



FACULTY OF EDUCATION
UNIVERSITY
OF WEST BOHEMIA

Astronomia
ASTRONOMIE PRO KAŽDÉHO

HOW TO USE REAL DATA FROM CATALOGUES OF ASTRONOMICAL OBJECTS (NOT ONLY) IN EDUCATION

OTA KÉHAR

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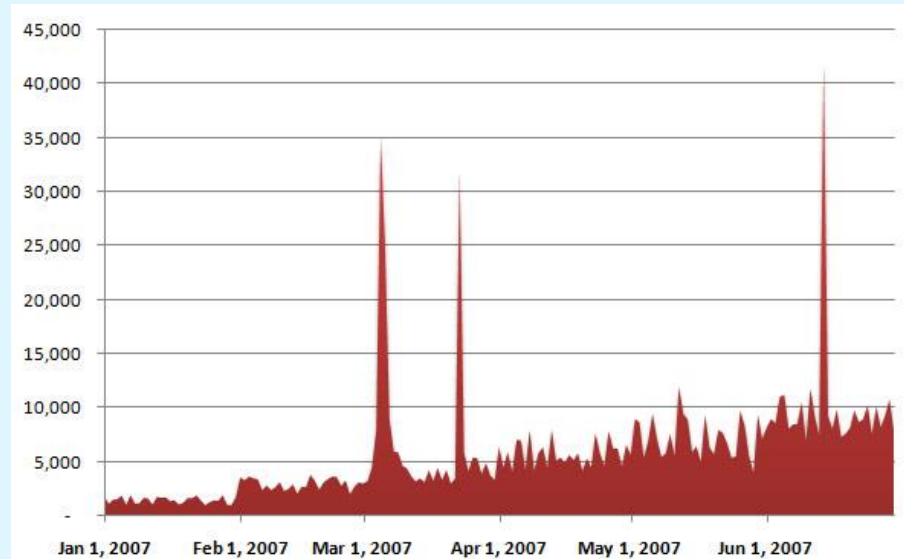
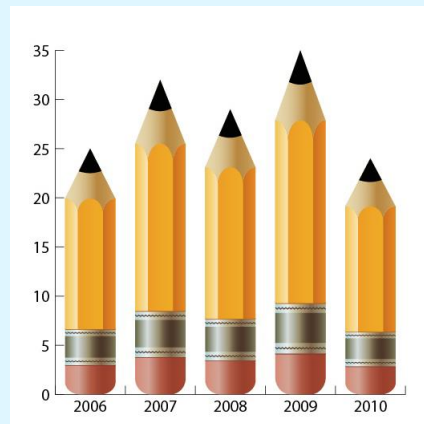
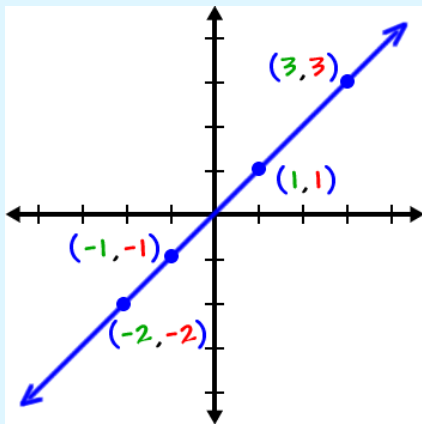
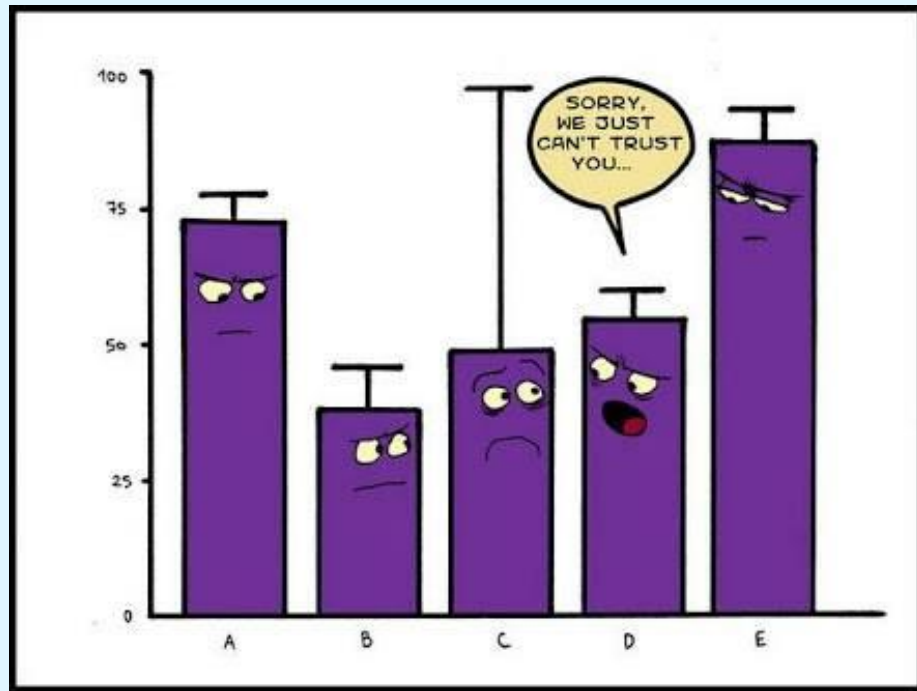
Ota Kéhar / Plzeň / Česká republika

- **RAM/LCC Manager at ŠKODA ELECTRIC, Plzen** ...job...
(RAM = Reliability, Availability, Maintainability; LCC = Life-cycle cost)
- **Eng study at Faculty of Electrical Engineering UWB, Plzen**
- **PhD study and now partly job as Assistant Professor at Faculty of Education, University of West Bohemia, Plzen** ...hobby...
- **Cooperation with Observatory at Rokycany and Plzen**
- Cooperation with Czech and European Astronomical Societies, with Union of Czech Mathematicians and Physicists
- Reviewer of Astronomy Olympiad
- Website creation





Graphs / plots / diagrams are everywhere...





What students should know about it?

Educational Framework Programme for High Schools

INFORMATION PROCESSING AND PRESENTATION

EN

Expected Outcomes

The pupil shall:

- ▶ process and present the outcomes of his/her work while using advanced functions of application software, multimedia technologies and the internet
- ▶ apply an algorithmic approach to problem solving

Subject Matter

- **publishing** – forms of documents and their structures, the principles of graphic and typographic modifications in a document, basic aesthetic principles in publishing
- **application software for work with information** – text editors, spreadsheets, graphics editors, databases, presentation software, multimedia, modelling and simulation, data export and import

ZPRACOVÁNÍ A PREZENTACE INFORMACÍ

CS

Očekávané výstupy

žák

- ▶ zpracovává a prezentuje výsledky své práce s využitím pokročilých funkcí aplikačního softwaru, multimediálních technologií a internetu
- ▶ aplikuje algoritmický přístup k řešení problémů

Učivo

- **publikování** – formy dokumentů a jejich struktura, zásady grafické a typografické úpravy dokumentu, estetické zásady publikování
- **aplikační software pro práci s informacemi** – textové editory, tabulkové kalkulátory, grafické editory, databáze, prezentační software, multimedia, modelování a simulace, export a import dat
- **algoritmizace úloh** – algoritmus, zápis algoritmu, úvod do programování

What are advanced functions of application software?

..., macros, pivot tables, databases, ...

..., functions, adding columns, using formulas, creating graphs, data sorting,

...



Students' Activities

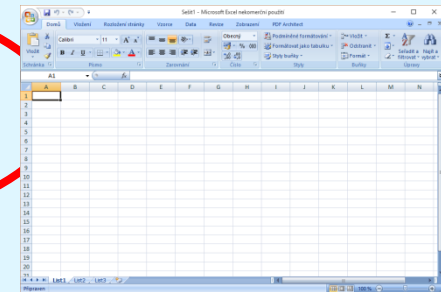


Real Data



Students

**Application
software**



**Graphs
Visualization**



Where to easily get Real Data?

VizieR Service

Search Criteria

Preferences

max: 50

HTML Table

☐ All columns

[Compute](#)

Mirrors

CDS, France

Find catalogs among 15939 available

Clear Find...

Expand search ☐

Catalog, author's name, word(s) from title, description, etc. e.g.: AGN, Veron, I/239, or bibcodes...

Search by Position across 17

Target Name (resolved by [Sesame](#))

Clear

[More about VizieR](#)

Wavelength	Mission	Astronomy
Radio	AKARI	Abundances
IR	ANS	Ages
optical	ASCA	AGN
UV	BeppoSAX	Associations
EUV	CGRO	Atomic_Data
X-ray	Chandra	Binaries:cataclysmic
Gamma-ray	COBE	Binaries:eclipsing

17 498 catalogues with Real Data!

Tools related to VizieR

- NEW CDS Portal** : Access CDS data including VizieR, Simbad and Aladin using the CDS portal
- Spectra, images in VizieR** : Search Spectra, images in VizieR
- Photometry viewer** : Plot photometry (sed) including all VizieR
- TAP VizieR** : query VizieR using ADQL (a SQL extension dedicated for astronomy)
- CDS cross-match service** : fast cross-identification between any 2 tables, including VizieR catalogues, SIMBAD

→ [Thanks for acknowledging the VizieR Service](#)

→ [Rules of usage of VizieR data](#)

© UDS/CNRS

[Contact](#)

Strasbourg Astronomical Data Center

vizier.u-strasbg.fr/viz-bin/VizieR



Multimedia Textbook **Astronomia**



Astronomia.zcu.cz

ASTRONOMICKÝ SERVER FAKULTY PEDAGOGICKÉ ZČU V PLZNI

Planety

Galaxie

Hvězdy



Planets

Galaxies

Stars

Astronomical photos

Astronomers

Spacecrafts

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Catalogues on Astronomia web pages

- **MPC** = 523 584 minor planets
www.minorplanetcenter.net (135 MiB, monthly update, semi-auto)



- **HIPPARCOS** = 118 218 stars
(60 MiB, static)
- **SIMBAD (*)** = 118 195 stars
simbad.u-strasbg.fr/simbad/ (36 MiB, weekly update, automatic)

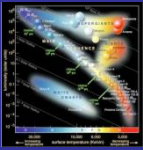


- **NGC** = 7 840 deep-sky objects
(2 MiB, 400 MiB pics, **weekly update**)
- **Messier** = 110 deep-sky objects
simbad.u-strasbg.fr/simbad/ (615 MiB pics, **weekly update**)



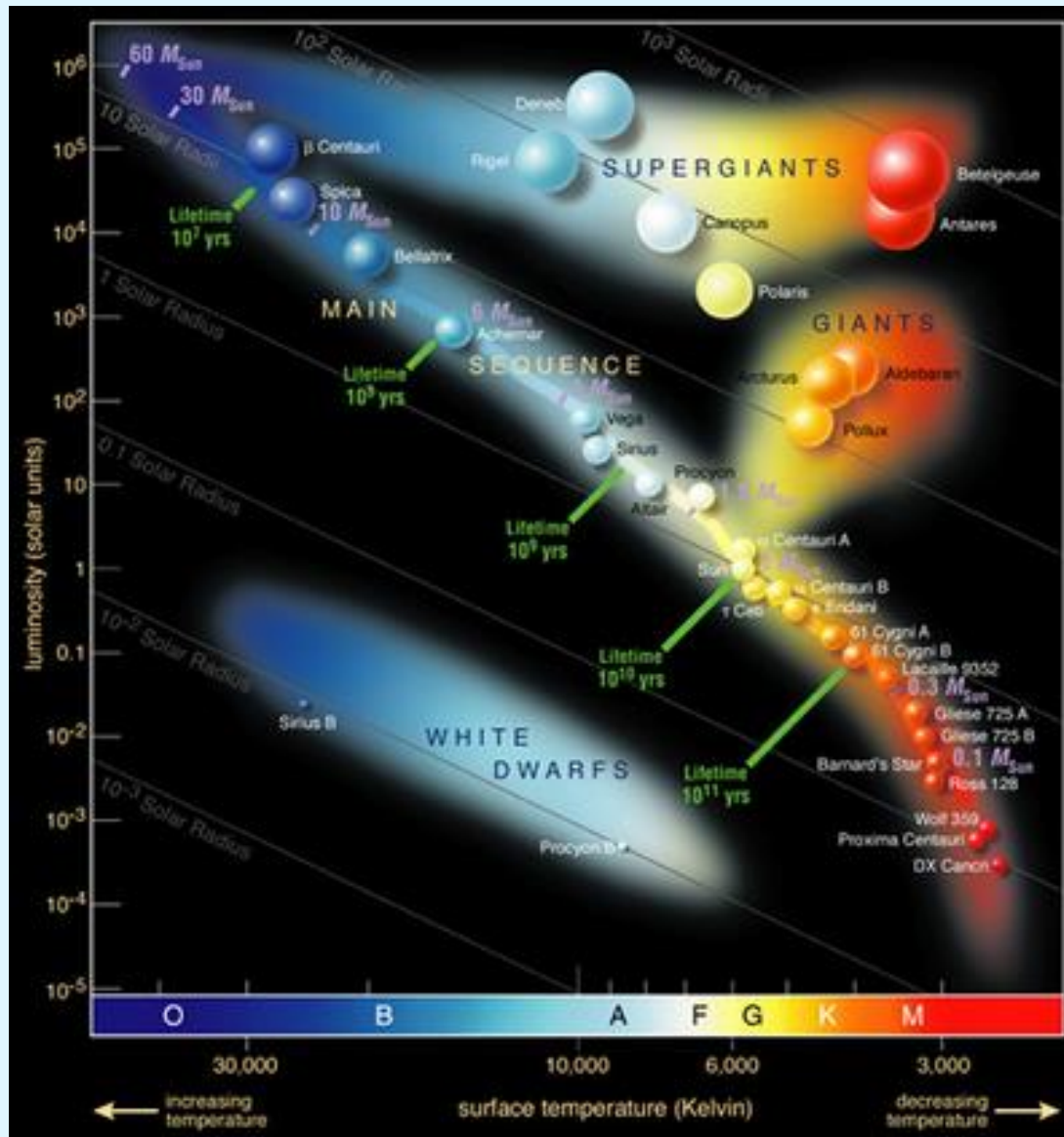
- **Exoplanets** = 3 824 exoplanets
exoplanet.eu (3 MiB, daily update, automatic)



