activity in the system is displayed through so-called "feeds". New observations of a specific object, newly determined minima or transits, and newly created objects are displayed to the user after viewing a specific "feed" in the form of cards so that the most recent events are displayed at the top. By scrolling the page down, other (older) events are displayed gradually.

VarAstro in its current form allows you to view two feeds accessible from the main menu: "Recent", where the activity of all system users is displayed, and then "My VarAstro", where the activity of only a specific logged-in user is displayed.





Clicking on a given card will display details about the given observation or object.

Is it necessary to create a user account?

It is not.

Most features that display data relevant to a specific object are available without logging in. The same goes for predictions of eclipsing binary minima and exoplanetary transits, for example.

However, if you plan to upload your observations or download your own or other people's observations (in the original format), then registration and login are required.

After logging in, the user has a list of all his previous observations and also a list of objects he has created in the database (see What functionalities are available to a logged-in user?).

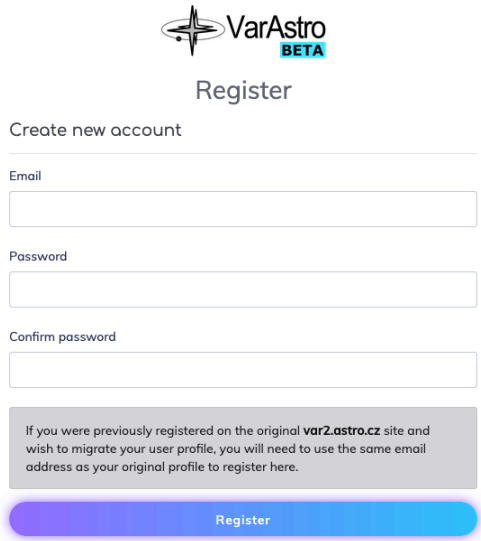
How to register?

In the top right corner is the user menu, for an unlogged user it contains only two items – “Login” and “Register”. Select “Register”.

Fill in the basic information in the form: registration email, which also serves as your username, and also enter a password.

If you previously had an account on the original var.astro.cz, use the email address you entered in your original profile to register. After registration, you will be able to link your new and original accounts and you will also see your original data in the user section.

If you don't remember which address you originally used, that's okay. After registering with a different email address, you can still link your original data to your new account at any time later.

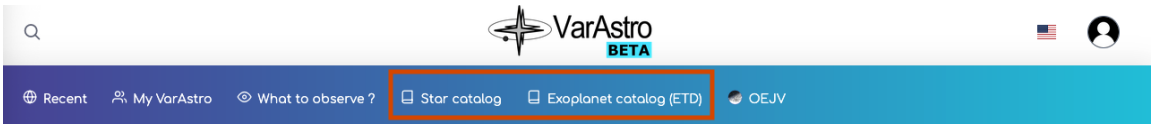


After submitting the form, you will receive an email with a link to complete your registration. You can then log in.

How to view data from the object catalog?

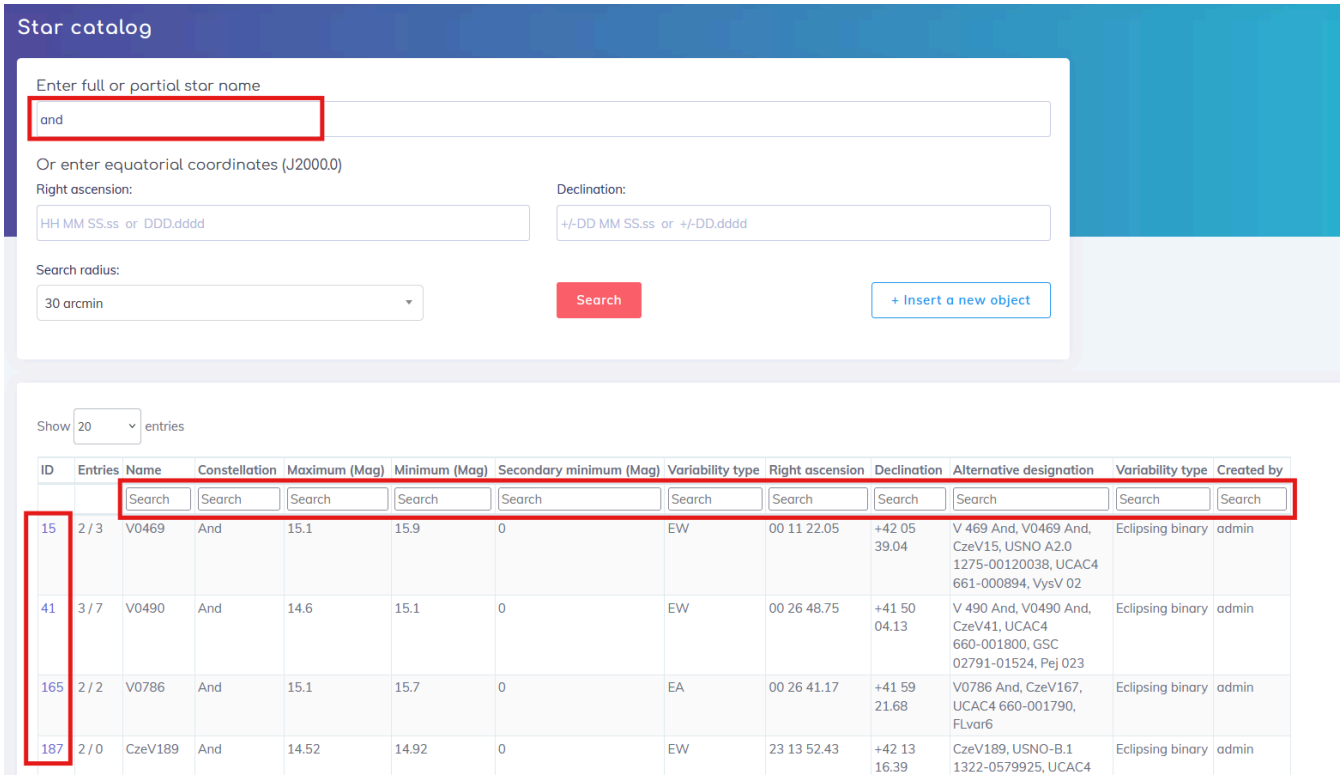
The basis of the system is formed by catalogs of objects – stars and exoplanets. The catalog of stars is further divided into subcatalogs according to the type of variability and includes, last but not least, the CzeV catalog of stars. The division into subcatalogs is only virtual, in reality VarAstro uses only one database of objects.

Catalogs are available from the main menu.

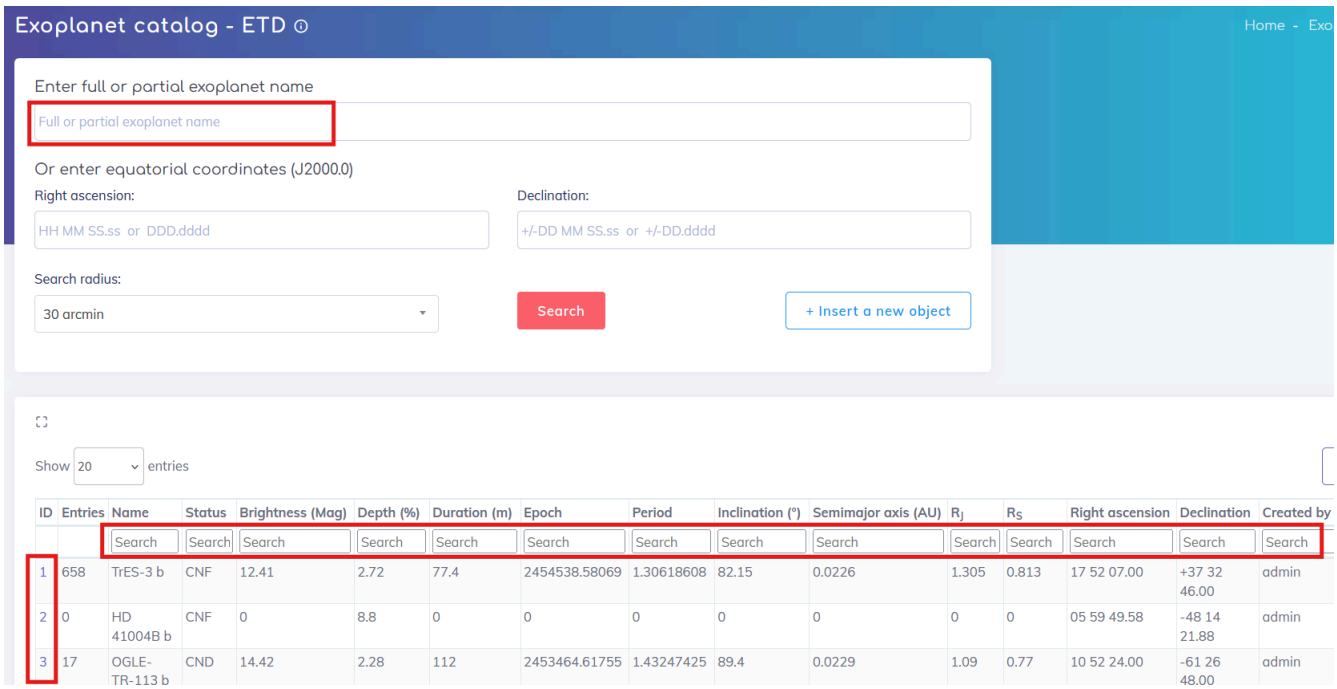


After selecting the appropriate catalog, a form for searching for objects and a table with search results are displayed.

Star catalog



Exoplanet catalog



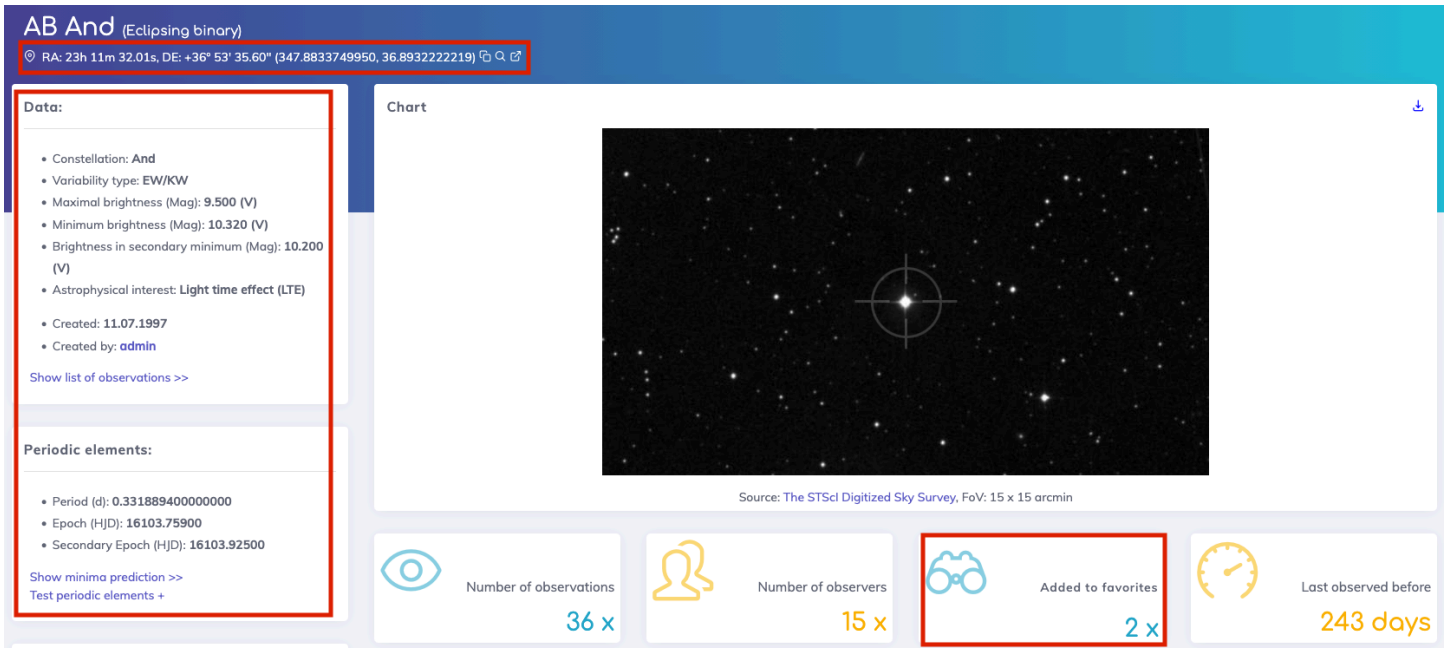
You can search by full or partial name and also by coordinates. If you do not enter any input data, all objects contained in the catalog are displayed in the table. The displayed selection can then be additionally filtered according to many other criteria, filters can be applied in the table header.

Details of a specific object can then be viewed by clicking on the identification number located in the first column of the table.

Indicative statistics about a specific object (number of observations / number of determined minima in the case of a star and number of determined transits in the case of an exoplanet) are found in the second column.

Star detail

A detail of a specific object (the star AB And) looks like this:



In the header, right below the star's name, you can find its coordinates (relative to the J2000.0 epoch) and auxiliary icons: by clicking on the first icon, you can copy the current coordinates to the clipboard, the second displays a list of objects in the vicinity of the coordinates, and the third redirects to the SIMBAD and VSX databases, which also display a list of objects in the vicinity of the coordinates.

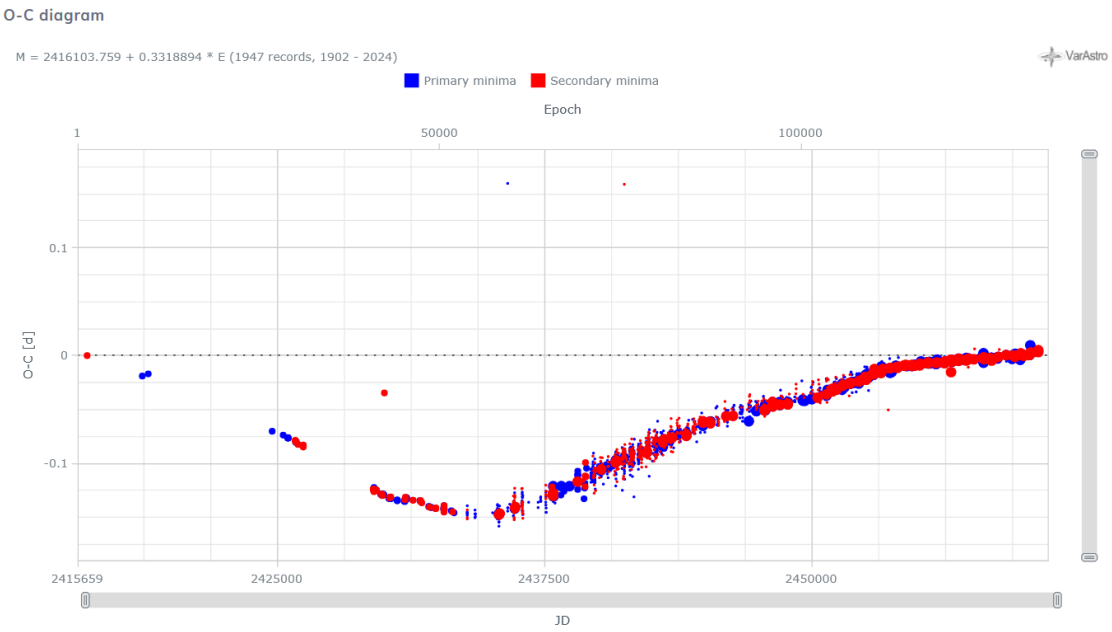
On the left side is a panel with additional information about the star, such as brightness, type of variability, and periodic elements, if the particular star has them.