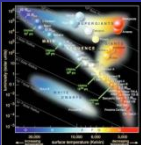


Hertzsprung-Russell diagram

Vertical axis:
Absolute magnitude M



Horizontal axis:
Colour index $B-V$



Meteor over China and Czech news

Novinky.cz

8. 10. 2017

[Přihlásit se](#) | [Seznam](#)

[Hlavní stránka](#) » [Koktejl](#)

There was a bright meteor over China.
It was like an earthquake, local people say

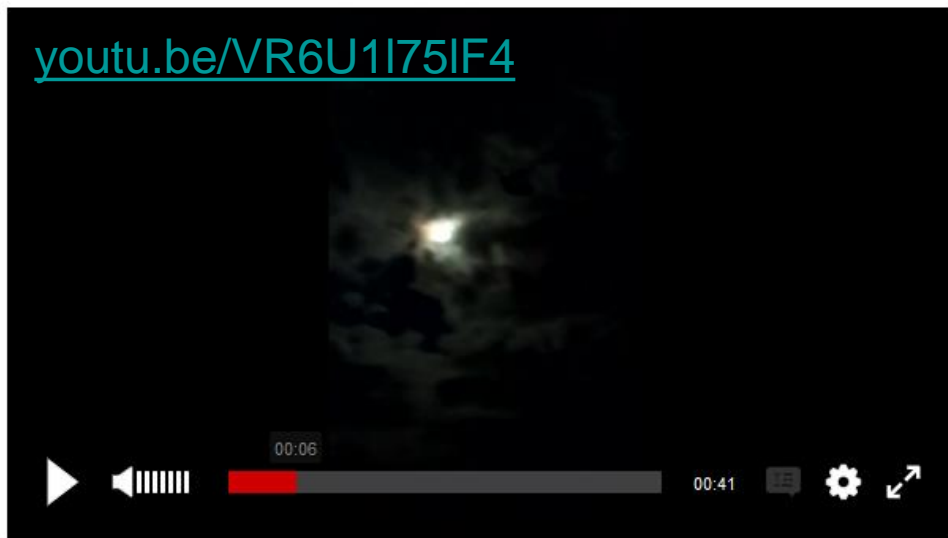
Nad Čínou se prohnal jasný meteor. Bylo to jako zemětřesení, tvrdí místní

Záběry jasné ohnivé koule ve středu zachytilo hned několik svědků v čínské oblasti Šangri-La v provincii Jün-nan na jihozápadě Číny. Spatření meteoru potvrdila i americká vesmírná agentura NASA, podle které meteor dosáhl jasnosti 2,1 magnitudy a uvolněné energie rovnající se 540 tunám TNT. Video poskytla agentura Reuters.

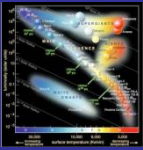
...NASA says, meteor
reached

brightness 2.1 mag and...

youtu.be/VR6U1I75IF4



www.novinky.cz/koktejl/451264-nad-cinou-se-prohnal-jasny-meteor-bylo-to-jako-zemetreseni-tvrdi-mistni.html



Meteor over China and original news

ejinsight
on the pulse

HOME

BUSINESS

STARTUPS

HONG KONG

WORLD

COLUMNISTS

LIVING

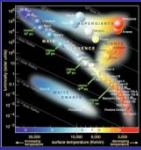


In this sequence shot, a meteorite lights up the night sky as it falls into the mountains. It landed about 40 km northwest of Shangri-la county in Yunnan province. Photo: Internet

Home > World > Greater China


Oct 6, 2017 4:30pm

www.ejinsight.com/20171006-meteor-shower-lights-up-yunnan-sky-during-mid-autumn-festival/



Meteor over China and original news

Meteor shower lights up Yunnan sky during Mid-Autumn Festival

 Like 32 people like this. Be the first of your friends.

Some people in Yunnan province were stunned by the rare sight of three meteors exploding in the night sky over Shangri-la county as they were watching the full moon during the Mid-Autumn Festival.

The phenomenon occurred at about 8 p.m. on Oct. 4, with witnesses saying they saw fireballs exploding in the air some 37 kilometers above the ground. Experts said the explosion had a force equivalent to 540 tons of TNT, Apple Daily reports.

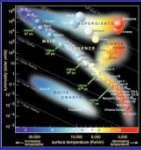
It is believed the meteors landed in a small village around 40 km. northwest of Shangri-la.

A netizen who filmed the event said the “sky lit up like day” and felt intense vibrations on doors and window panes.

In many of the clips, a flash of intense light could be seen as a meteorite fell from the sky and into the mountains.

The National Aeronautics and Space Administration (NASA) was the first to detect the astronomical event. It clocked the meteorite’s speed at 14.6 km. per second and said it likely landed in a ball of fire.

www.ejinsight.com/20171006-meteor-shower-lights-up-yunnan-sky-during-mid-autumn-festival/



Meteor over China and original news

Local authorities have yet to report any casualties or damage and are searching for the meteorite for research purposes.

A local villager told the paper that he heard a loud bang and felt the ground shake. His pigs were so scared they ran out of the pigsty.

The China Earthquake Network Center said the power of the explosion would be equivalent to a 2.1 magnitude earthquake on the Richter scale.

Local sources said it is possible that the meteorite landed in Dêqên county in Diqing Tibetan autonomous prefecture.

Astronomer Ye Quanzhi from the California Institute of Technology said the hilly terrain would make it very difficult to locate the meteorite.

However, as the meteor had fallen at a relatively slow speed, there is a higher chance of obtaining bigger samples.

The last meteor shower in China occurred on Nov. 5, 2014 when a meteor exploded over Xilingol in Mongolia with a power equivalent to 450 tons of TNT.

Meteorite hunters rushed to the scene in the hope of finding fragments which could fetch up to 100,000 yuan each. They ended up empty-handed.

– Contact us at english@hkej.com

www.ejinsight.com/20171006-meteor-shower-lights-up-yunnan-sky-during-mid-autumn-festival/



Browser

Excel Spreadsheet

Diagrams

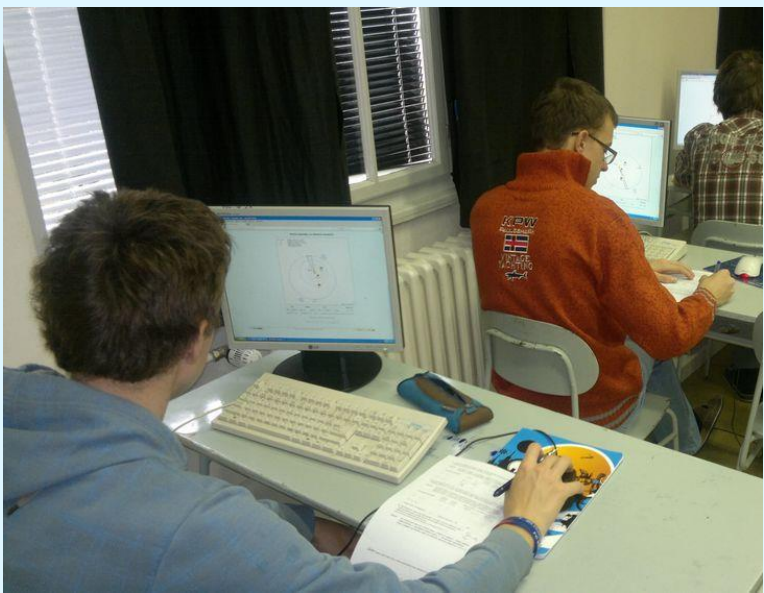
Worksheet n Procedure & Questions

Czech / English versions

4



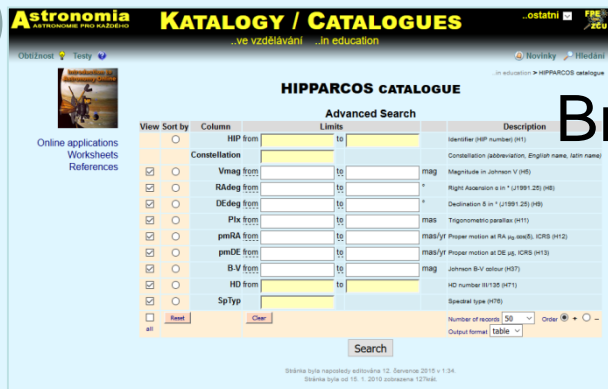
Physics and Informatics lessons





Raw Real Data Usage and Processing

1



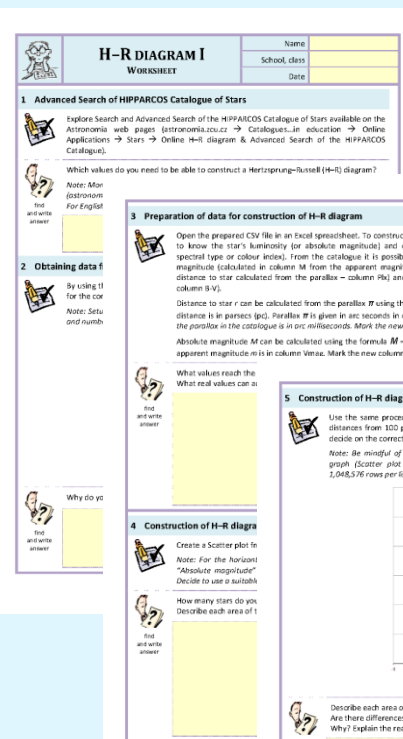
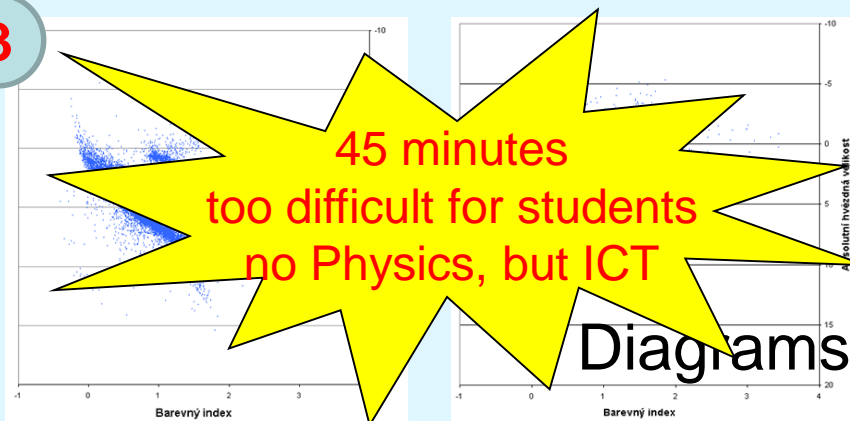
Browser

2

</

45 minutes
too difficult for students
no Physics, but ICT

Diagrams



Worksheet
with Procedure
& Questions

6. Location of stars in H-R diagram

Plot a location of the Sun and the five brightest stars from the list of nearby stars to the H-R diagram of nearby stars. Fill in the attached table.

Note: You can find the needed values in the catalogues of stars. Calculate values marked by an asterisk using the formulas provided in exercise 3.

What types of stars did you find? What are the characteristic features of each type?

Star (name, designation)	Apparent magnitude m	Absolute magnitude M (*)	Parallax π (")	Distance r (pc) (*)	Colour index	Spectral type	Constellation (abbreviation)
Sun							

Conclusion

Store output files with H-R diagram as Excel worksheets to the chosen folder.

Describe: how did you solve this task, mention problematic areas, all difficulties of this task. Do you have any suggestions on how to improve it?

Czech / English
versions



Comment from students

Je potřebovala více času, některé věci
bylo pro mě špatně slovenské.
Ale je to krásné a já jsem, dovedla
jsem se mnohem nověho, ať už
to nikdy nepoužiji. 😊

*“More time is needed, some things were all
Greek to me. But it is very interesting.
I learned many of new things, but I will
never use it...”*

Student from Faculty of Philosophy and Arts



Czech comedy

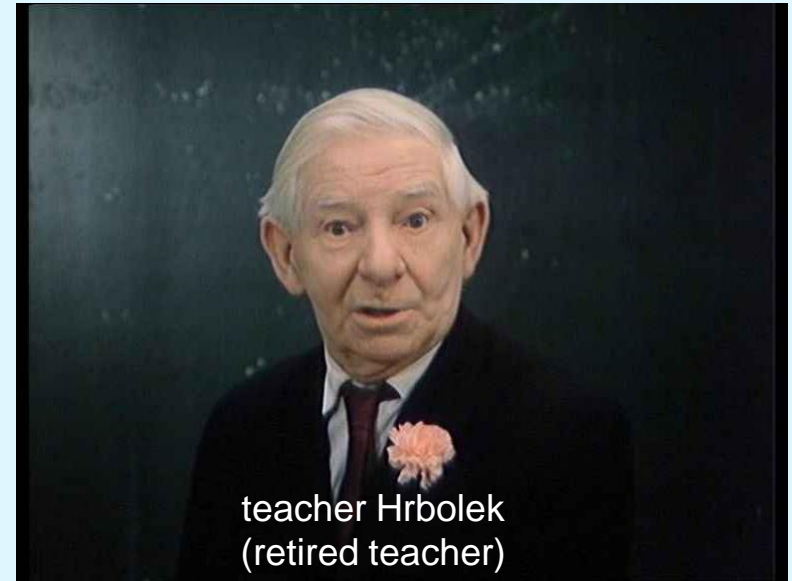
From Czech comedy “Marecek, Pass Me the Pen!“, teacher Hrbolek:
“No, i skladník ve šroubárně si může přečísti Vergilia v originále.”