The panel on the left also contains quick links to a list of observations of the given star, predictions of minima if it is an eclipsing binary, and possibly a test of periodic elements if we want to test how the timing of minima and the phasing of observations will change when the periodic elements change.

Below the chart with the star's surroundings are statistics. By clicking on the "added to favorites" tab, a specific star will be added to the list of favorite objects. This can be used, for example, to predict the minimum of eclipsing binaries - if we are only interested in favorite stars.

The O-C diagram itself, the list of minima and the phase curve are then located below - on smaller displays you have to "scroll down" the page.

O-C diagram



The O-C diagram can be zoomed in and displayed using the sliders on the bottom and right side. At the same time, most diagrams or graphs are "clickable", after hovering over a specific point with the mouse, you can double-click to display the relevant observation, including the fit of the minimum, if a specific observation exists for a given point (time of the minimum).

List of minimum times

Times of minima / maxima - including records from the original O-C gateway

P: M = **2416103.759** + **0.3318894** * E
S: M = **2416103.925** + **0.3318894** * E

Show 20 entries

TAB | CSV (;) | Excel

ID	HJD_{min}	UTC_{min}	Epoch	O-C (d)	P/S	Phot. band	Observer	Publication	Note	Instrument
	Search	Search	Search	Search	Sear	Search	Search	Search	Search	Search
20377	2459759.49491	06/28/2022, 23:52	131537	-0.000098	P	V	Sjoerd Dufoer	C		Vixen 20cm VMC200L
20949	2459785.55017	07/25/2022, 01:12	131615	0.001789	S	I	Kateřina Hoňková	C	Ročník Expy: 2022 Pozorovatelé: Andrea Biskupová, Vojtěch Dienstbier Podmínky: jasno, později Měsíc	NWT 200/1000, G2-1600, AZ/EQ-6, Lacerta M-Gen II
20948	2459785.55021	07/25/2022, 01:12	131615	0.001829	S	R	Kateřina Hoňková	C	Ročník Expy: 2022 Pozorovatelé: Andrea Biskupová, Vojtěch Dienstbier Podmínky: jasno, později Měsíc	NWT 200/1000, G2-1600, AZ/EQ-6, Lacerta M-Gen II
20947	2459785.55038	07/25/2022, 01:12	131615	0.001999	S	V	Kateřina Hoňková	C	Ročník Expy: 2022 Pozorovatelé: Andrea Biskupová, Vojtěch Dienstbier Podmínky: jasno, později Měsíc	NWT 200/1000, G2-1600, AZ/EQ-6, Lacerta M-Gen II
221708	2459795.6709	08/04/2022, 04:06	131646	-0.000052	P	V	Samolyk G	A 0051		
221707	2459795.8382	08/04/2022, 08:07	131646	0.001248	S	V	Samolyk G	A 0051		

The displayed minimums can be additionally filtered according to other criteria; filters can be applied in the table header.

The details of the specific observation from which the minimum time was determined can be viewed by clicking on the identification number in the first column of the table. If the identification number does not work as a reference (gray instead of blue), this means that the minimum was imported from the original O-C gateway, which collected the minimum (and also maximum) times from the available literature.

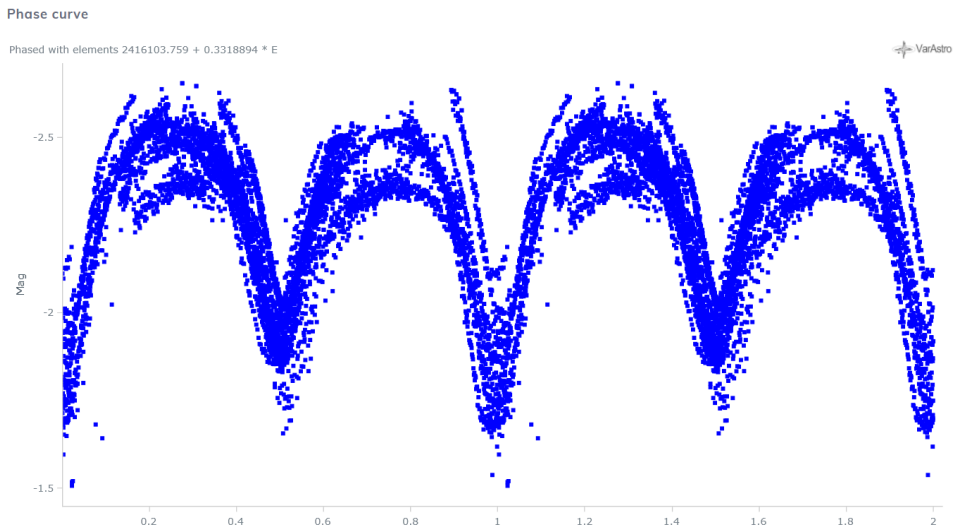
Additional information about the data source can be found in the "Publication" or "Note" column.

The meaning of each abbreviation used can be found at https://var.astro.cz/var-astro/doc/ocgate_literature_reference.html.

Unless otherwise specified, the heliocentric Julian date is used here (and in other parts of the VarAstro system) for the purpose of presenting temporal events (relative to a specific object).

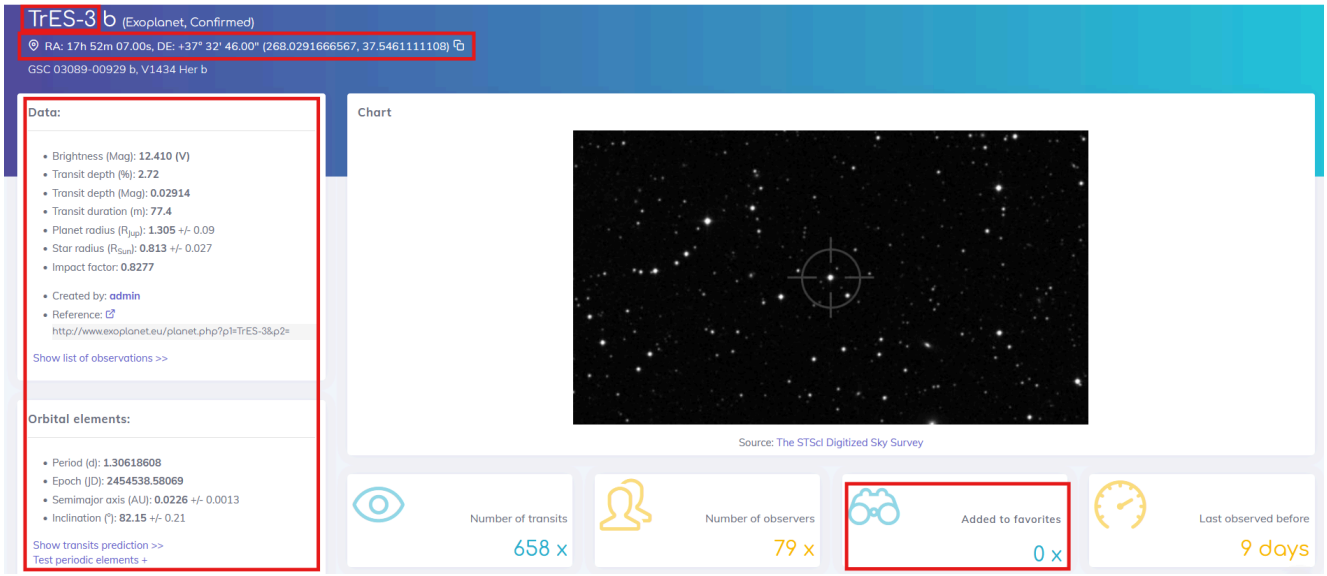
Displayed minima can be exported to the clipboard or to a file using the buttons on the right above the table header.

Phase curve



Exoplanet detail

A detail of a specific object (exoplanet TrES-3 b) looks like this:



In the header, right under the name of the exoplanet, you can find its coordinates (relative to the epoch J2000.0). Click on the icon on the far right to copy the coordinates to the clipboard.

By clicking on the name of an exoplanet in the header, we can display information about its parent star. If a particular star has multiple exoplanets, we can "click through" to other exoplanets (orbiting around it).

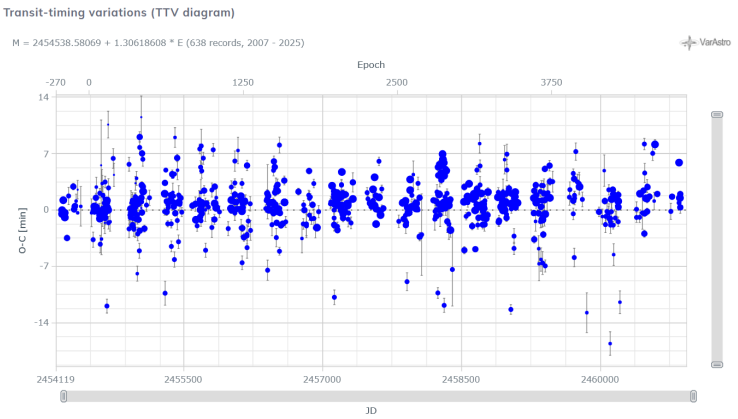
On the left side is a panel with information about the exoplanet, such as data on the brightness of the host star, the decrease in brightness caused by the transit, the duration of the transit, information on the size of the exoplanet and host star, as well as orbital elements.

Similar to the star detail, there are quick links to a list of observations of the given exoplanet (or its parent star), transit predictions, and also a periodic element test if we want to test how the timing of transits and the phasing of observations will change when the periodic elements change.

Below the chart with the star's surroundings are statistics. By clicking on the "added to favorites" tab, a specific exoplanet will be added to the list of favorite objects. This can be used, for example, for transit predictions - if we are only interested in favorite exoplanets.

Diagrams showing variations in the transit time (TTV), transit depth variations, transit length variations, and a list of transit midpoint times are located below - on smaller displays, you will need to "scroll down" the page.

Transit time variation (TTV)



The diagram can be zoomed in and displayed using the sliders on the bottom and right. After hovering over a specific point with the mouse, you can double-click to display relevant observations, including transit fits, if observations exist for that point (time of the transit midpoint).

List of transit midpoint times

Times of mid-transit

M = **2454538.58069** + **1.30618608** * E

Show 10 entries

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ID	HJD_{mid}	UTC_{mid}	Epoch	O-C (d)	Duration (min)	Depth (mmag)	Phot. band	DQ	Light curve	Observer & Reference	Note
	Search	Search	Searc	Search	Search	Search	Search	Se	Search	Search	Search
106	2454977.46035 +/- 0.00069	05/25/2009, 23:02	336	0.001137	87 +/- 3.3	22 +/- 1.3	Clear	3		Radek Kocián TRESCA	clear sky, no autoguiding, exposure 60s
104	2454977.46033 +/- 0.00067	05/25/2009, 23:02	336	0.001117	74.8 +/- 3.4	27.2 +/- 1.9	Clear	3		Jaroslav Trnka TRESCA	50s exposure, no autoguiding
281	2454977.45991 +/- 0.00029	05/25/2009, 23:02	336	0.000697	75.4 +/- 1.5	27.5 +/- 1.1	Clear	1		Štefan Gajdoš, Ivana Jakšová TRESCA	
18718	2454977.4599 +/- 0.001	05/25/2009, 23:02	336	0.000687	78 +/- 3	27.1 +/- 1	R	2		Gregorio AXA	
105	2454977.45981 +/- 0.00089	05/25/2009, 23:02	336	0.000597	80.5 +/- 4.3	30.4 +/- 2	Clear	3		Luboš Brát TRESCA	combined data obtained using two separate scopes (see chart)
18716	2454977.4577 +/- 0.0017	05/25/2009, 22:59	336	-0.001513	81 +/- 4.8	27.2 +/- 1.1	Clear	5		Srdoc AXA	

The displayed transit midpoint times can be additionally filtered according to other criteria; filters can be applied in the table header.

The details of the specific observation from which the transit midpoint time was determined can be viewed by clicking on the identification number in the first column of the table. If the identification number does not function as a reference (gray instead of blue), this means that the transit midpoint time was imported from the original ETD database, which collected (among other things) transits from available literature and the Internet.

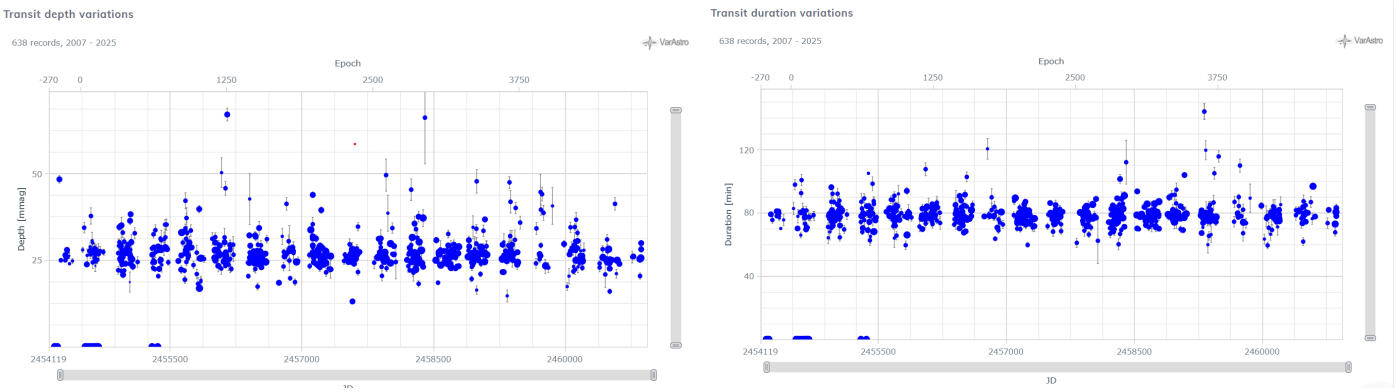
Additional information about the data source is then found in the "Observer and reference" column, where a hyperlink to the original source is also located.

All transits originally available in the Tresca database are now part of VarAstro - the "Tresca" hyperlink therefore leads to the VarAstro site.

Unless otherwise specified, the heliocentric Julian date is used here (and in other parts of the VarAstro system) for the purpose of presenting temporal events (relative to a specific object).

The displayed times can be exported to the clipboard or to a file using the buttons on the right above the table header.

Variations in transit depth and duration



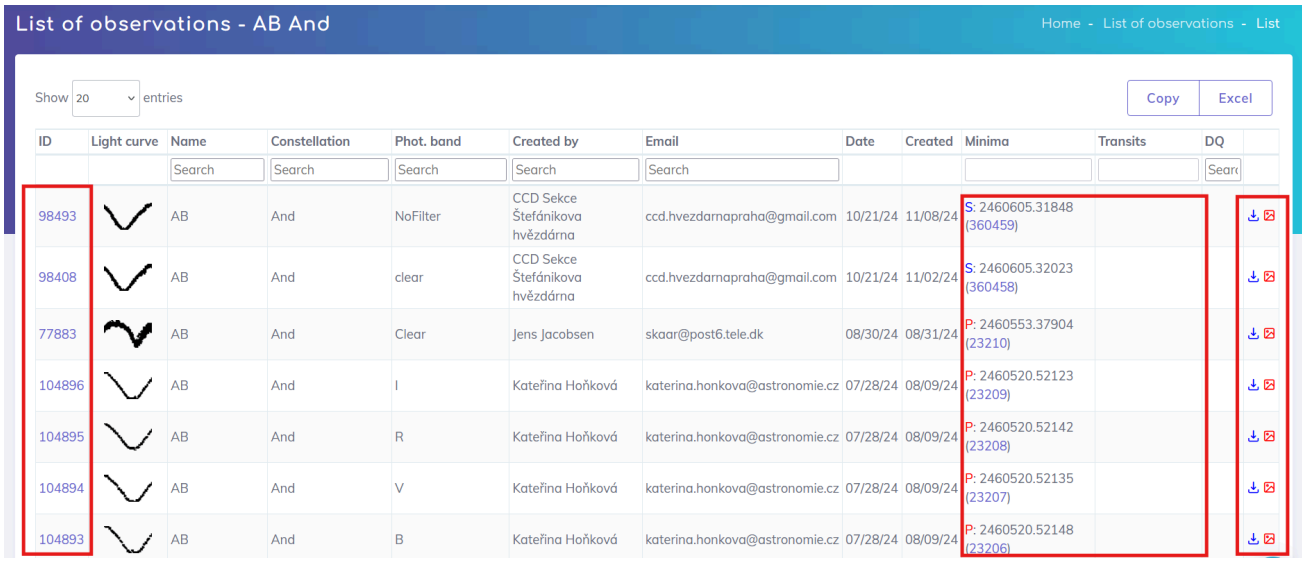
Here again, the diagrams can be zoomed in and interesting parts can be displayed using the sliders on the bottom and right. After hovering over a specific point with the mouse, you can double-click to display the relevant observation, including the transit fit, if one exists for the given observation point.

How to view the list of observations and details of a specific observation?

List of observations

To view a complete list of all observations of a given object, you can use the link from the panel on the left side of the screen in the detail of the given object.

After clicking on the link, a table with a list of observations of the given object will be displayed, which, in addition to general information, also contains a preview of the photometry and the specified times of minima (times of the center of transits), if the given observation contains any.



ID	Light curve	Name	Constellation	Phot. band	Created by	Email	Date	Created	Minima	Transits	DQ
		Search	Search	Search	Search	Search					Sear
98493		AB	And	NoFilter	CCD Sekce Štefánikova hvězdárna	ccd.hvezdarnapraha@gmail.com	10/21/24	11/08/24	S: 2460605.31848 (360459)		
98408		AB	And	clear	CCD Sekce Štefánikova hvězdárna	ccd.hvezdarnapraha@gmail.com	10/21/24	11/02/24	S: 2460605.32023 (360458)		
77883		AB	And	Clear	Jens Jacobsen	skaar@post6.tele.dk	08/30/24	08/31/24	P: 2460553.37904 (23210)		
104896		AB	And	I	Kateřina Hoňková	katerina.honkova@astronomie.cz	07/28/24	08/09/24	P: 2460520.52123 (23209)		
104895		AB	And	R	Kateřina Hoňková	katerina.honkova@astronomie.cz	07/28/24	08/09/24	P: 2460520.52142 (23208)		
104894		AB	And	V	Kateřina Hoňková	katerina.honkova@astronomie.cz	07/28/24	08/09/24	P: 2460520.52135 (23207)		
104893		AB	And	B	Kateřina Hoňková	katerina.honkova@astronomie.cz	07/28/24	08/09/24	P: 2460520.52148 (23206)		

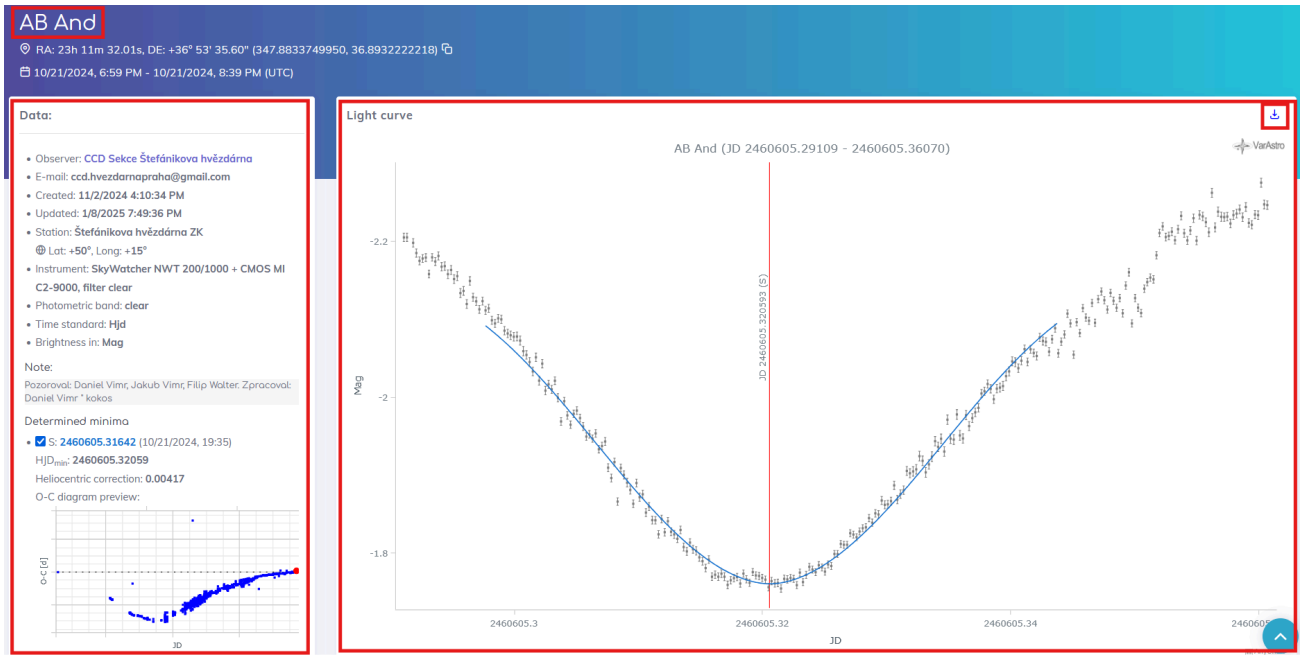
Details of a specific observation can then be viewed by clicking on the identification number located in the first column of the table.

Observation detail

Details of a specific observation can be accessed in several ways, not just by clicking through the list of observations for a given object.

The detail of a given object can also be displayed using a table with minimum times or transit midpoint times (first column of the table) and also via O-C, TTV and other diagrams, where double-clicking on individual points of the graph displays the associated observation, if any (see Star detail or Exoplanet detail).

Below is a detail of a specific observation of the star AB And.

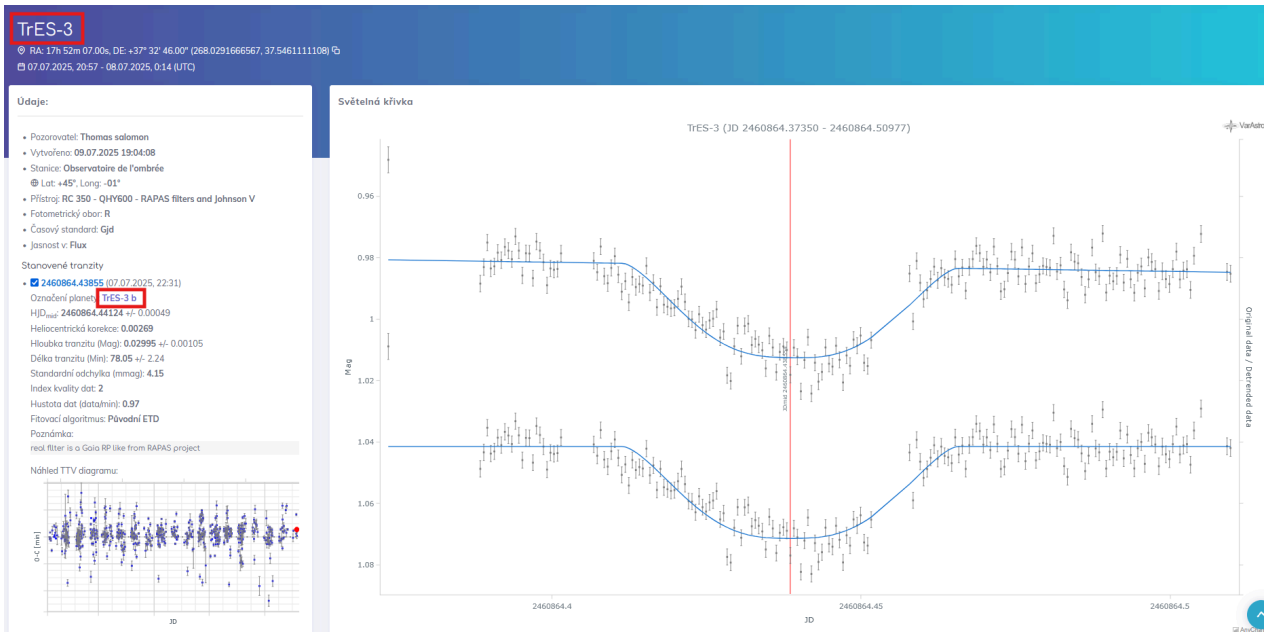


In the left panel, in addition to basic information about the observation, there is also a list of determined minima, if the observation contains them, and a preview of the O-C diagram, where the determined minimum is highlighted in red.

Clicking on the star name in the header of the page will display details about the star.

Further down the page, below the light curve display with a possible minimum fit, there is additional information – fit residues, air mass, a chart with the surroundings of the observed star (with marked comparison stars) and, last but not least, any comments.

For completeness, an example of a specific observation of the transit of the exoplanet TrES-3 b (photometry of the star TrES-3) is given below, the presentation is slightly different, since the transit fit is shown instead of the minimum. The left panel also contains some additional information about the fit, including e.g. the data quality index.



Note that the observation is actually "assigned" to the star TrES-3 (as can be inferred from the star name in the observation detail header), not to its exoplanet. The pairing with a specific exoplanet occurs only at the moment the fit of the observed transit is saved.

The designation TrES-3 b is therefore only found in the left panel, which displays information about the transit fit.

Download the original photometry file

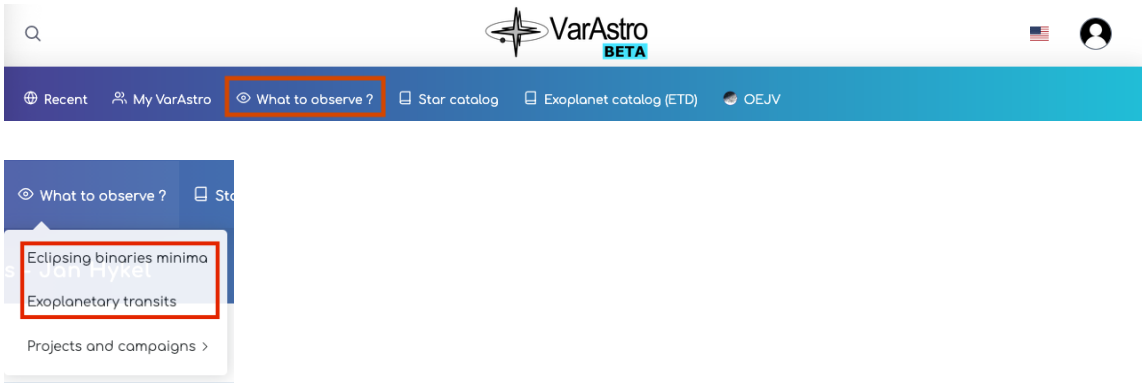
If the user is logged in, they can download the original photometry files (or even an image with a chart) via the observation table. The icons that allow this are located in the last column of the table.

The same can be achieved on the observation detail page, the icon for downloading the original photometry file is located in the top right of the tab header with the light curve displayed.

What to observe?

Predictions

Predictions of observable events are available from the main menu: "What to observe?"



Any active observation campaigns or projects can also be found in the same menu.

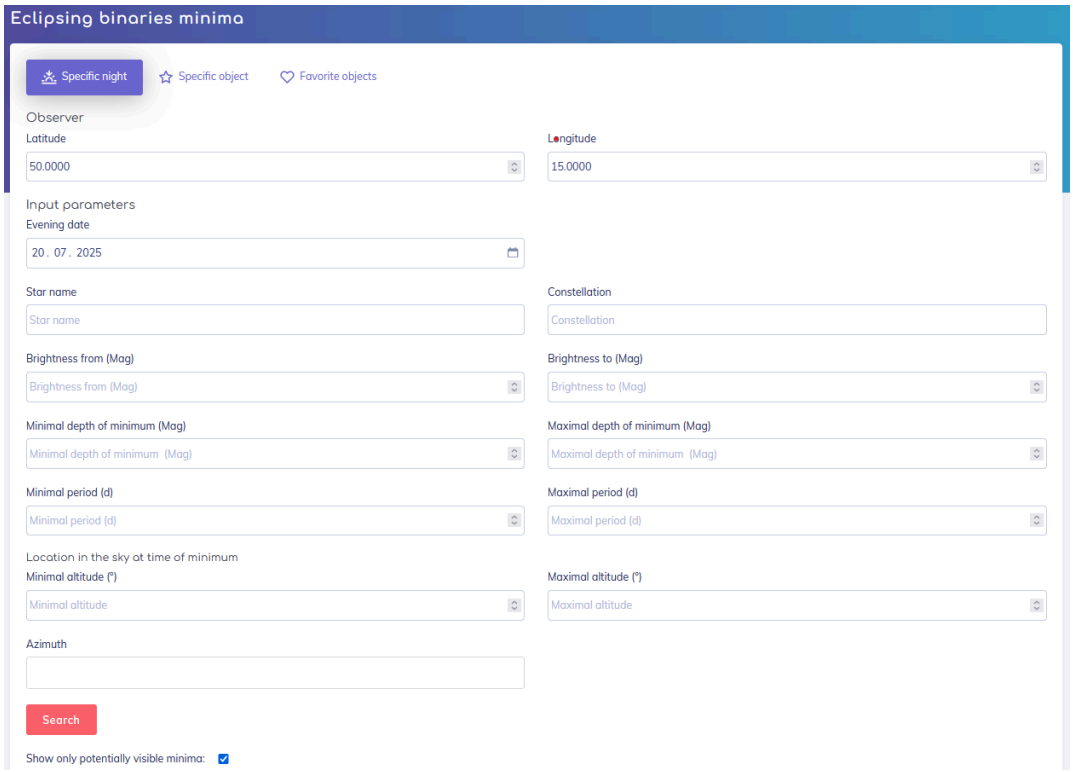
The input forms for both types of predictions are slightly different, but the principle is the same. It is possible to limit the selection of objects based on name, constellation, possible astrophysical interest, brightness range, depth of minimum (transit depth), period range, and it is possible to specify where in the sky (azimuth / altitude) the object may occur at the time of minimum (center of transit).