Pupil Plha: "I have a question – will I use Latin in my field of activity?"

Teacher Hrbolek: "Which field of activity do you want to dedicate?"

Pupil Plha: "I work as a warehouse operator in screw factory."



Teacher Hrbolek: "**Well, even warehouse operator in screw factory can read Virgil in the original!** I am writing you on the list."

Pupil Plha: "I still have not decided."

Teacher Hrbolek: "You will come every Wednesday at 2 pm, Mlha (fog)!"



My comment

Original message from comedy:

**“Well, even warehouse operator in screw factory
can read Virgil in the original!”**

My message:

**“Well, even student from Faculty of Philosophy and
Arts can create Hertzsprung-Russell diagram from
Real Data from catalogue of stars HIPPARCOS or
SIMBAD...”**



Right way how to use catalogues?

SIMBAD basic query result

other query modes : [Identifier query](#) [Coordinate query](#) [Criteria query](#) [Reference query](#) [Basic query](#) [Script submission](#) [Output options](#) [Help](#)

Object query : polaris C.D.S. - SIMBAD4 rel 1.207 - 2013.08.08CEST04:07:42

[Available data](#) : [Basic data](#) • [Identifiers](#) • [Plot & images](#) • [Bibliography](#) • [Measurements](#) • [External archives](#) • [Notes](#) • [Annotations](#)

Basic data :
V* alf UMi -- Classical Cepheid (delta Cep type)

query around with radius arcmin

Other object types: `oC* () , * (*,AG,BD,CSI,FKS,GC,GCRV,GEN#,GSC,HD,HIC,HIP,HR,JPL1,N30,PLX,PMC,PPM,ROT,SAO,SKY#,TYC,UBV) , ** (ADS,CCDM,IDS,WDS) , SB* (SBC7,SBC9) , V* (V*,AAVSO) , IR (IRAS) , UV (TD1)`

ICRS coord. (ep=J2000) : `02 31 49.09456 +89 15 50.7923 (Optical) [1.14 0.97 90] A 2007A&A...474..653V`

FK5 coord. (ep=J2000 eq=2000) : `02 31 49.095 +89 15 50.79 (Optical) [1.14 0.97 0] A 2007A&A...474..653V`

FK4 coord. (ep=B1950 eq=1950) : `01 48 47.78 +89 01 43.6 (Optical) [6.60 5.58 0] A 2007A&A...474..653V`

Gal coord. (ep=J2000) : `123.2805 +26.4614 (Optical) [1.14 0.97 0] A 2007A&A...474..653V`

Proper motions *mas/yr* [error ellipse]: `44.48 -11.85 [0.11 0.13 0] A 2007A&A...474..653V`

Radial velocity / Redshift / cz : `V(km/s) -17.4 [0.9] / z(~) -0.000058 [0.000003] / cz -17.40 [0.90] (~) A 1953GCRV...C.....0W`

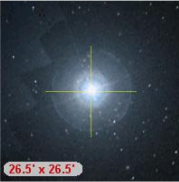
Parallax *mas*: `7.54 [0.11] A 2007A&A...474..653V`

Spectral type: `F7: Ib- IIv C ~`

Fluxes (2) : `B 2.591 [~] C ~
V 2.005 [~] C ~`

essential notes:

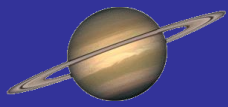
- see also [NAME POLARIS CIRRUUS CLOUD](#)
- see also [NAME POLARIS FLARE](#)



```
List - [z:\data1.csv]
Soubor Upravit Možnosti Kódování Nápověda 100 %

Astronomia, katalog HIPPARCOS, 13:22:28, 21. 2. 2011
Uvhlédáno dle DEdeg(≥ 40, ≤ 90); seřazeno podle Umag vzestupně; nalezeno 22 072 záznamů, výpis omezen na 10 záznamů

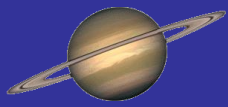
HIP;označení;jméno hvězdy;RAhms;DEdms;Umag;RAdeg;DEdeg;Plx;pmRA;pmDE;`B-U`;HD;SpType;souhvězdí;
24608;α Aur, 13 Aur;Capella;05 16 41,30;+45 59 56,5;0,08;79,17206517;45,99902927;77,29;75,52;-427,13;0,795;34029;M1: comp;Aur
102098;α Cyg, 50 Cyg;Deneb;20 41 25,91;+45 16 49,2;1,25;310,35797270;45,28033423;1,01;1,56;1,55;0,092;197345;A2Ia;Cyg
62956;ε UMa, 77 UMa;Alioth;12 54 01,63;+55 57 35,4;1,76;193,50680410;55,95984301;40,30;111,74;-8,99;-0,022;112185;A0p;UMa
15863;ε Per, 33 Per;Mirfa;03 24 19,35;+49 51 40,5;1,79;51,08061889;49,86124281;5,51;24,11;-26,01;0,481;20902;F5Ib;Per
54061;α UMa, 50 UMa;Dubhe;11 03 43,84;+61 45 04,0;1,81;165,93265365;61,75111888;26,38;-136,46;-35,25;1,061;95689;F7U comp;UMa
67301;η UMa, 85 UMa;Alkaid;13 47 32,55;+49 18 47,9;1,85;206,88560880;49,31330288;32,39;-121,23;-15,56;-0,099;120315;B3U SB;UMa
28360;β Aur, 34 Aur;Mekalinalan;05 59 31,77;+44 56 50,8;1,90;89,88237261;44,94743492;39,72;-56,41;-0,88;0,077;40183;A2U;Aur
11767;α UMi, 1 UMi;Polárka;02 31 47,08;+89 15 50,9;1,97;37,94614689;89,26413805;7,56;44,22;-11,74;0,636;8890;F7: Ib- IIv SB;UMi
72607;β UMi, 7 UMi;Kocab;14 50 42,40;+74 09 19,7;2,07;222,67664751;74,15547596;25,79;-32,29;11,91;1,465;131873;K4II Iv var;UMi
14576;β Per, 26 Per;Algol;03 08 10,13;+40 57 20,3;2,09;47,04220716;40,95565120;35,14;2,39;-1,44;-0,003;19356;B8U;Per
```

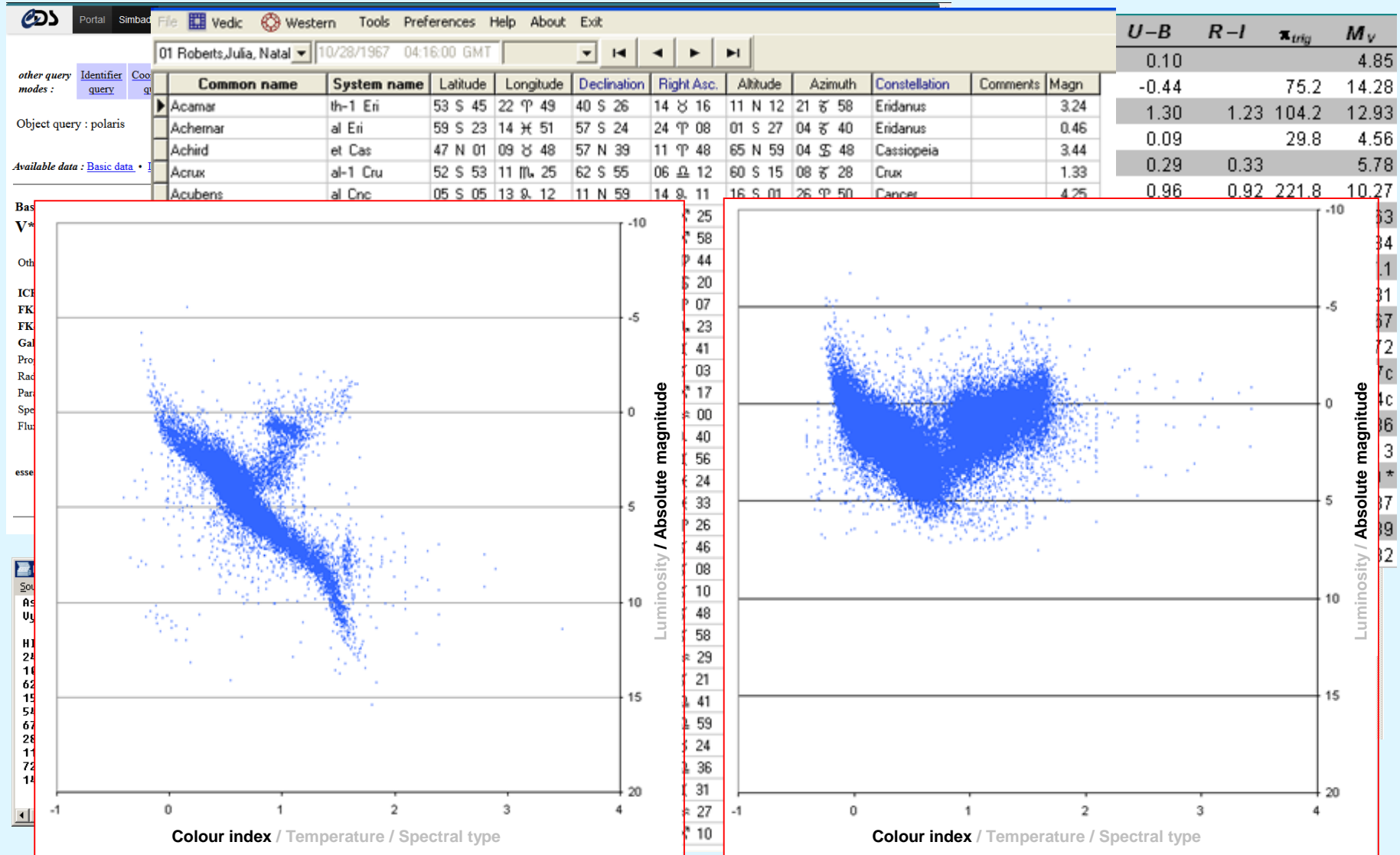
Right way how to use catalogues?

DS Portal Simbad Vizier Aladin X-Match Other + Help										Name	RA(1950)	Dec(1950)	pm	angle	v _{rad}	Sp Type	m _v	B-V	U-B	R-I	π _{trig}	M _v
SIMBAD basic										Sun						G2 V	-26.72	0.65	0.10			4.85
other query modes : Identifier query Coordinate query Criteria query Reference query Basic query Script submission Output options										NN	00 00 06	-34 29.7	0.758	168.6		DC9	14.90	0.46	-0.44		75.2	14.28
Object query : polaris										GJ 1001	00 02 05	-40 57.8	1.618	154.5	-3	M3.5	12.84	1.63	1.30	1.23	104.2	12.93
Available data : Basic data Identifiers Plot & images Bibliography Measurements External links										NN	00 02 16	+34 22.8	0.776	83.0	+6.4 VAR	G2 V	6.11	0.62	0.09		29.8	4.56
Basic data :										NN	00 02 21	+22 59.5	0.380	91.5		G9 V	7.82	0.74	0.29	0.33		5.78
V* alf UMi -- Classical Cepheid (delta Cep type)										Gl 1	00 02 28	-37 36.2	6.097	112.5	22.9	M4 V	8.54	1.46	0.96	0.92	221.8	10.27
Other object types : oC* () , * (*, AG, BD, CSI, FKS, GC, GCRV, GEN*, GSC, HD, HI (ADS, CDM, IDS, WDS) , SB* (SBC7, SBC9) , V* (V*, AAVSO										Gl 2	00 02 32	+45 30.6	0.894	100.5	0.1	dM2 e	9.93	1.49	1.18	0.85	87.0	9.63
ICRS coord. (ep=J2000) : 02 31 49.09456 +89 15 50.7923 (Optical) [1.14										NN	00 02 43	+48 12.0	0.009	305.5		G5	8.30					6.84
FK5 coord. (ep=J2000 eq=2000) : 02 31 49.095 +89 15 50.79 (Optical) [1.14 0.97										Gl 3	00 02 48	-68 06.2	0.582	190.7	41	K5 V	8.48	1.06	1.03	0.42	72.5	7.1
FK4 coord. (ep=B1950 eq=1950) : 01 48 47.78 +89 01 43.6 (Optical) [6.60 5.58 0										Gl 4 A	00 03 02	+45 32.2	0.839	101.8	+0.0 SB	dK6 e	8.97	1.44	1.21	+0.71 J	87.0	8.67
Gal coord. (ep=J2000) : 123.2805 +26.4614 (Optical) [1.14 0.97 0] A 2										Gl 4 B	00 03 02	+45 32.1	0.885	98.3	0.1	M0.5 V	9.02	1.45	1.20		87.0	8.72
Proper motions mas/yr [error ellipse]: 44.48 -11.85 [0.11 0.13 0] A 2007A6A...474..653V										Gl 4.1A	00 03 38	+58 09.5	0.260	76.7	-11.6	G5 V	6.43c	+0.64c	+0.11c		46.5	4.77c
Radial velocity / Redshift / cz : V(km/s) -17.4 [0.9] / z(-) -0.000058 [0.000003] /										Gl 4.1B	00 03 38	+58 09.5	0.260	76.7	-16	dG8	7.20c	+0.78c	+0.33c		46.5	5.54c
Parallaxes mas: 7.54 [0.11] A 2007A6A...474..653V										NN	00 03 40	-66 07.5	0.593	160.6		M4	12.16	1.55		1.04		10.86
Spectral type: F7: Ib-IV C ~										Gl 4.2A	00 03 44	-49 21.2	0.592	93.9	2.6	G1 IV	5.71	0.52	0.03	0.17	48.3	4.13
Fluxes (2) : B 2.591 [-~] C ~ V 2.005 [-~] C ~										Gl 4.2B	00 03 44	-49 21.2	0.592	93.9			11.50				48.3	9.9*
essential notes : see also NAME POLARIS CIRRUS CLOUD										Gl 5	00 04 01	+28 44.7	0.422	114.1	-5.5	K0 Ve	6.14	0.75	0.33		70.2	5.37
see also NAME POLARIS FLARE										GJ 1002	00 04 13	-07 47.5	2.041	203.6	-42	M5-5.5	13.75	1.98	+1.60:	1.63	212.8	15.39
										GJ 1003	00 04 46	+28 58.8	1.890	127.2		m	14.18	1.49	1.40	1.14	53.5	12.82

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Astronomia, katalog HIPPARCOS, 12:53:56, 23. 2. 2011																
2	Vyhledání nalezeno 22 982 záznamů																
3																	
4	HIP	označení	jméno hvě:	RAhms	DEdms	Vmag	RAdeg	DEdeg	Plx	pmRA	pmDE	'B-V'	HD	SpType	souhvězdí		
5	2			00 00 00,91	-19 29 55,8	9,27	0,0038	-19,499	21,9	181,21	-0,93	0,999	224690	K3V			
6	6			00 00 04,35	+03 56 47,4	12,31	0,0181	3,94649	18,8	226,29	-12,84	1,336		M0V:			
7	7			00 00 05,41	+20 02 11,8	9,64	0,0225	20,0366	17,74	-208,12	-200,79	0,74		G0			
8	10			00 00 08,70	-50 52 01,5	8,59	0,0363	-50,867	10,76	42,23	40,02	0,489	224717	F6V			
9	18			00 00 12,75	-04 03 13,5	11,03	0,0531	-4,0537	19,93	-127,22	23,78	1,567		K5			
10	20			00 00 15,11	+23 31 45,4	8,51	0,063	23,5293	10,76	36	-22,98	0,516	224723	G0			
11	23			00 00 17,86	+13 18 44,0	7,57	0,0744	13,3122	12,21	54,15	9,65	0,456	224742	F2V			
12	25			00 00 19,05	-44 17 25,1	6,28	0,0794	-44,29	13,74	58,36	-108,64	0,763	224750	G3IV			
13	34			00 00 23,87	+26 55 05,7	6,43	0,0995	26,9182	12,71	42,2	-53,47	0,514	224758	F7,5IV-V			
14	38			00 00 26,65	-79 03 42,6	8,65	0,111	-79,062	23,84	162,3	-62,4	0,778	224752	G6V			
15	39			00 00 26,85	-16 41 48,9	7,46	0,1119	-16,697	10,98	169,72	-32,54	0,475	224763	F3V			
16	45			00 00 32,21	-72 12 09,8	9,59	0,1342	-72,203	15,1	-37,2	-2,78		224766	G6/G8V:			

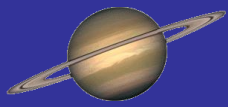


Right way how to use catalogues?




•  .. Probably not...





What about another way?




KATALOGY / CATALOGUES

..ve vzdělávání ..in education

Obtížnost Testy

Novinky Hledání

..In education > Online applications using data from catalogues



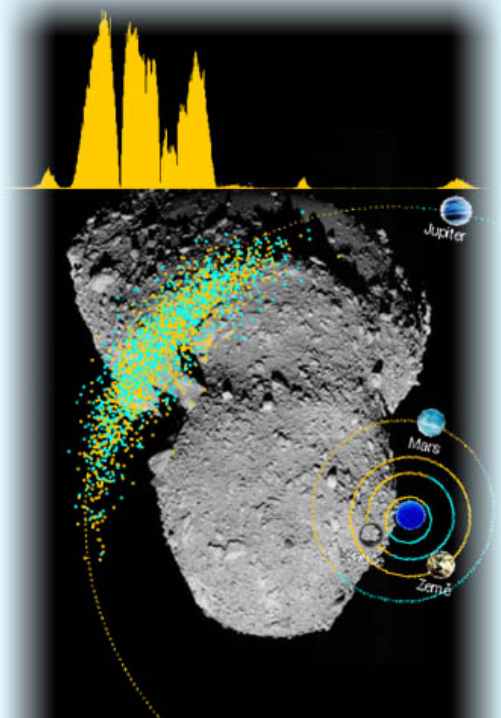
Online applications
Worksheets
References

ONLINE APPLICATIONS USING DATA FROM CATALOGUES

Minor planets

Hundreds of thousands of numbered Minor planets whose parameters are periodically (monthly) updates can be used for demonstration of Kepler's laws or display (in different point of view) interesting group of Minor planets.

- **Analysis of Minor planets parameters**
Change of one slider of any parameter, the other sliders adjusts to match intervals of Minor planet. You can choose from different groups of Minor planets, e.g. Trojans. For selected (even inhomogeneous) group of Minor planets; parameters can be saved to the file or to use special Data Export.
- **Kirkwood gaps**
This is a part of Analysis of Minor planets parameters as a special Data Export. It shows graph of semimajor axes on quantity of minor planets. It can be found several gaps. They correspond to the location of orbital resonances with Jupiter.
- **Historical development**
This is a part of Analysis of Minor planets parameters as a special Data Export. It shows graph of year of discovery on quantity of minor planets.
- **Current location in the Solar system**
This is a part of Analysis of Minor planets parameters as a special Data Export. It shows location of selected group of minor planet, it is also possible to animate this one by increasing/decreasing of date.
- **Kepler's laws demonstration**
It is possible to view current (or for selected date) location in the Solar system for any Minor planet. On this image it is possible to demonstrate all Kepler's laws, including the location of focuses and the center of the ellipse, perihelion, aphelion, mainly the law of equal areas (using the interactive behavior with area calculation), and more.
- **Apparent magnitude of Minor planet calculation**
The image with location of Minor planet in Solar system shows calculated



EN version:

astronomia.zcu.cz/catalogues

CS version:

astronomia.zcu.cz/katalogy



Online Application Real Data Usage

1

Astronomia
ASTRONOMIE PRO KAŽDÉHO

KATALOGY / CATALOGUES
...ve vzdělávání ...In education

Obtížnost Testy Novinky Hledání

SEARCH RESULTS

Searching for "Sirius" Found 1 item(s) (0.0031 s)

Catalog HIPPARCOS

HIP	Designation	Name	RAhms	DEdms	Vmag	RAdeg	DEdeg	Plx	pmRA	pmDE	B-V	SpType
	h m s		d m s		mag	°	°	mas	mas/yr	mas/yr	mag	
32349	α CMa, 9 CMa	Sirius	06 45 09.25	-10 42 47.3	-1.44	101 288 541 05	-10 713 143 06	379.21	-546.01	-1 223.08	0.009	A0m...

Another alternative names: Sirius, Canicula, Aschere

Astronomical database SIMBAD (with the written approval of CDS, Strasbourg)

HIP	Type	Coordinates		Proper motion		Plx	Magnitude	SpType	HRD
		h m s	d m s	mas/yr	mas				
32349	**	06 45 09.25	-10 42 47.3	-546.01	379.21	U -1.51 B -1.46 V -1.46	A1V+DA		
	ICR9 (J2000)	RA: 06 45 09.25	DE: -10 42 47.3	RA: -546.01	379.21	R -1.46 J -1.43 Z -1.36			
	FK5 (J2000)	RA: 06 45 09.25	DE: -10 42 47.3	RA: -546.01	379.21	H -1.33 K -1.36			
	FK4 (B1950)	RA: 06 42 56.72	DE: -10 38 45.4						

Note: SIMBAD database check performed on 12. 9. 2015, 1:00; last update held on 14. 2. 2014, 1:02

Back

Stránka byla naposledy editována 8. srpna 2013 v 0:33.
Stránka byla od 15. 1. 2010 zobrazena 1456x.

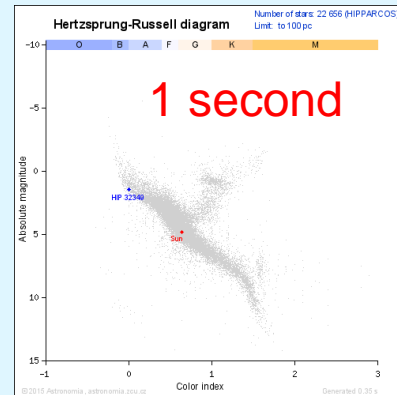
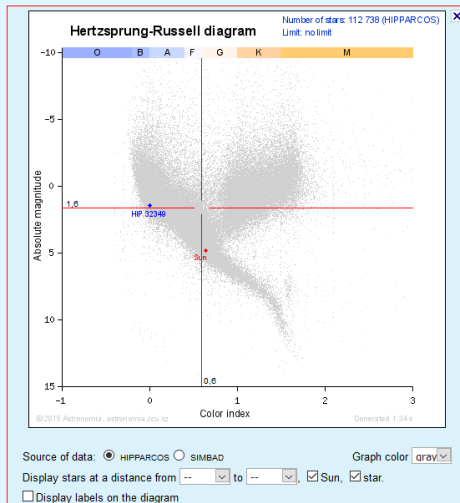
TOPLIST INDEX RSS

© 2015 Astronomické katalogy (Autorský tým)

W3C XHTML 1.0 W3C CSS RSS

2

Browser



Diagrams
in Browser

Czech / English
versions

Worksheet
with Procedure
& Questions

H-R DIAGRAM II
WORKSHEET

Name _____
School, class _____
Date _____

1 Advanced Search of HIPPARCOS Catalogue of Stars

Explore the Advanced search of the HIPPARCOS Catalogue of Stars available on the webpage Astronomia (astronomia.zcu.cz) → Catalogues, In education → Online Applications → Stars → Advanced Search of the HIPPARCOS Catalogues. Note: Consider mainly the apparent magnitude (Vmag) and parallax (Plx) that are important to construct Hertzsprung-Russell (H-R) diagram.

What is the range of apparent magnitudes (Vmag) of stars stored in the HIPPARCOS Catalogue of Stars?

2 Constellations and List of Stars

Choose one constellation (possible stars from the catalogue sorted by)

Which constellation did you choose brightest stars of your chosen constellation?

3 Three Stars, Stars Location on H-R DI

Select three stars from the above pages (find the location of selected whether the star is brighter than it)

Which stars did you choose? What stars are brighter than the Sun or not?

Designation (name) of star

HIP _____

HIP _____

HIP _____

4 A Comparison of H-R Diagrams

Display an H-R diagram for stars within 100 pc (nearby stars).
Display an H-R diagram for stars from 100 pc to 400 pc (distant stars).

Describe each area of both H-R diagrams.
Are there differences between the H-R diagrams of nearby and distant stars? Why? Explain the reason(s).

Note: Compare each area of both H-R diagrams; find which area is missing or which one is more expressive. Also, consider the values on the vertical axis.

Conclusion

Describe: how did you solve this task, mention problematic areas, all difficulties of this task. Do you have any suggestions on how to improve it?



Catalogues on Astronomia web pages

- **MPC** = 523 584 minor planets
(135 MiB, **monthly update**)
www.minorplanetcenter.net



- **HIPPARCOS** = 118 218 stars
(60 MiB, static)
- **SIMBAD (*)** = 118 195 stars
(36 MiB, **weekly update**)
simbad.u-strasbg.fr/simbad/



- **NGC** = 7 840 deep-sky objects
(2 MiB, 400 MiB pics, static)
- **Messier** = 110 deep-sky objects
(615 MiB pics, static)
- **Exoplanets** = 3 824 exoplanets
(3 MiB, **daily update**)
exoplanet.eu





Number of (numbered) minor planets increase

1st	– 1801	
1st thousand	– 1921	(1000) Piazzia
2nd thousand	– 1942	
3rd thousand	– 1960	
ten thousand	– 1981	
hunderd thousand	– 2000	
milion	– ?	
two hunderd thousand	– 2002	
three hunderd thousand	– 2005	
four hunderd thousand	– 2014	
five hunderd thousand	– 2017	

523 584 numbered minor planets



Minor planets parameters analysis

Astronomia
ASTRONOMIE PRO KAŽDÉHO

KATALOGY / CATALOGUES

..ve vzdělávání ..in education

..ostatní ☐



Obtížnost Testy

Novinky Hledání

..in education > Minor planets analysis



Online applications
Worksheets
References

MINOR PLANETS ANALYSIS

Number: 1 – 523 584

Min: 1

Max: 523 584

Year of discovery: 1801 – 2016

Min: 1801

Max: 2016

Semimajor axis a : 0.6 au – 817.4 au

Min: 0.6 au

Max: 817.4 au

817.4 au

Orbital eccentricity ε : 0.0 – 1.0

Min: 0.0

Max: 1.0

Inclination to the ecliptic i : 0.0° – 172.9°

Min: 0.0

Max: 172.9

Absolute magnitude H : -1.1 mag – 25.5 mag

Min: -1.1 mag

Max: 25.5 mag

Type of Minor planet..

..expand..

Data Export..

..expand..