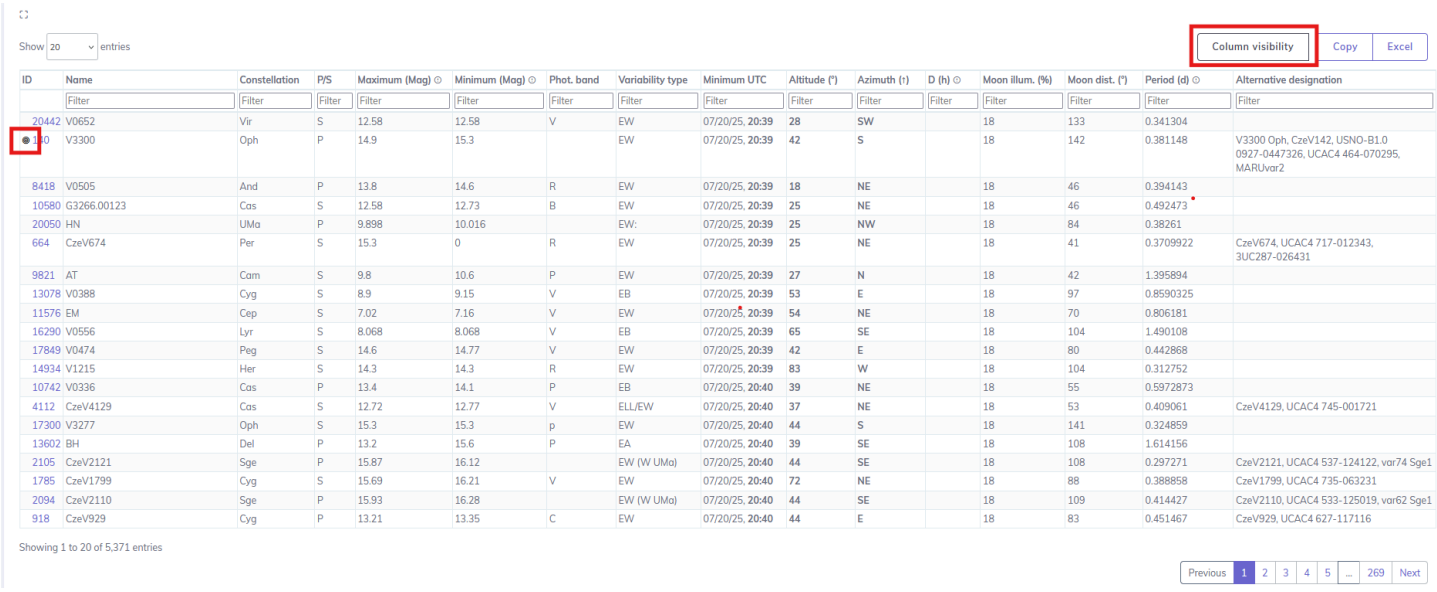
By default, predictions are displayed for the current observing night and for the geographical location specified in the user's profile, or for 50 degrees north latitude and 15 degrees east longitude (of course, this can be changed in the form).

Using the buttons at the top of the form header, you can then view predictions for a specific object (you can also view them using the "Show prediction" link on the star or exoplanet details page, see Star detail, or Exoplanet detail), forecasts for favorite objects (the user must be logged in), implicitly for half a year in advance.

If this option is not disabled, only potentially observable phenomena are displayed by default (we are usually not interested in occultation minima or transits in the daytime sky or at night, if they are below the horizon).

Minima predictions





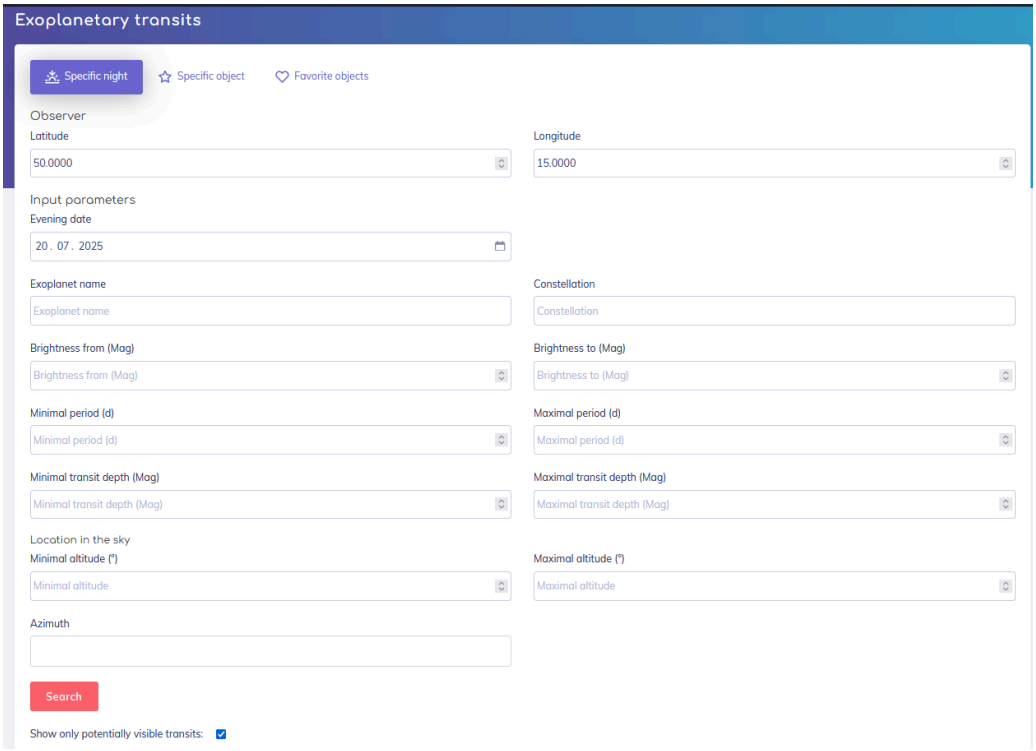
The output is a table with minimum predictions - the name of the eclipsing star, the type of minimum (primary or secondary), the time of minimum (in UTC), the position in the sky at the time of minimum, and other information (brightness data) are displayed.

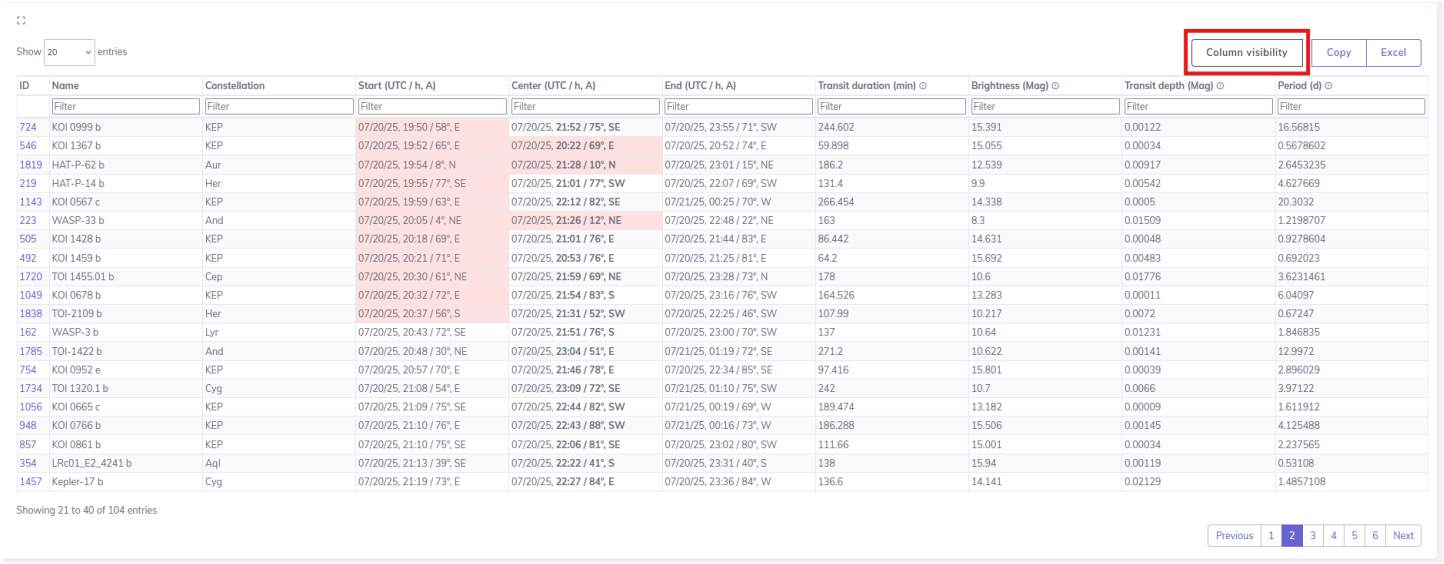
A colored “target” icon in front of a star's name indicates a possible astrophysical interest or other note about the star. Details are displayed when you hover your mouse over this “target” icon.

You can use the "Column Visibility" button to hide unused columns. And possibly add some extra columns - not everything is displayed by default (for example, the current moon phase and the angular distance of the moon from the observed star are implicitly hidden).

Before observing the selected minimum, it is advisable to check the development of the O-C diagram of the given object - the VarAstro forecasting system uses fixed periodic elements to determine the times of the minimum and is not yet able to take into account any deviation caused by the development of the O-C diagram in the forecasts.

Transit predictions





ID	Name	Constellation	Start (UTC / h, A)	Center (UTC / h, A)	End (UTC / h, A)	Transit duration (min)	Brightness (Mag)	Transit depth (Mag)	Period (d)
	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter
724	KOI 0999 b	KEP	07/20/25, 19:50 / 58°, E	07/20/25, **21:52 / 75°, SE**	07/20/25, 23:55 / 71°, SW	244.602	15.391	0.00122	16.56815
546	KOI 1367 b	KEP	07/20/25, 19:52 / 65°, E	07/20/25, **20:22 / 69°, E**	07/20/25, 20:52 / 74°, E	59.898	15.055	0.00034	0.5678602
1819	HAT-P-62 b	Aur	07/20/25, 19:54 / 8°, N	07/20/25, **21:28 / 10°, N**	07/20/25, 23:01 / 15°, NE	186.2	12.539	0.00917	2.6453235
219	HAT-P-14 b	Her	07/20/25, 19:55 / 77°, SE	07/20/25, **21:01 / 77°, SW**	07/20/25, 22:07 / 69°, SW	131.4	9.9	0.00542	4.627669
1143	KOI 0567 c	KEP	07/20/25, 19:59 / 63°, E	07/20/25, **22:12 / 82°, SE**	07/21/25, 00:25 / 70°, W	266.454	14.338	0.0005	20.3032
223	WASP-33 b	And	07/20/25, 20:05 / 4°, NE	07/20/25, **21:26 / 12°, NE**	07/20/25, 22:48 / 22°, NE	163	8.3	0.01509	1.2198707
505	KOI 1428 b	KEP	07/20/25, 20:18 / 69°, E	07/20/25, **21:01 / 76°, E**	07/20/25, 21:44 / 83°, E	86.442	14.631	0.00048	0.9278604
492	KOI 1459 b	KEP	07/20/25, 20:21 / 71°, E	07/20/25, **20:53 / 76°, E**	07/20/25, 21:25 / 81°, E	64.2	15.692	0.00483	0.692023
1720	TOI 1455.01 b	Cep	07/20/25, 20:30 / 61°, NE	07/20/25, **21:59 / 69°, NE**	07/20/25, 23:28 / 73°, N	178	10.6	0.01776	3.6231461
1049	KOI 0678 b	KEP	07/20/25, 20:32 / 72°, E	07/20/25, **21:54 / 83°, S**	07/20/25, 23:16 / 76°, SW	164.526	13.283	0.00011	6.04097
1838	TOI-2109 b	Her	07/20/25, 20:37 / 56°, S	07/20/25, **21:31 / 52°, SW**	07/20/25, 22:25 / 46°, SW	107.99	10.217	0.0072	0.67247
162	WASP-3 b	Lyr	07/20/25, 20:43 / 72°, SE	07/20/25, **21:51 / 76°, S**	07/20/25, 23:00 / 70°, SW	137	10.64	0.01231	1.846835
1785	TOI-1422 b	And	07/20/25, 20:48 / 30°, NE	07/20/25, **23:04 / 51°, E**	07/21/25, 01:19 / 72°, SE	271.2	10.622	0.00141	12.9972
754	KOI 0952 e	KEP	07/20/25, 20:57 / 70°, E	07/20/25, **21:46 / 78°, E**	07/20/25, 22:34 / 85°, SE	97.416	15.801	0.00039	2.896029
1734	TOI 1320.1 b	Cyg	07/20/25, 21:08 / 54°, E	07/20/25, **23:09 / 72°, SE**	07/21/25, 01:10 / 75°, SW	242	10.7	0.0066	3.97122
1056	KOI 0665 c	KEP	07/20/25, 21:09 / 75°, SE	07/20/25, **22:44 / 82°, SW**	07/21/25, 00:19 / 69°, W	189.474	13.182	0.00009	1.611912
948	KOI 0766 b	KEP	07/20/25, 21:10 / 76°, E	07/20/25, **22:43 / 88°, SW**	07/21/25, 00:16 / 73°, W	186.288	15.506	0.00145	4.125488
857	KOI 0861 b	KEP	07/20/25, 21:10 / 75°, SE	07/20/25, **22:06 / 81°, SE**	07/20/25, 23:02 / 80°, SW	111.66	15.001	0.00034	2.237565
354	LRc01_E2_4241 b	Aql	07/20/25, 21:13 / 39°, SE	07/20/25, **22:22 / 41°, S**	07/20/25, 23:31 / 40°, S	138	15.94	0.00119	0.53108
1457	Kepler-17 b	Cyg	07/20/25, 21:19 / 73°, E	07/20/25, **22:27 / 84°, E**	07/20/25, 23:36 / 84°, W	136.6	14.141	0.02129	1.4857108

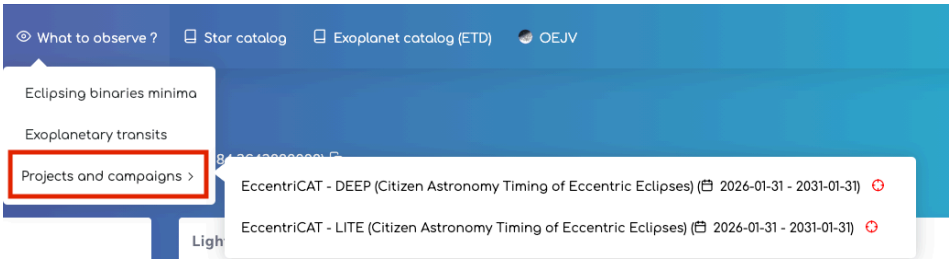
The output is a table with transit predictions - the name of the exoplanet, the time (in UTC) and position in the sky at the moment of the beginning, middle and end of the transit and other data (e.g. the brightness of the parent star and the depth of the transit) are displayed. A box in the table

highlighted in reddish color indicates a potentially unobservable event (beginning, middle or end of the transit).

It also applies here that you can use the "Column Visibility" button to hide unused columns and possibly add some extra columns.

Projects and campaigns

Active observation projects and campaigns are also available from the main menu: "What to observe?"