523 584

(number of found minor planets)



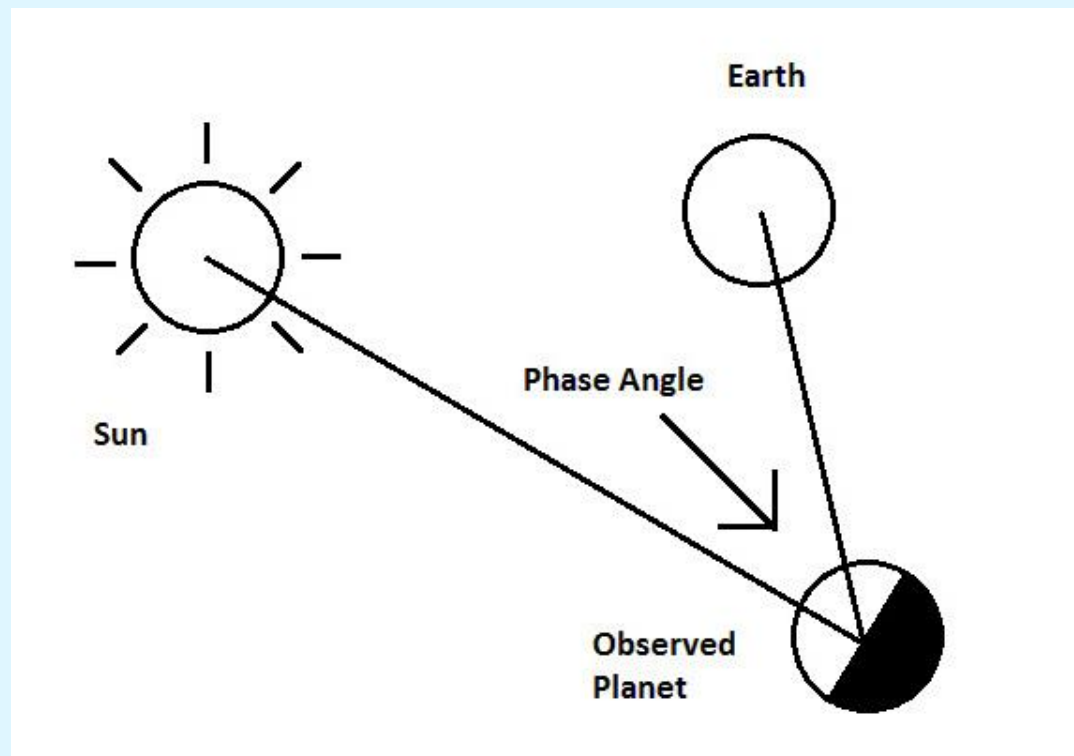
Absolute magnitude H

The apparent magnitude that the object would have if it were one astronomical unit (au) from both the Sun and the observer, and in conditions of ideal solar opposition.

Where is the observer?

$$m = H + 5 \log \Delta + 5 \log r$$

$$D = \frac{1329}{\sqrt{p}} 10^{-0.2H}$$





Albedo p

100 %



31 %



reflectivity

$$p = 5\%$$

$$p = 25\%$$

$$p = 50\%$$

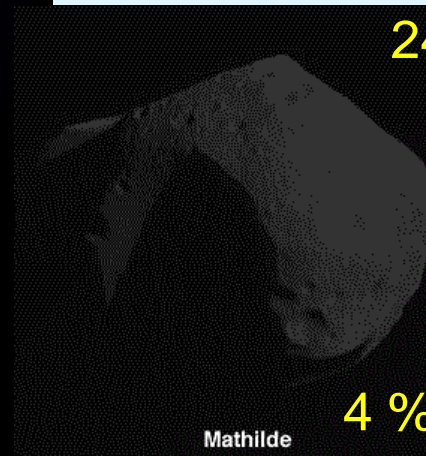
12 %



5 %



24 %



Mathilde

4 %



Ida



Historical development of minor planets discovery

Astronomia
ASTRONOMIE PRO KAŽDÉHO

KATALOGY / CATALOGUES

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Obtížnost Testy

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..in education > Minor planets analysis



Online applications
Worksheets
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MINOR PLANETS ANALYSIS

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Min: 0.0°

Max: 172.9°

Absolute magnitude H : -1.1 mag – 25.5 mag

Min: -1.1 mag

Max: 25.5 mag

Type of Minor planet..

..expand..

Data Export..

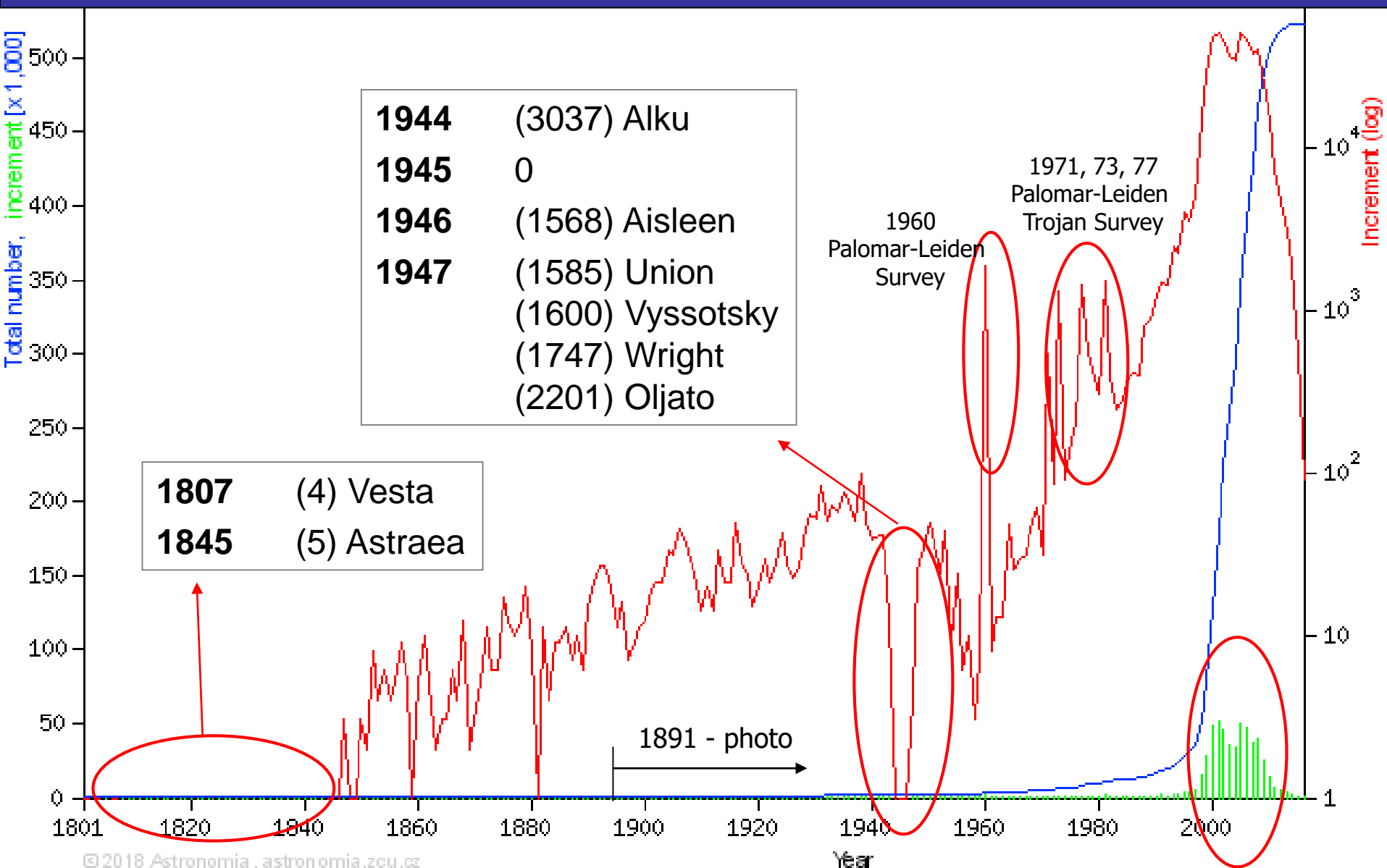
..expand..

523 584

(number of found minor planets)



Historical development of minor planets discovery





Number of minor planets per semi-major axis

Astronomia
ASTRONOMIE PRO KAŽDÉHO

KATALOGY / CATALOGUES

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Obtížnost Testy

Novinky Hledání

..in education > Minor planets analysis



Online applications
Worksheets
References

MINOR PLANETS ANALYSIS

Number: 1 – 523 584

Min: 1

Max: 523 584

Year of discovery: 1801 – 2016

Semimajor axis a : 0.6 au – 817.4 au

Min: 0.6 au

Max: 817.4 au

817.4 au

Max: 817.4 au

Orbital eccentricity ε : 0.0 – 1.0

Min: 0.0

Max: 1.0

Inclination to the ecliptic i : 0.0° – 172.9°

Min: 0.0°

Max: 172.9°

Absolute magnitude H : -1.1 mag – 25.5 mag

Min: -1.1 mag

Max: 25.5 mag

Type of Minor planet..

..expand..

Data Export..

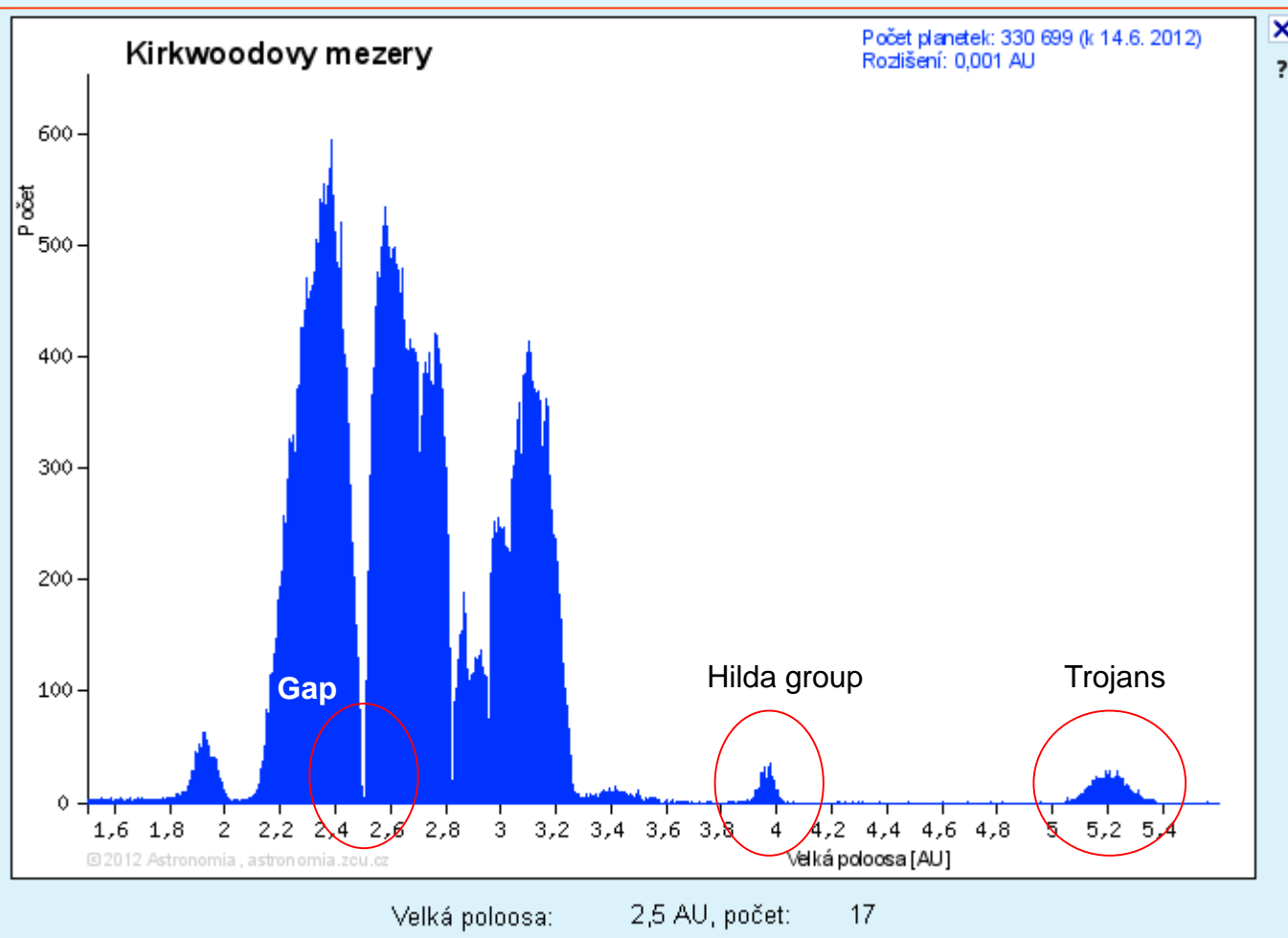
..expand..