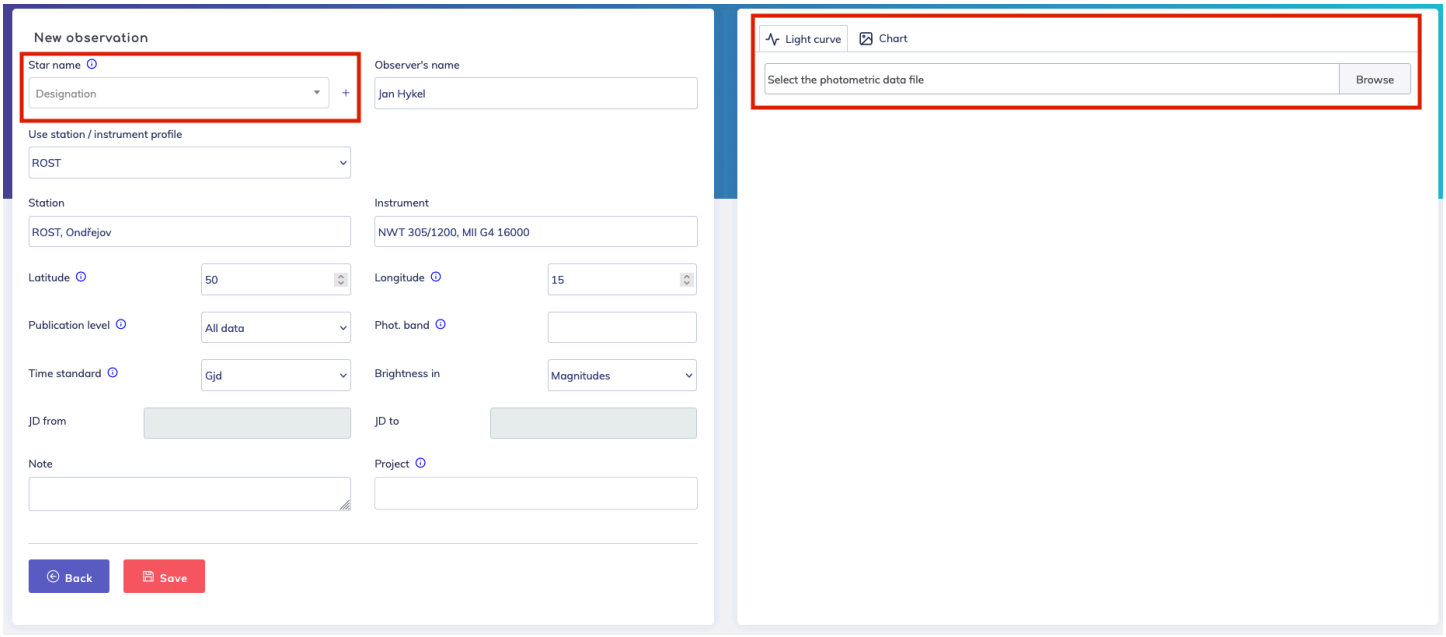
Clicking on a specific project will display a page with project details: the name, what it concerns, who the project leader is, the project time limit (if it is time-limited) and last but not least, it may also contain a list of specific objects that the project leader has requested to be observed. Further down the page there may also be links to minima/transit predictions for these specific objects (the predictions can also be viewed by clicking on the red "target" icon directly from the project list in the menu).

How to upload your own observations?

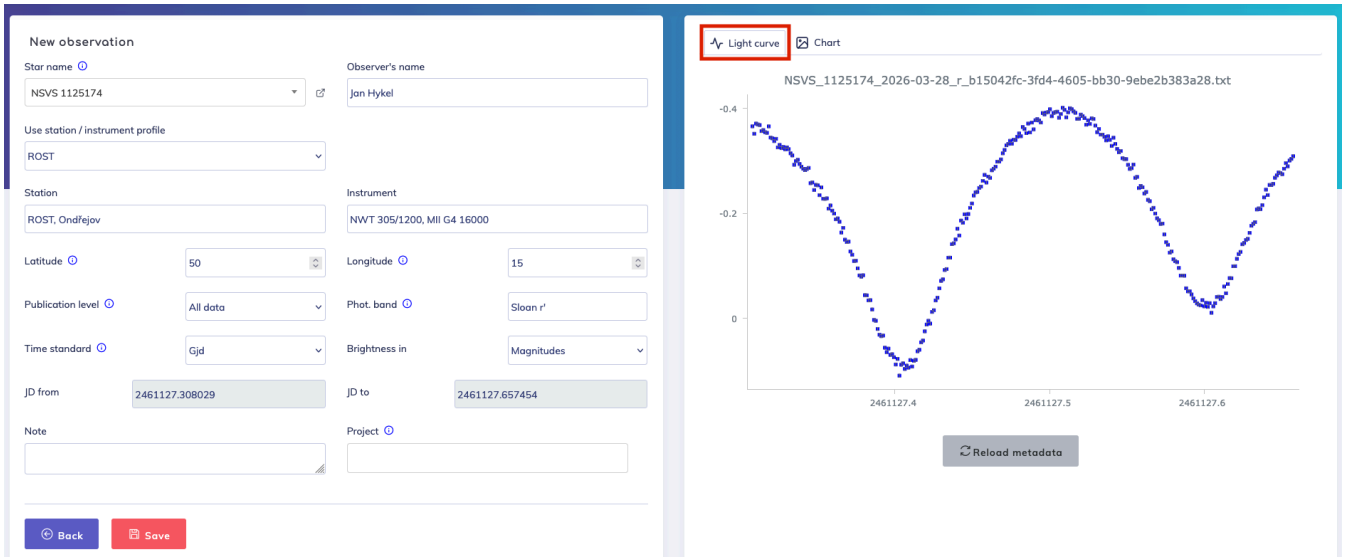
The user must be logged in.

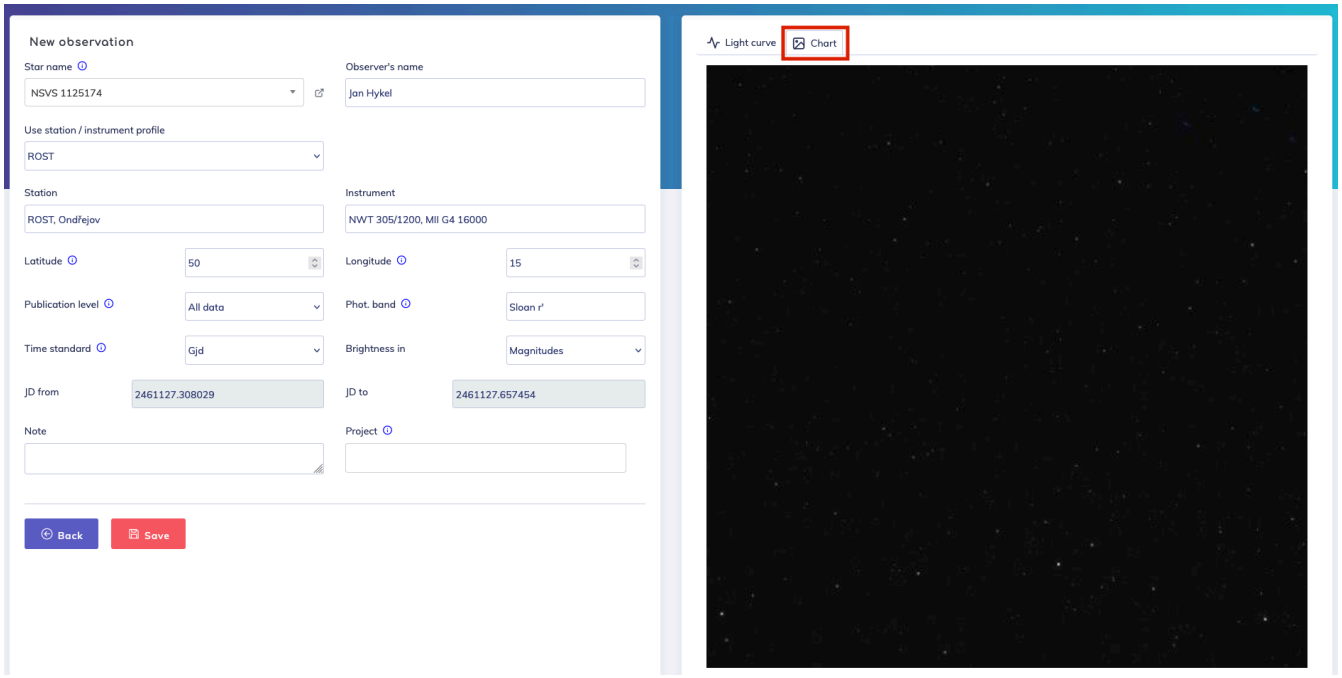
Uploading a new observation is accessible from the user menu, or via the "Upload observation" quick button visible in the main menu.

After activating the button, the following form will appear:



The form is divided into two parts: on the left, observation data is entered, on the right, there is space for uploading photometric data, as well as a chart with the surroundings of the observed object and a description of the comparison and check stars.





It is recommended to first upload a photometry file - this may contain information about the time standard used, the photometric filter, and the units in which the brightness is given. In many cases, the VarAstro system is able to read this information and pre-fill the essential part into the left part of the form.

The supported input data format is a text file, where the first column is the Julian date (full or reduced) and the second column is the star's brightness value (magnitude or flux). Additionally, the AAVSO format is also supported.

If the photometry file is processed using the SIPS tool, the VarAstro system is also able to read the star identification (coordinates) and attempt to match it with a star in the database, possibly pre-filling it into the "Star Name" field.

If necessary, the data can be edited manually.

Special attention should be paid to the time standard used, as different photometric tools use different standards – geocentric or heliocentric Julian date, barycentric Julian date. It is always necessary to choose the correct time standard, namely the one in which the data is taken.

Also worth noting is the choice of units in which brightness is displayed - magnitudes or flux. VarAstro works with magnitudes internally. If you upload an observation and the preview appears "strangely inverted", you probably entered the brightness unit incorrectly - try swapping it.

Don't forget to also include information about the observatory and the instrument used. To avoid having to fill in this information manually each time, you can pre-fill it in My profile. If you use multiple observatories/instruments, it is possible to create multiple profiles with descriptions and then simply switch between them.

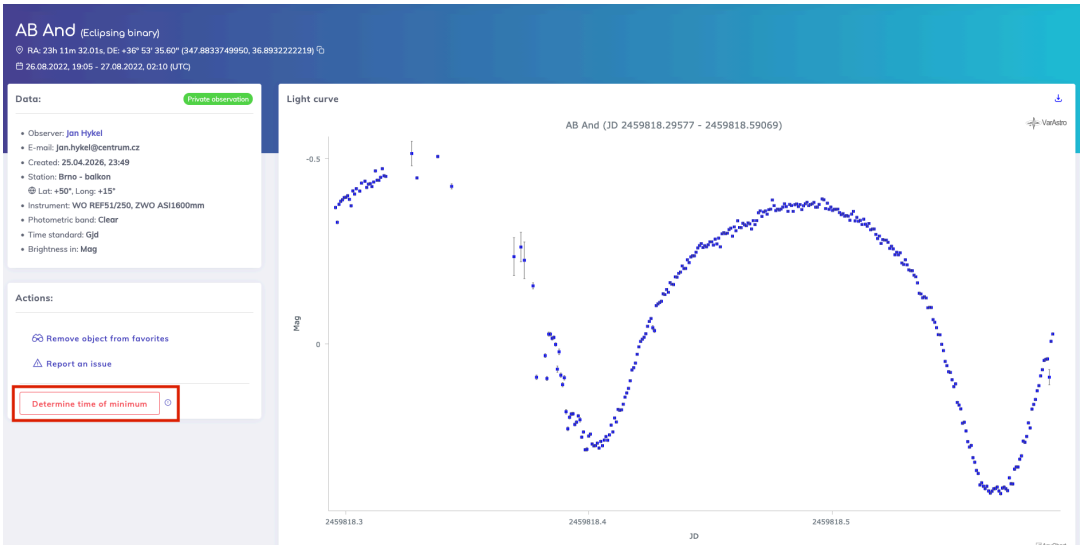
If you are observing an object as part of one of the observation projects/campaigns, you can specify it.

Before submitting an observation, we can also set the publication level – the observation can be “private.” In this case, the observation will not be visible to other users.

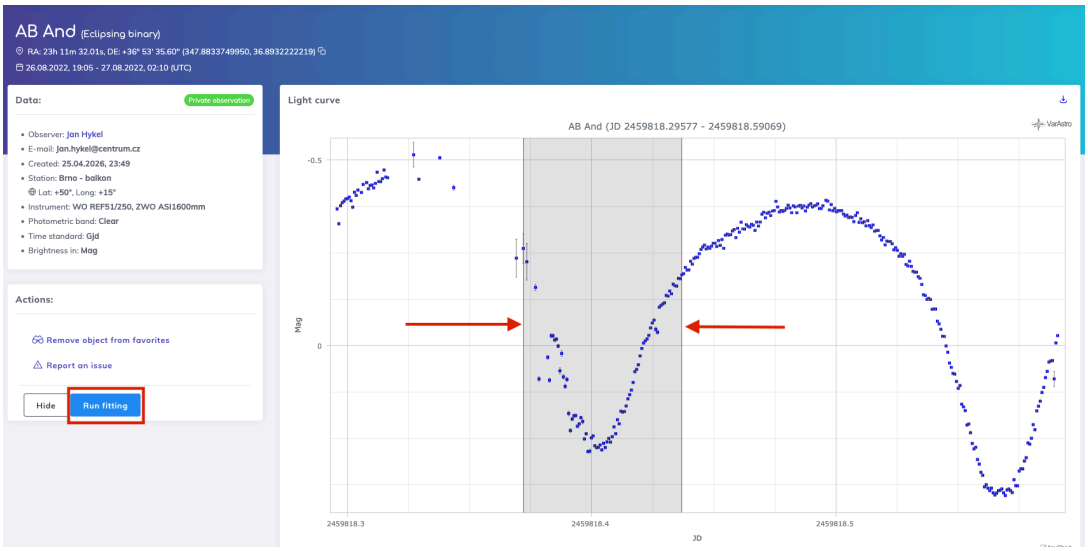
The observation is finally sent by pressing the "Save" button. The details of the newly entered observation are then displayed.

Fitting minima of eclipsing binaries

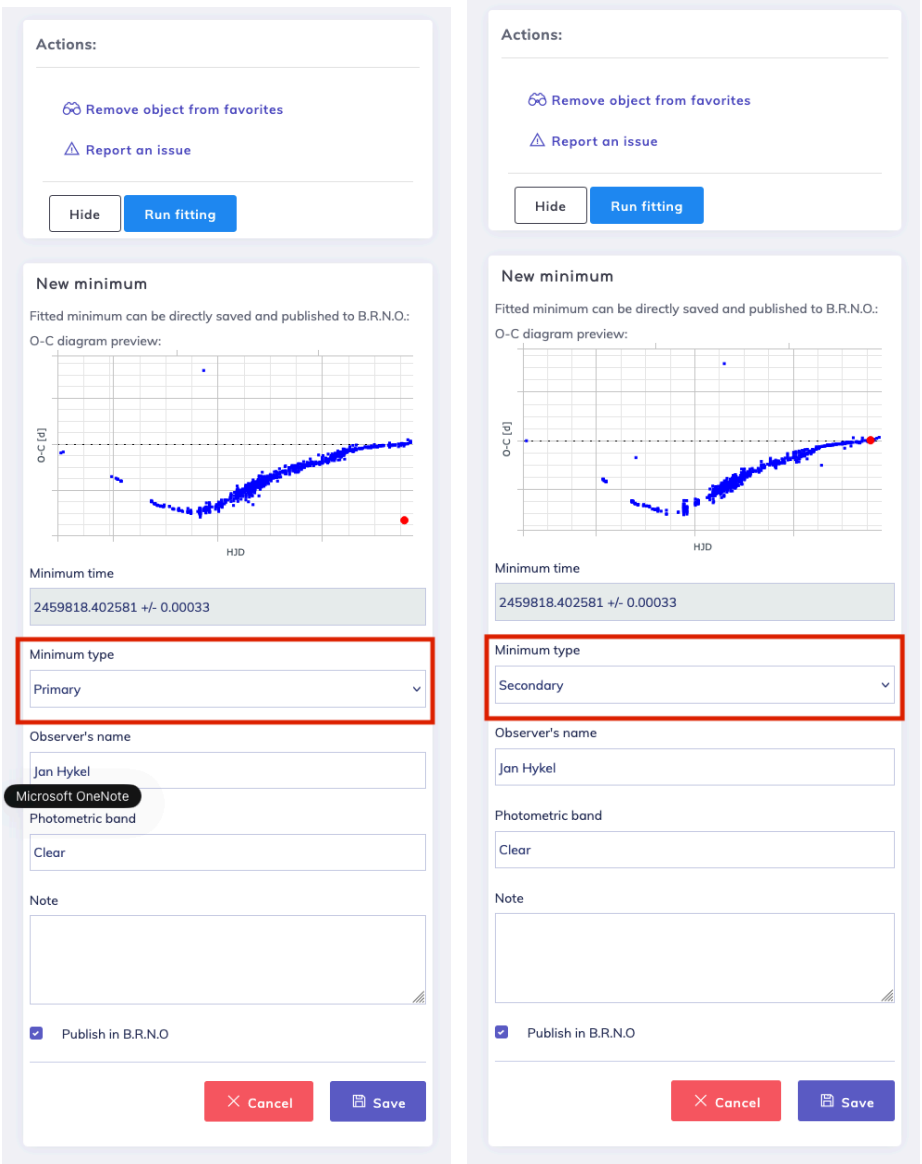
In the details of our specific observation (if it is a captured binary occultation), we can determine the time of the minimum. We display the minimum fitting tool by clicking the "Determine time of minimum" button.