523 584

(number of found minor planets)



Kirkwood gaps



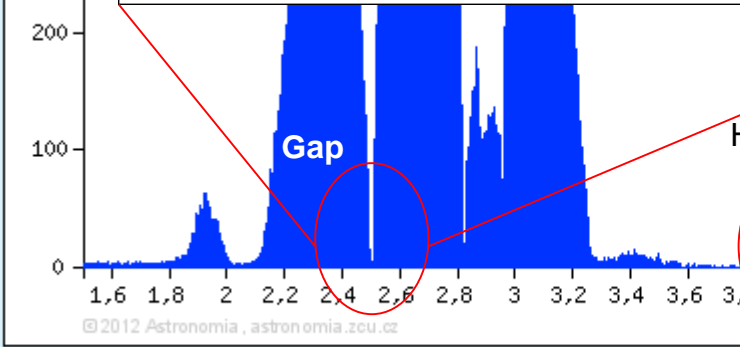
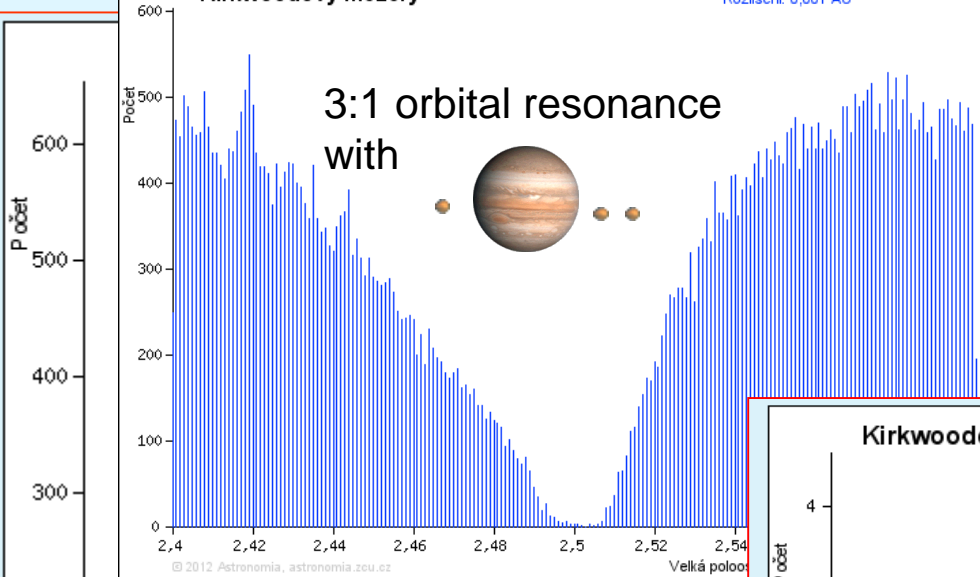
Kirkwood gaps



Kirkwoodovy mezery

Počet planetek: 62 798 (k 7.11. 2012)
Rozlišení: 0,001 AU

3:1 orbital resonance with

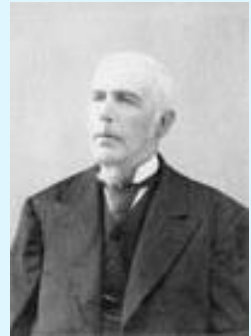


Velká poloosa: 2,5 AU,

Počet planetek: 330 699 (k 14.6. 2012)
Rozlišení: 0,01 AU

1857
(50)

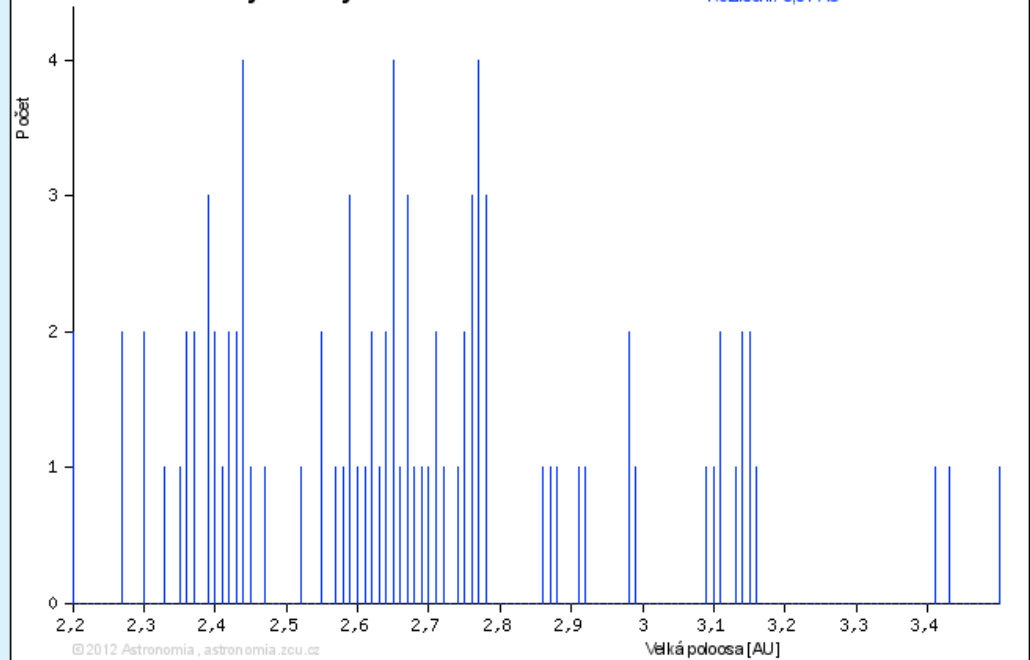
1866
(91)



Kirkwood

Kirkwoodovy mezery

Počet planetek: 91 (k 14.6. 2012)
Rozlišení: 0,01 AU



Velká poloosa: --- AU, počet: ---

$$a = 2,5 \text{ au} \rightarrow T = 3,95 \text{ years}$$

$$a = 5,2 \text{ au} \rightarrow T = 11,86 \text{ years}$$



Interesting „group“ of minor planets

Near-Earth Asteroids/Minor planets (NEA)



Interesting „group“ of minor planets

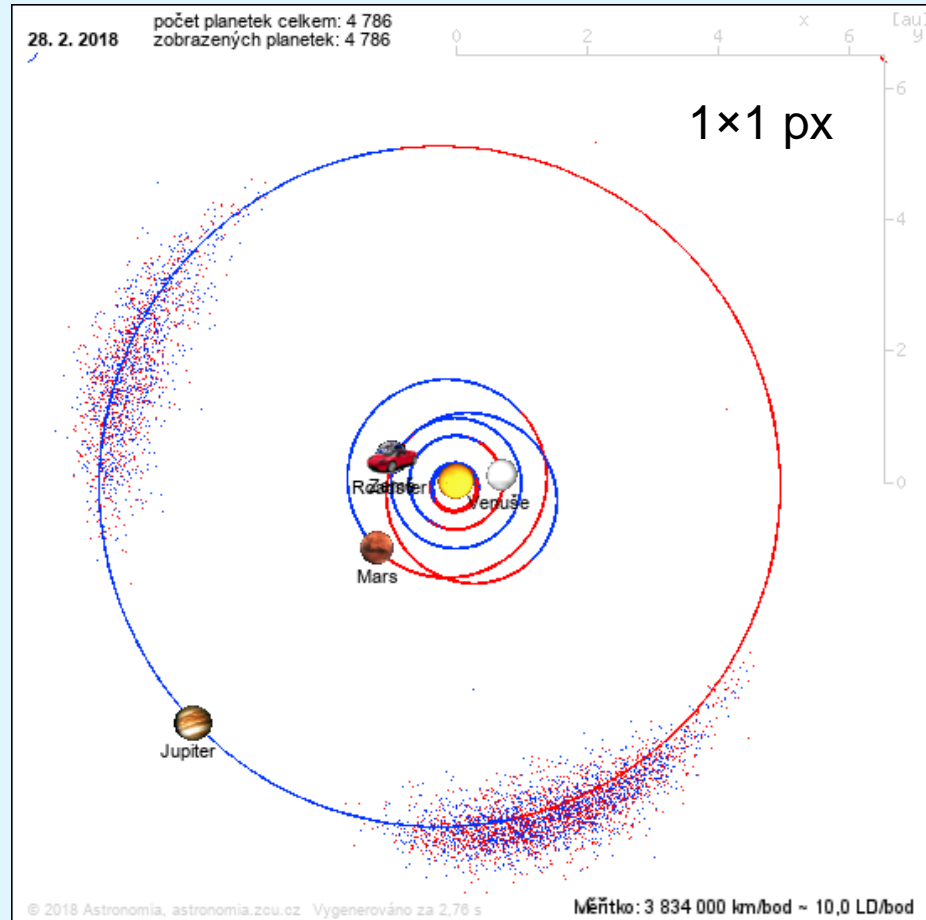
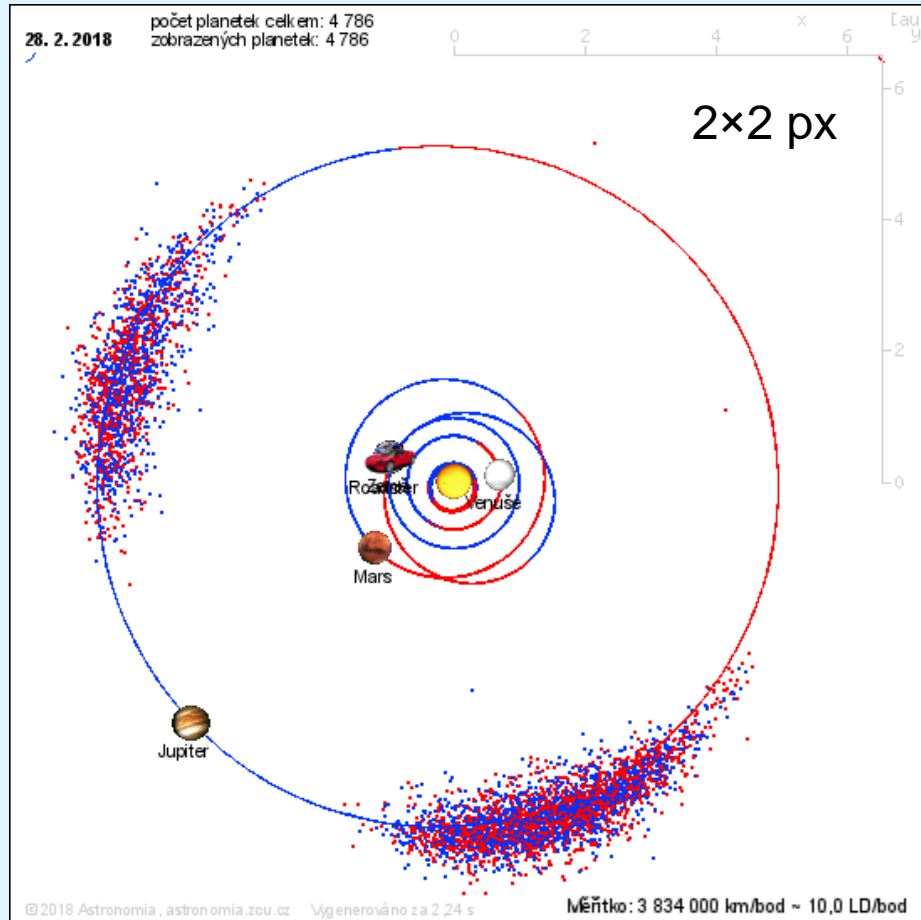
150 000 000 km

1 au

Sun  Earth

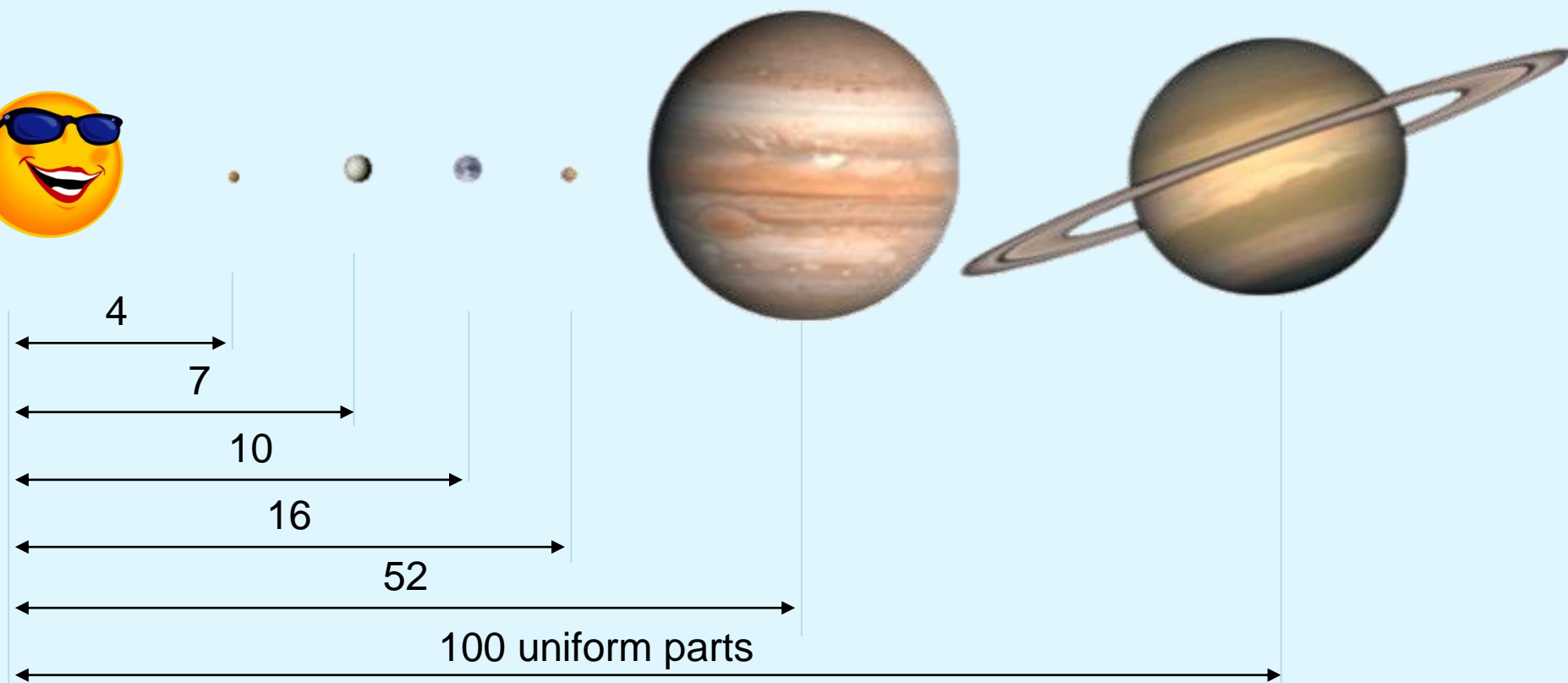
(object dimensions and distances are not in scale)