A tool will appear to select the time interval in which the fitting algorithm will then try to find the minimum. Select the area around the expected minimum so that the decrease/increase in brightness around the minimum is included, but avoid maxima and their surroundings. See the image below.

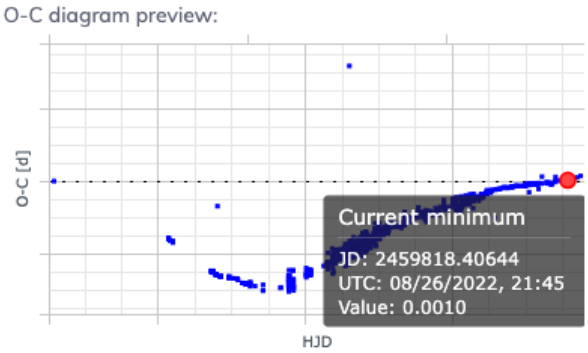


Pressing the "Run fitting" button will perform a minimum fit, which will then be displayed in the light curve. The determined minimum time and other data, including a preview of the O-C diagram, will be displayed in the left panel.



From the O-C diagram preview (where the red dot represents a new minimum that is somewhat out of line with expectations) and from the original photometry, it is clear that this is a secondary minimum, not a primary. So we change the minimum type to “secondary”. This causes the O-C diagram preview to be redrawn – the determined minimum now fits in more than well with the others.

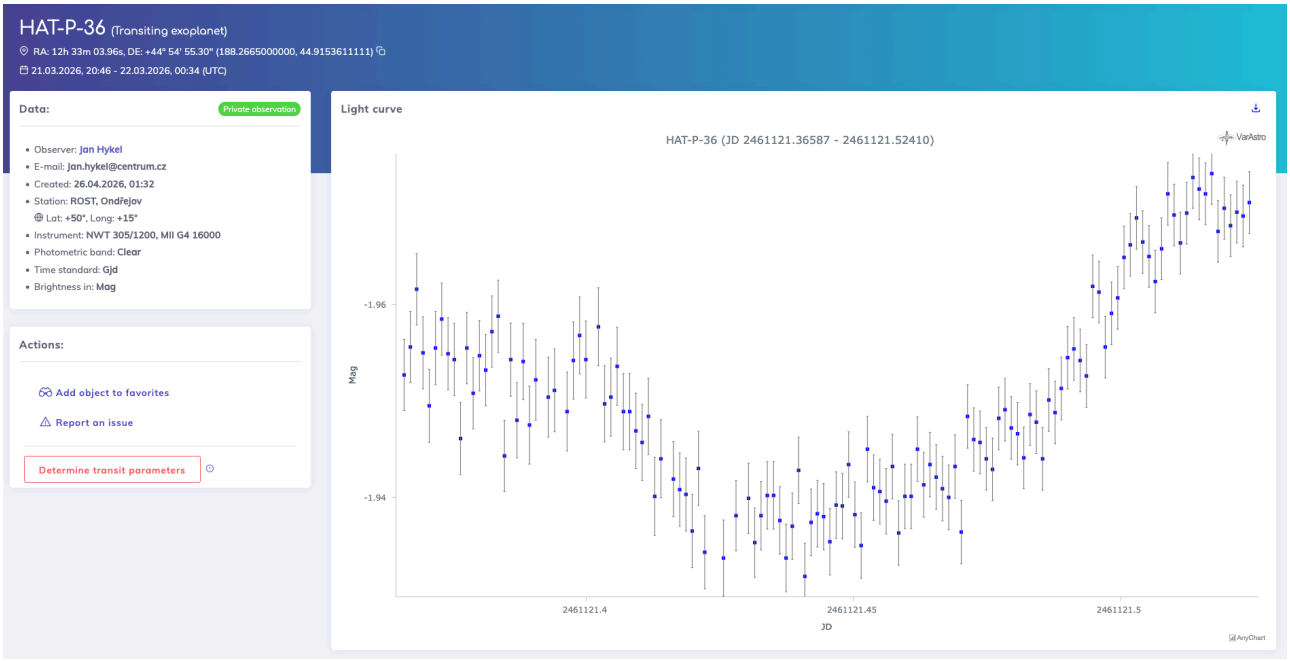
By hovering the mouse over the red dot representing the new minimum time, it is possible to display information about how much the time differs from the prediction.



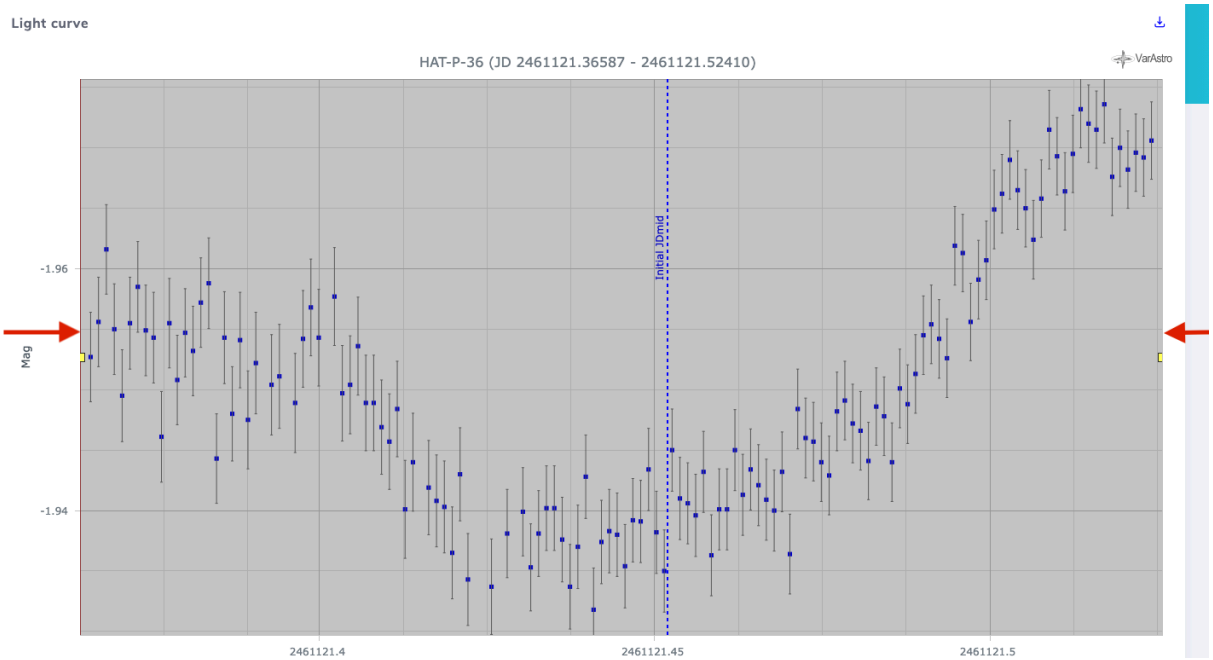
Save the new minimum by pressing the "Save" button.

Fitting exoplanet transits

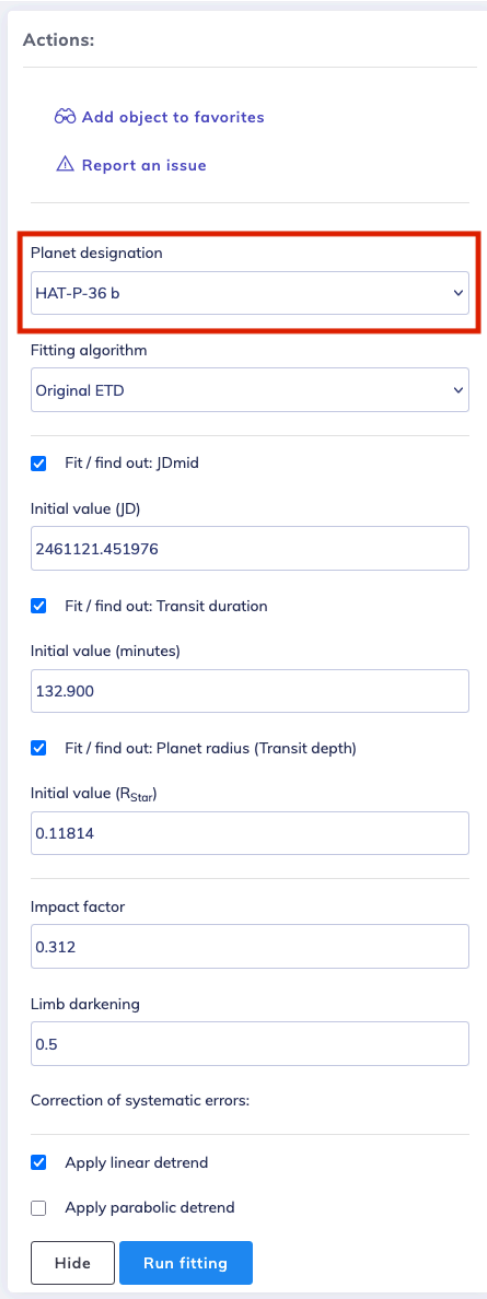
In the details of our specific observation, if it is a captured transit of an exoplanet, we can determine its parameters. We display the transit fitting tool by clicking the "Determine transit parameters" button.



A tool for selecting a time interval will appear, in which the fitting algorithm will then try to find and determine the transit parameters. Select the time interval in which you expect the transit, including the entry and exit from the transit (or leave the default time interval selection). See the image below.



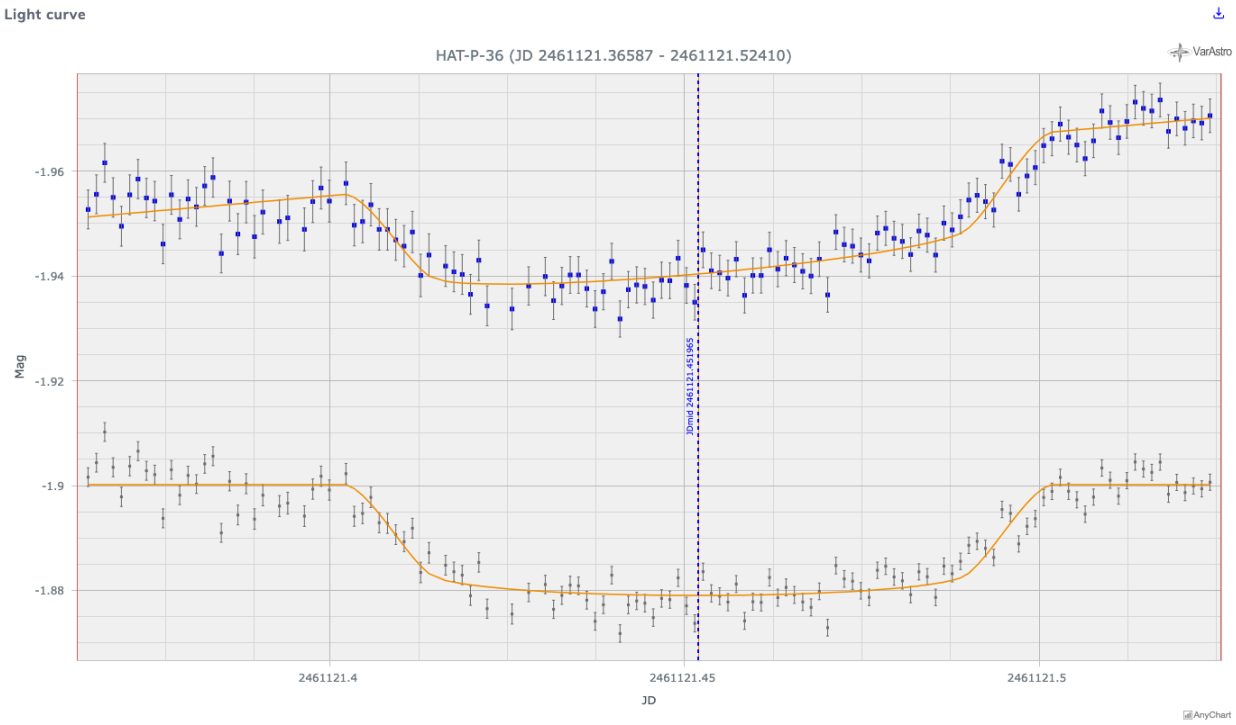
Also select the expected approximate time of the mid-transit (blue dashed line) if this does not match the implicit estimate. The specified time will be written into one of the input parameters displayed in the left panel.



In most cases, there is no need to change the default values of the other parameters - they are carried over from the data on the specific expected exoplanet. However, it is possible to specify which parameters will be fitted and which will be fixed. If the observation captures a complete transit, it is advisable to specify both the moment of the transit's midpoint, its depth, and its length.

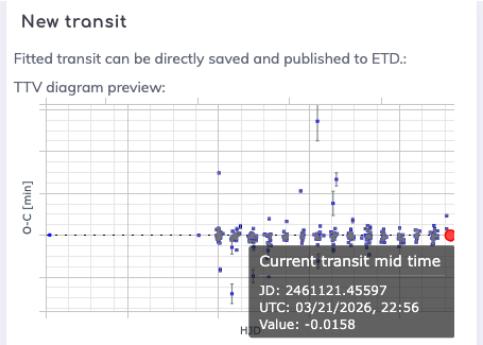
Last but not least, it is possible to set the correction of systematic errors - in most cases, linear detrending is sufficient.

After pressing the "Run fitting" button, the algorithm will attempt to find the desired transit parameters (displayed in the left panel). The light curve graph will then display the fit of the original photometry as well as the fit of the detrended data.



Transit parameters in the left panel, including a preview of the TTV diagram:

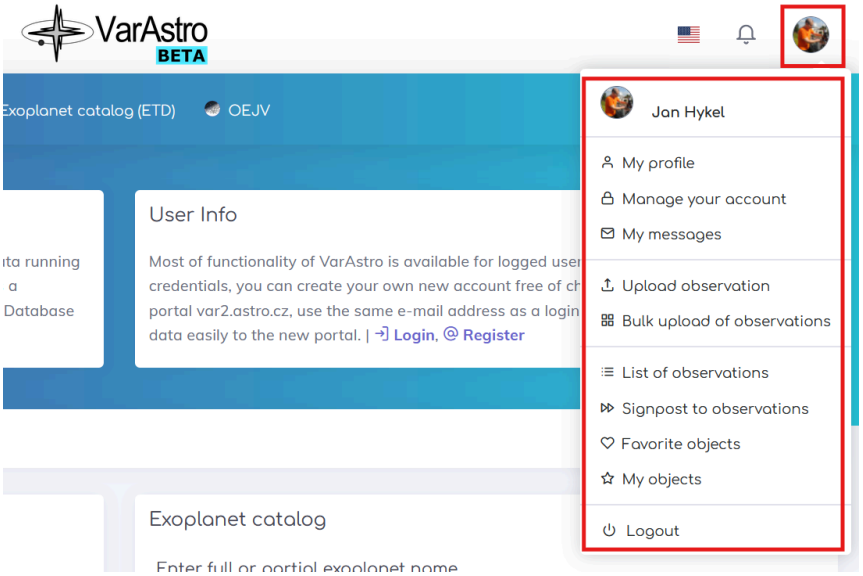
By hovering the mouse over the red dot representing the new transit midpoint time, it is possible to display information about how much the time differs from the prediction.



Save the new transit by pressing the "Save" button.

What functionalities are available to a logged-in user?

A logged-in user has a user menu available, which is displayed when you hover your mouse over the round "avatar" icon in the top right (you can set your own image in the section under "My profile").



For example, a user can view a list of all their observations, change their login password, send an internal message to another VarAstro user, or view a list of their favorites and objects they have created.

The main function is, however, uploading observations to the database and determining minima of eclipsing binaries and exoplanet transits using internally contained models. A logged-in user is also authorized to download original observations of other users.

The following is a brief description of the individual items of the user menu.

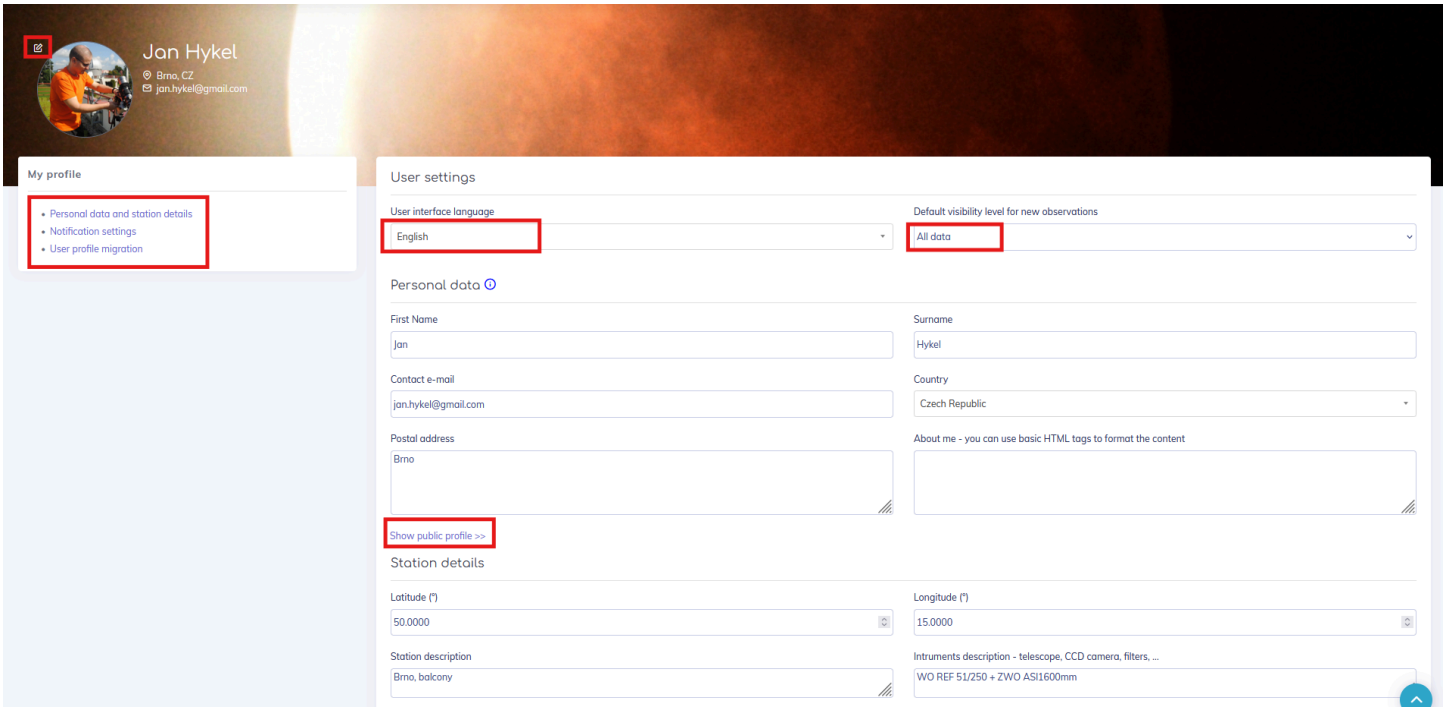
My profile

Here you can change the user interface language, fill in the data about the observer, his observatory and instruments. It is possible to create multiple observatory and instrument profiles.

Please fill in at least your first and last name.

The filled in observatory and instrument details are then used to pre-populate the form when uploading a new observation. The same applies to the default visibility/publication level.

A user can choose not to publish their observations, such observations are then not visible to other users.



If you previously had an account on the original var.astro.cz and used a different email address to register than the one entered in the original profile, you can link your new and original accounts – via the “User profile migration” link in the left panel. However, if you used the same email address, the data from the original profile was automatically linked to the new account. You don't need to do anything else.

The "Notification settings" item is used to display a form with settings for turning on/off the automatic generation of event notification emails.

At the bottom of the user profile page, you can upload user profile pictures, which are then displayed in the header of the public profile (the public profile can be viewed via the "Show Public Profile" link). The public profile only displays the user's name, country, any details (filled in the "About Me" field), and contact email (for logged-in users).

It is also possible to change the avatar image - using the "pencil" icon in the top left.

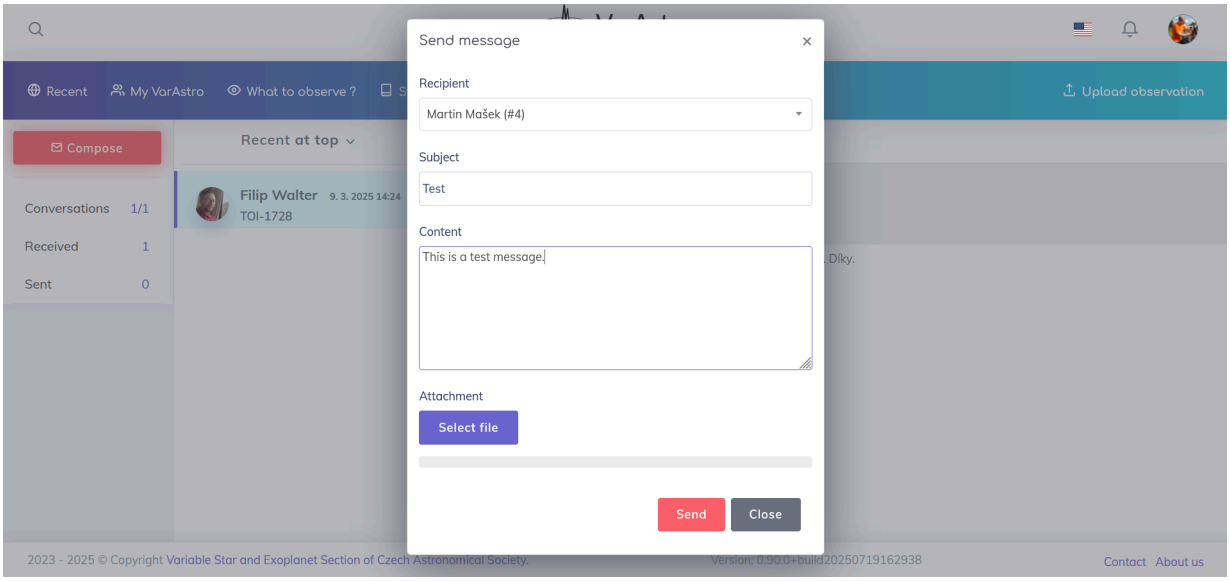
Manage your account

Here you can change the current user password.

My messages

It is used for internal communication with other users of the VarAstro system. It is possible to create new messages and send them to other users and read messages from other users.

The user is notified of an incoming message by an active bell icon on the right in the header (which also contains a list of other notifications), or by an incoming email.



Upload observation

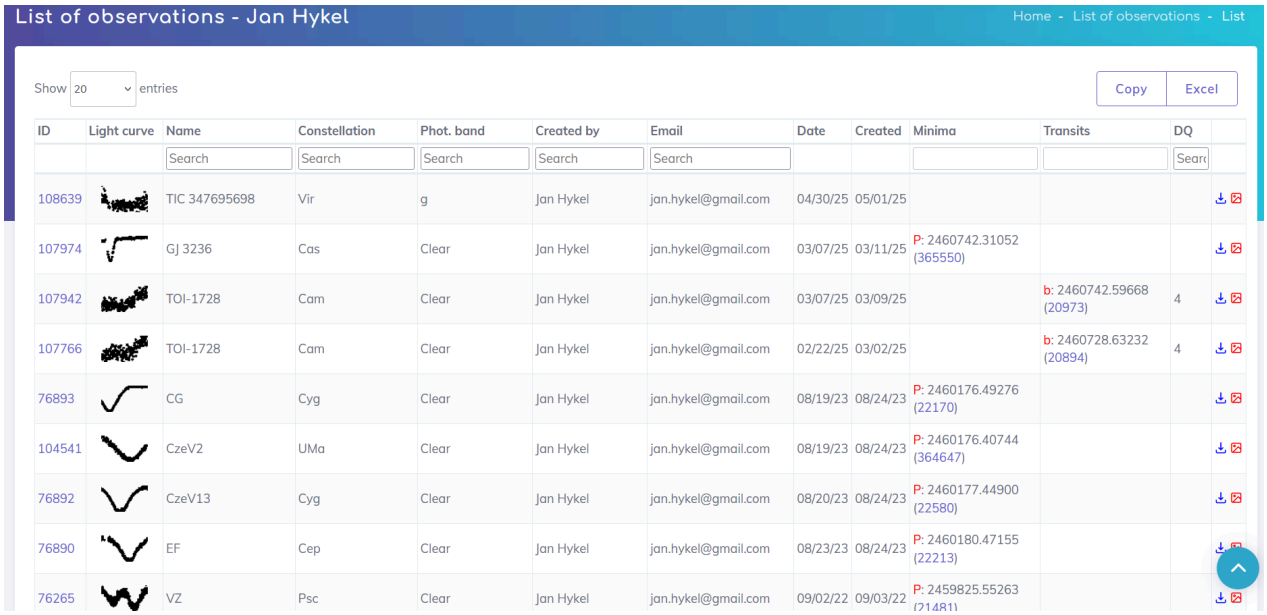
See How to upload your own observations?.

Bulk upload of observations

This is a modification of the observation upload tool that allows you to process multiple observations at once.

List of observations

Displays a list of all user-uploaded observations, including determined minima of eclipsing binaries and exoplanetary transits.

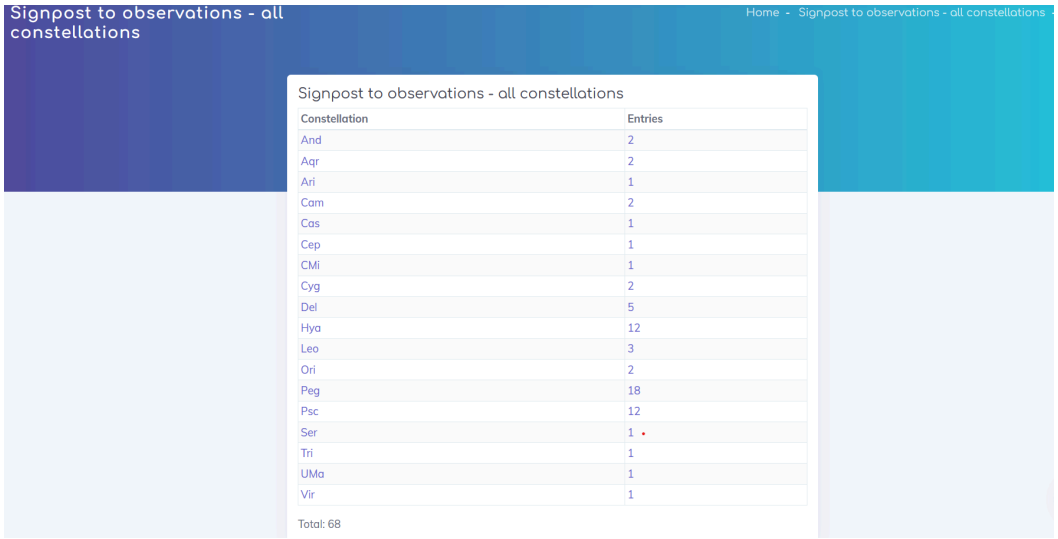


Details of a specific observation can then be viewed by clicking on the identification number located in the first column of the table.

Signpost to observations

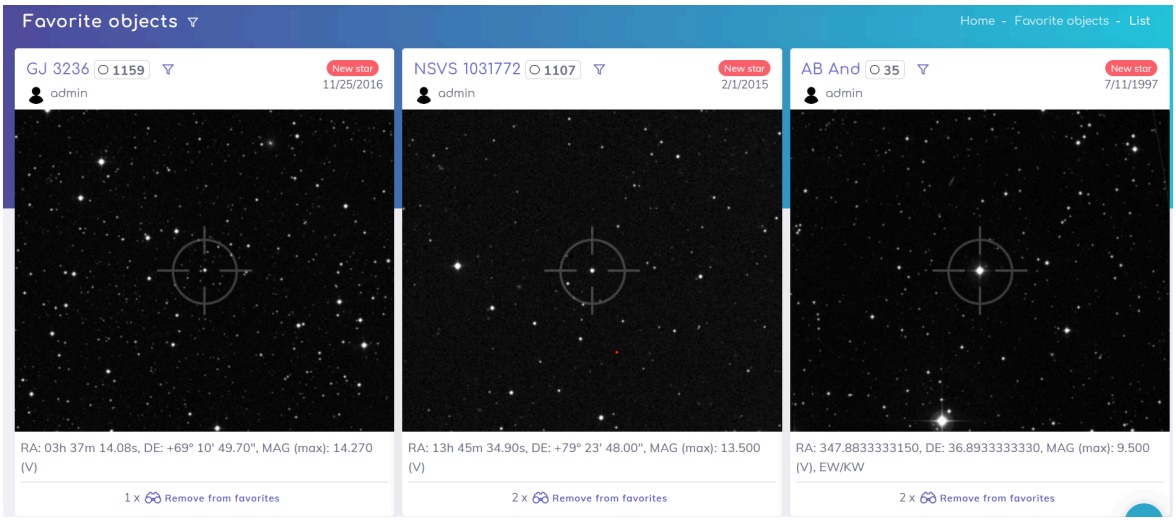
This "signpost" allows us to click through to observe a specific star, even if we don't remember its name. All we need to do is know the constellation.