Group of Jupiter Trojans



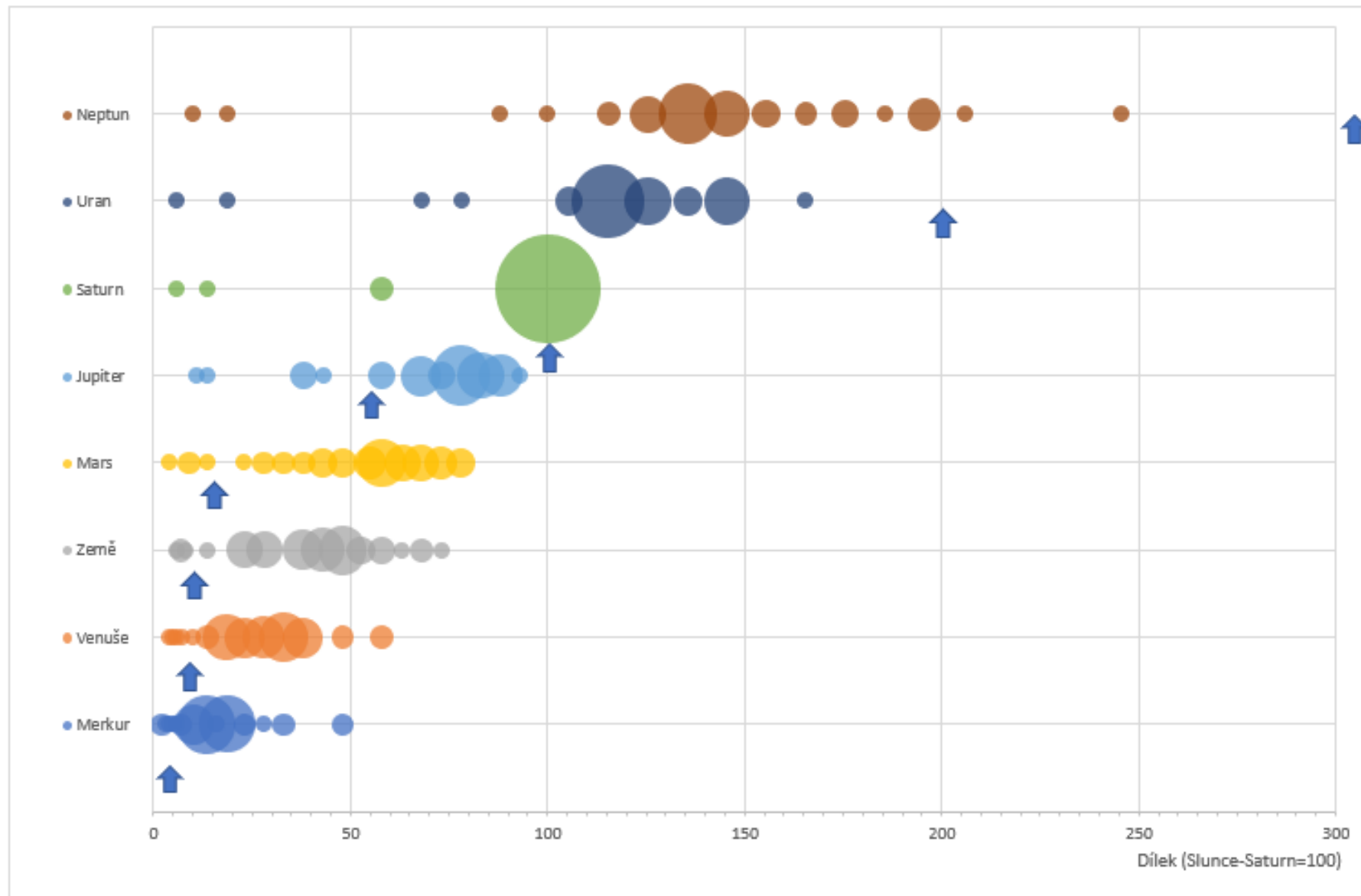


Perceptions about distances of planets



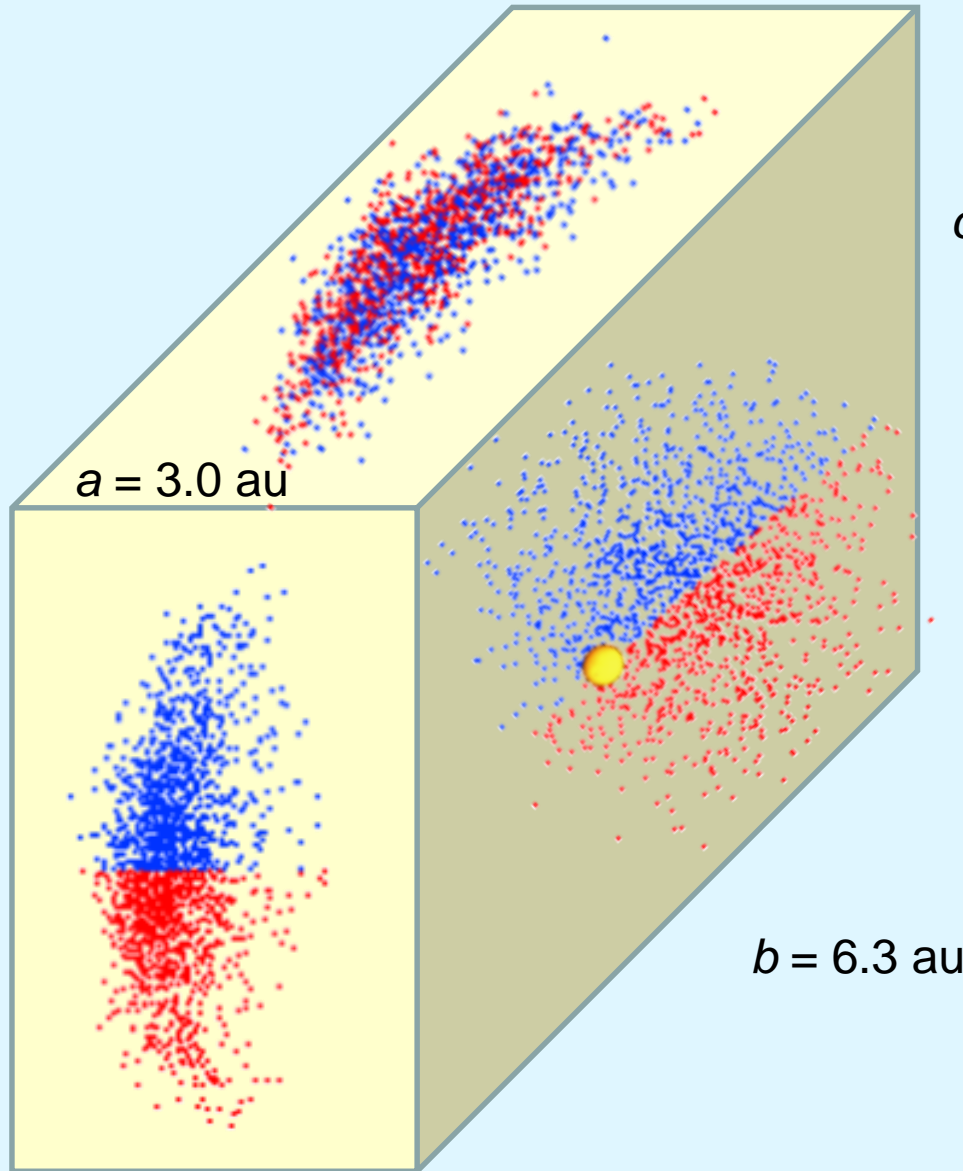


Perceptions about distances of planets





Mutual distances of Jupiter Trojans



$c = 6.2 \text{ au}$

$$n \sim 1700 \quad V = abc$$

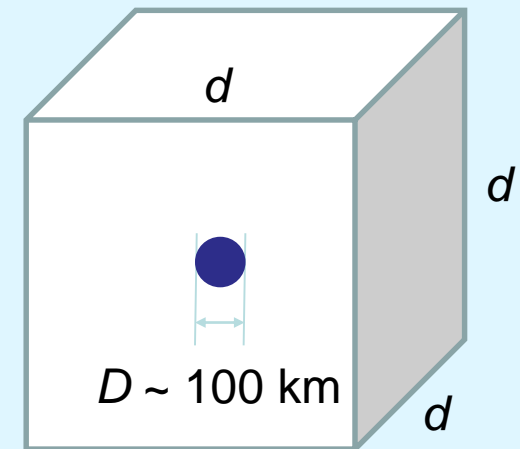
$$V \sim 120 \text{ au}^3 \quad V_k = V / n$$

$$V_k \sim 0.07 \text{ au}^3$$

~ 166 thousand of Sun

$$d \sim 0.4 \text{ au}$$

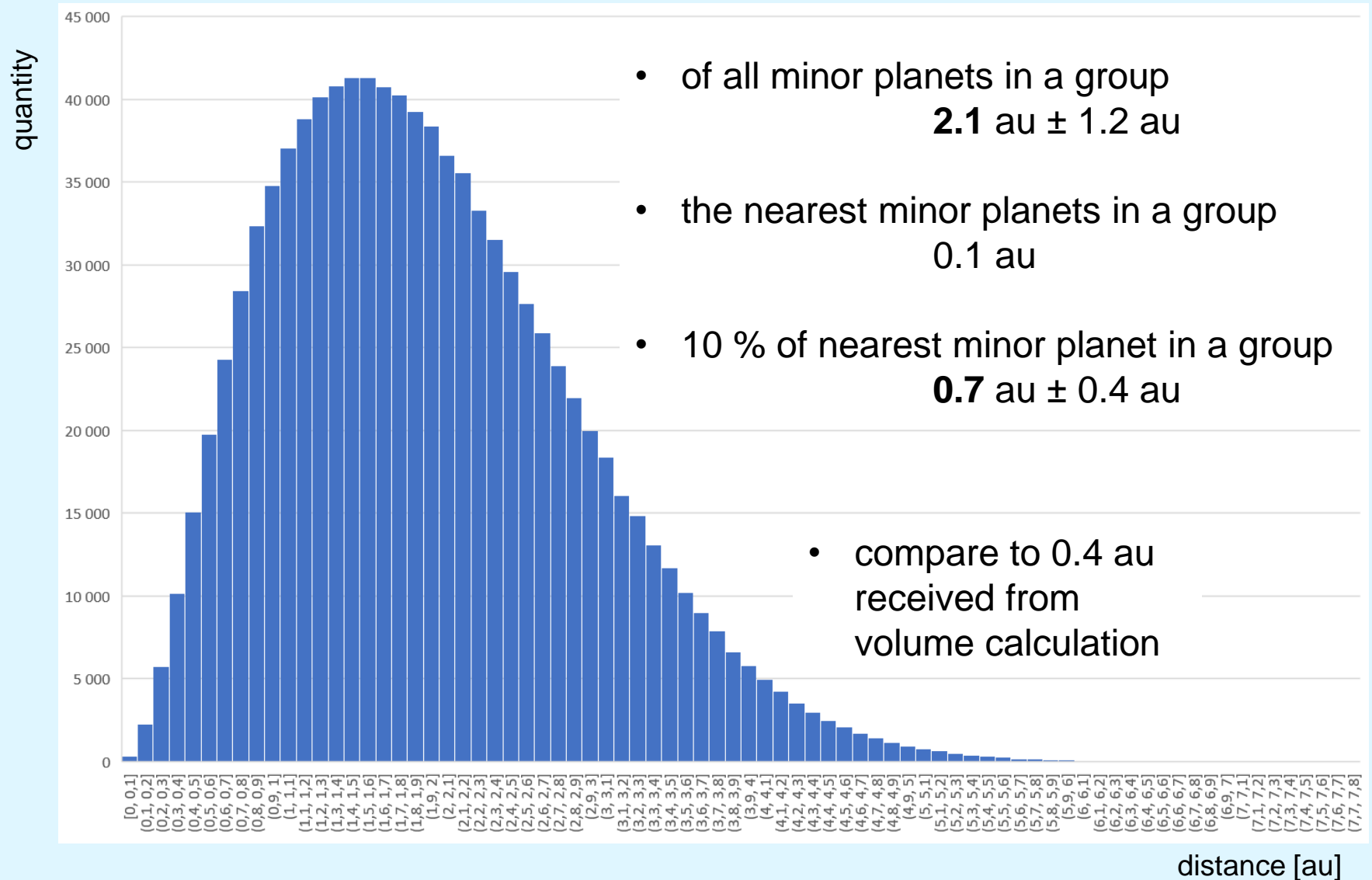
~ Sun–Mercury



(object dimensions and distances are not in scale)



Mutual distances of Jupiter Trojans





Mutual distances of Jupiter Trojans

150,000,000 km

1 au

Sun  Earth

300,000,000 km

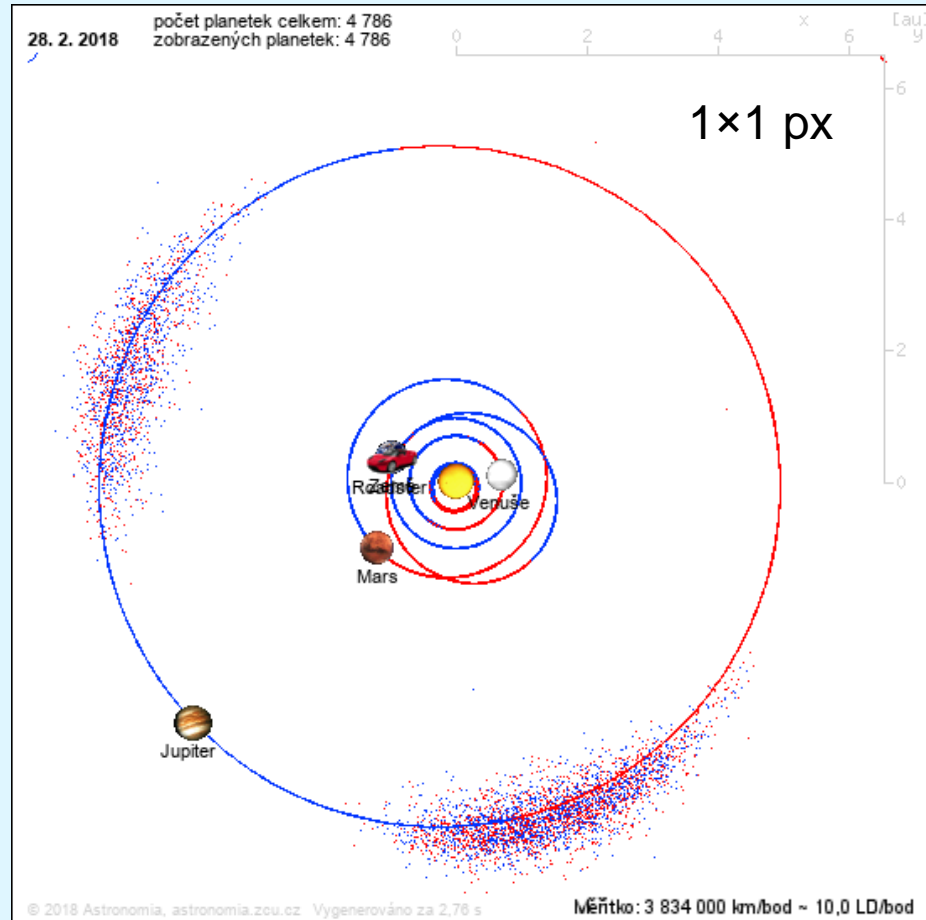
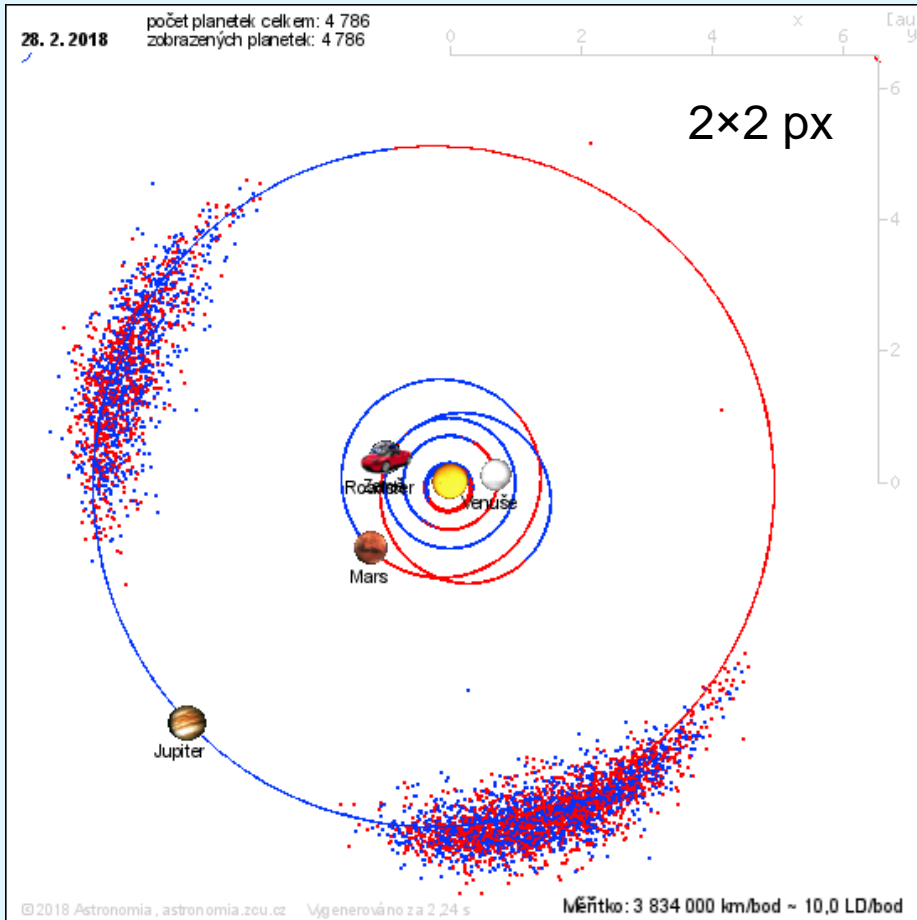
2 au

Earth, Jan  Earth, Jul

100,000,000 km

0.7 au

Sun  Venus



(object dimensions and distances are not in scale)



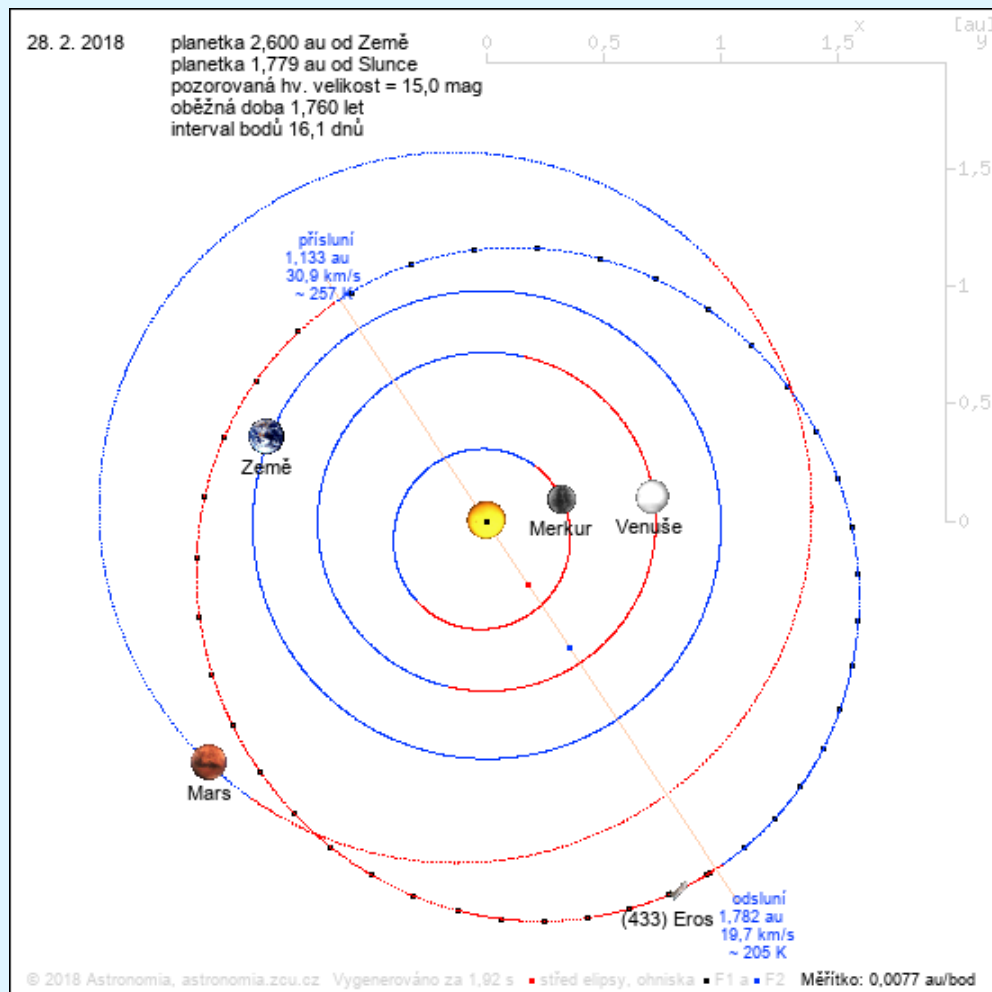
Interesting „group“ of minor planets

Hilda group
Hungaria group
Phocaea group



Location of minor planet

- actual location, date change
- animation forward, back
- estimation of minor planet temperature
- estimation of minor planet apparent magnitude
- trajectory colour
(above – blue/below – red ecliptic)
- **perihelion, aphelion passages**
- **closest approach to Earth, far approach to Earth**
- **highest, lowest brightness from Earth**
- **Kepler's laws**





Open question...



➤ Which Deep-sky Objects / Bright stars / Constellations are Above Horizon?

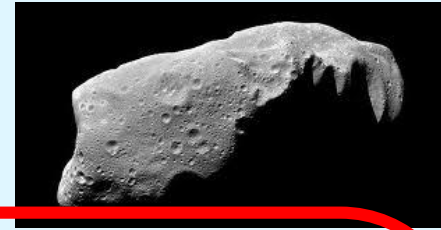


Catalogues on Astronomia web pages

- **MPC**

www.minorplanetcenter.net

= 523 584 minor planets
(135 MiB, **monthly update**)



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= 118 218 stars
(60 MiB, static)



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simbad.u-strasbg.fr/simbad/

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(2 MiB, 400 MiB pics, static)



- **Messier**

= 110 deep-sky objects
(615 MiB pics, static)

- **Exoplanets**

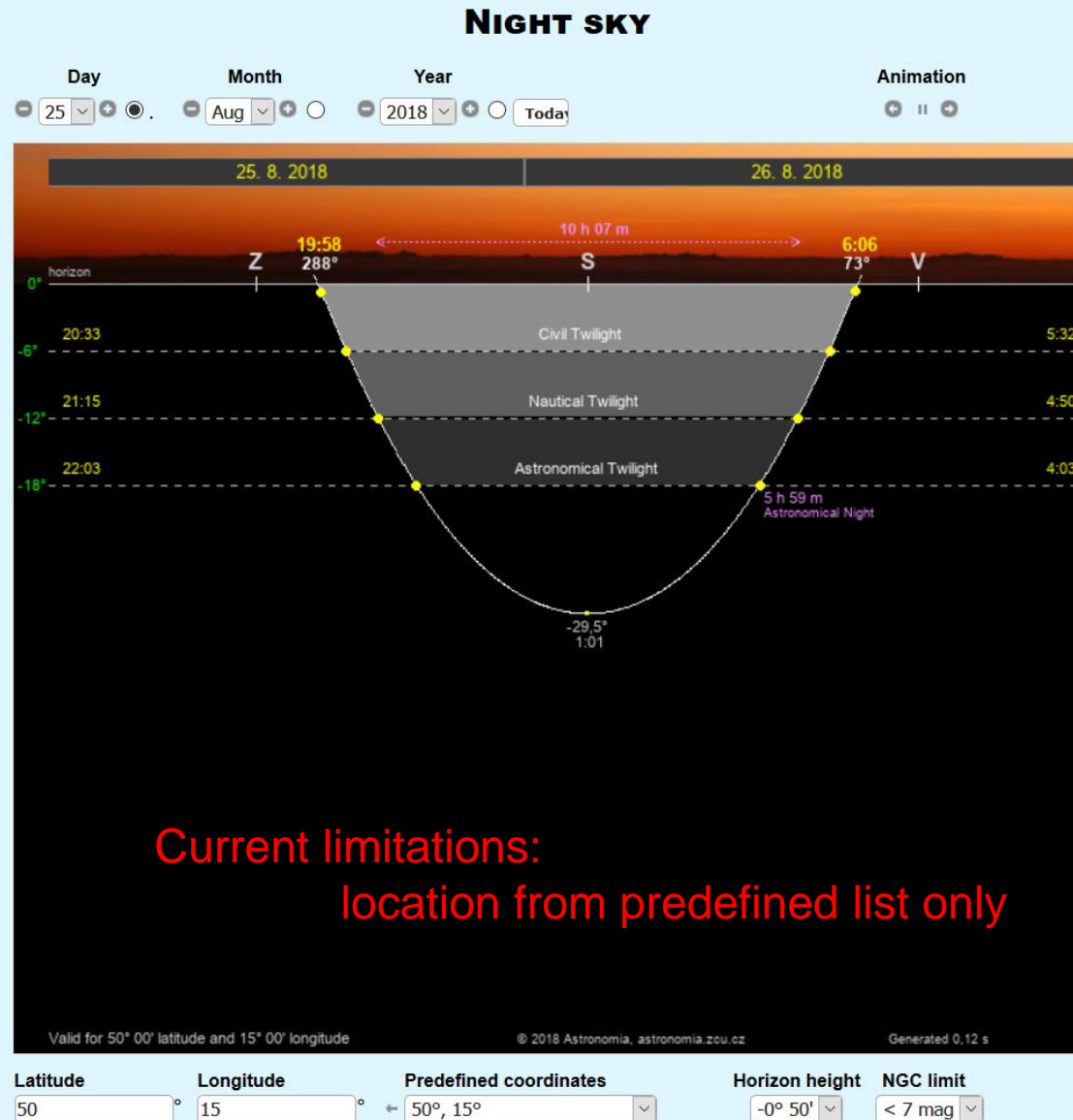
exoplanet.eu

= 3 824 exoplanets
(3 MiB, **daily update**)





„Night sky“ Online application





FACULTY OF EDUCATION
UNIVERSITY
OF WEST BOHEMIA

Astronomia
ASTRONOMIE PRO KAŽDÉHO

HOW TO USE REAL DATA FROM CATALOGUES OF ASTRONOMICAL OBJECTS (NOT ONLY) IN EDUCATION

OTA KÉHAR

kehar@kmt.zcu.cz

Faculty of Education, University of West Bohemia, Plzen, Czech Republic