A summary table with the number of observations in individual constellations will be displayed. After selecting a specific constellation, another table will be displayed with the number of observations of specific stars in that constellation.



Favorite objects

A list of objects that the user has marked as favorites (stars and exoplanets) will be displayed. For favorite objects (among others), VarAstro generates notifications that someone else has added a new observation to this object, minimum or transit fit.



My objects

A list of objects (stars and exoplanets) that the user has added to the database and is their "owner" will be displayed. One of the privileges of the object owner is the ability to subsequently edit them - for example, to adjust brightness data or periodic elements.

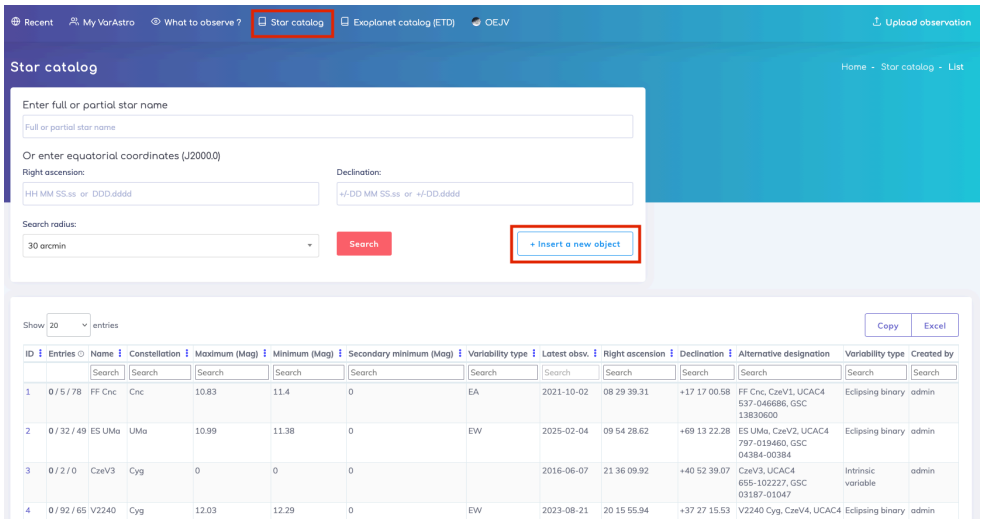
Another registered user does not have these rights (yet). However, in the future, a function of dynamic user rating based on activity will be added, and the active user's rights will gradually increase. This will allow them to edit "other" objects.

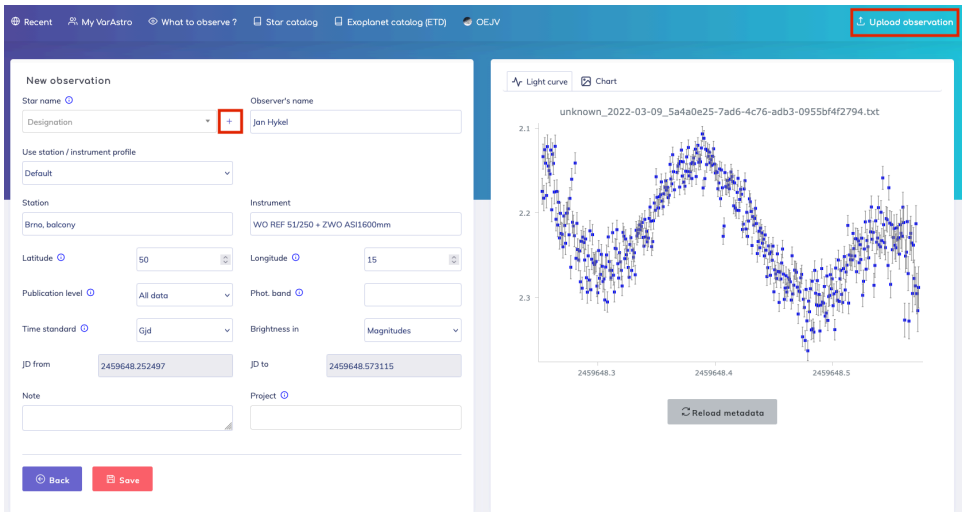
I want to upload a new observation, but the corresponding object does not exist in the database. What should I do?

VarAstro does not contain nearly as many variable stars as, for example, the VSX catalog. If you cannot find a matching star while trying to upload a new observation, a logged-in user can create one themselves.

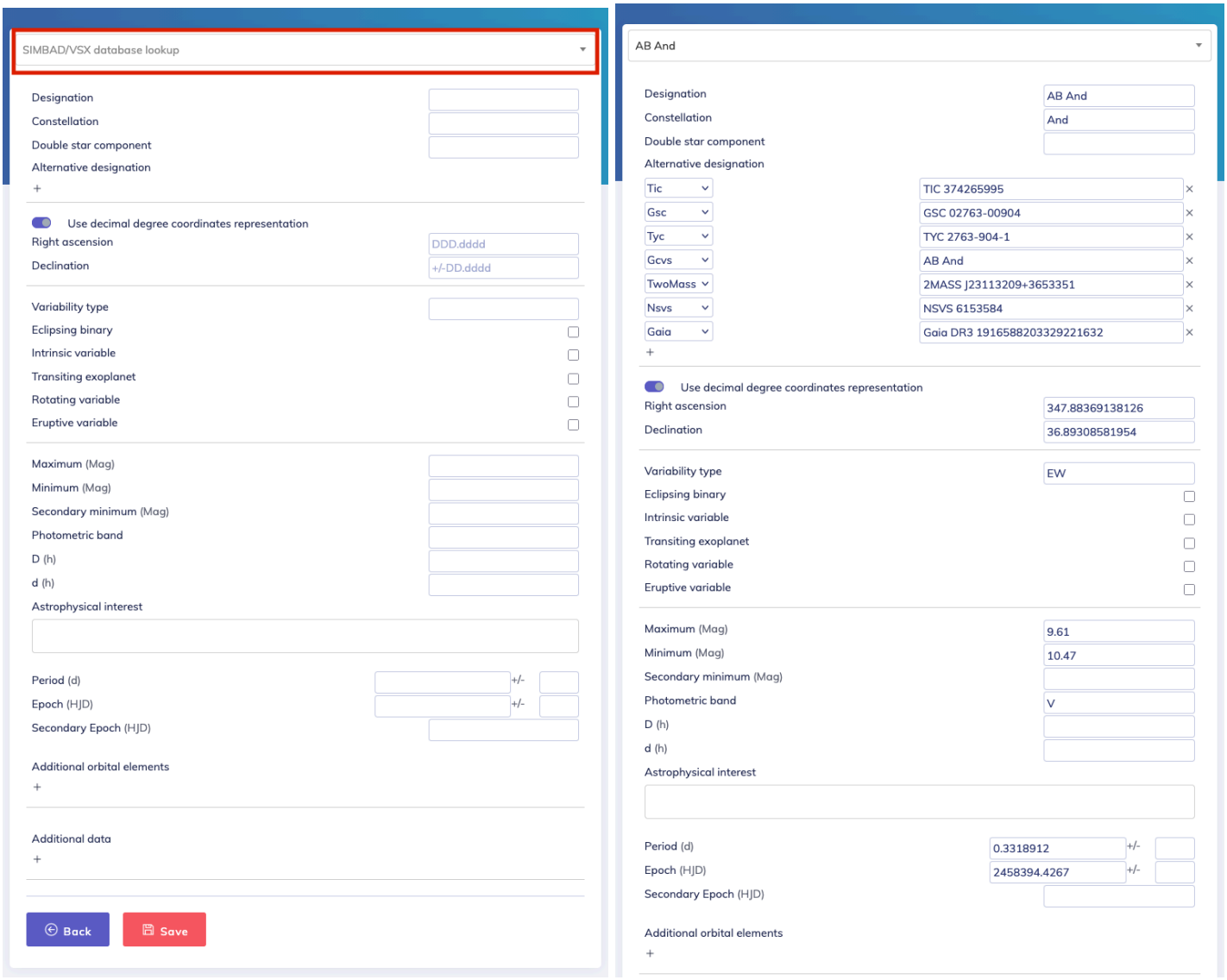
Creating a new star

The "New Star" form can be accessed either from the star catalog using the "Insert a new object" button, or from the observation upload form if we find that we cannot find the object.





The form for creating a new star looks like this:



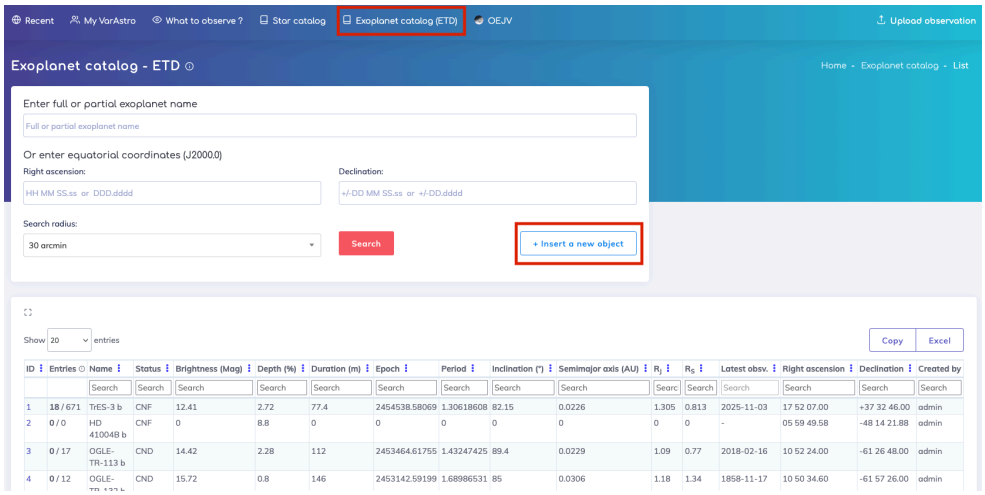
It is necessary to fill in basic information about the star, especially its name, constellation and coordinates (J2000.0). The default representation is in degrees, both for right ascension (0 to 360) and declination (-90 to +90). However, you can switch to a view where the right ascension will be in the classic format of hours / minutes / seconds. It is also appropriate to fill in data on the type of variability, brightness data and periodic elements.

The form allows you to use the services of the online databases SIMBAD and VSX, where after entering the name of the star or its coordinates, most of the data will be pre-filled, including cross-identifications (if the star is found). The user only needs to confirm the data.

A new star will be created after pressing the "Save" button and can then be used to upload a new observation.

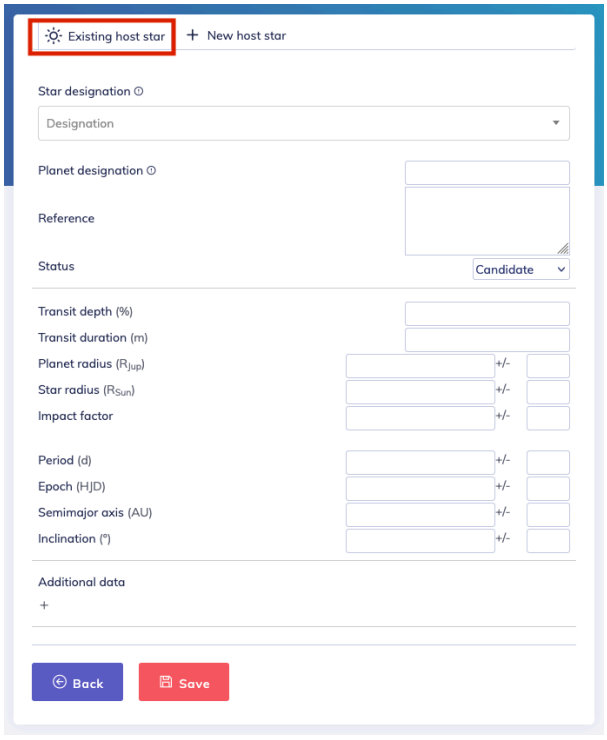
Creating a new exoplanet

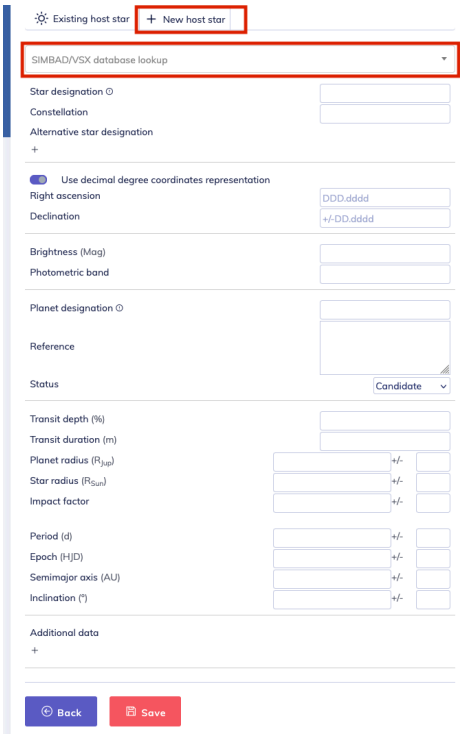
The "New Exoplanet" form can be accessed from the exoplanet catalog using the "Insert a new object" button.



The form for creating a new exoplanet differs depending on whether we "just" want to add a new planet to an existing star (VarAstro uses a hierarchical system - each exoplanet is connected to its parent star in the database, so the star must also exist), or whether we want to create a new star/exoplanet pair in one step at a time. We make the choice by clicking on the "Existing host star" or "New host star" tab.

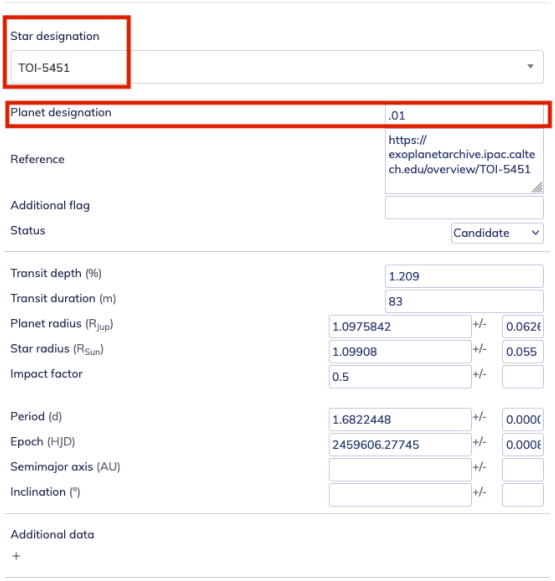
If we are creating a new star/exoplanet pair, it is also necessary to fill in the data about the host star (name, coordinates). Alternatively, the data can be pre-filled using a query to the SIMBAD/VSX database, similarly as described in the chapterCreating a new star.





For a specific exoplanet, it is necessary to fill in its designation (only the planet designation, e.g. "b", or ".01", etc.), data on the decrease in brightness during the occultation (transit depth), transit duration, or other parameters regarding the geometry of the system, and last but not least, orbital / periodic elements.

The data can be found, for example, in the NASA Exoplanet Archive (https://exoplanetarchive.ipac.caltech.edu).



A new exoplanet (or star/exoplanet pair) is created after pressing the "Save" button. The created exoplanet (or its parameters) can then be used when fitting a specific transit in the observation detail.