

Unusual Concept of ICT in Astronomy



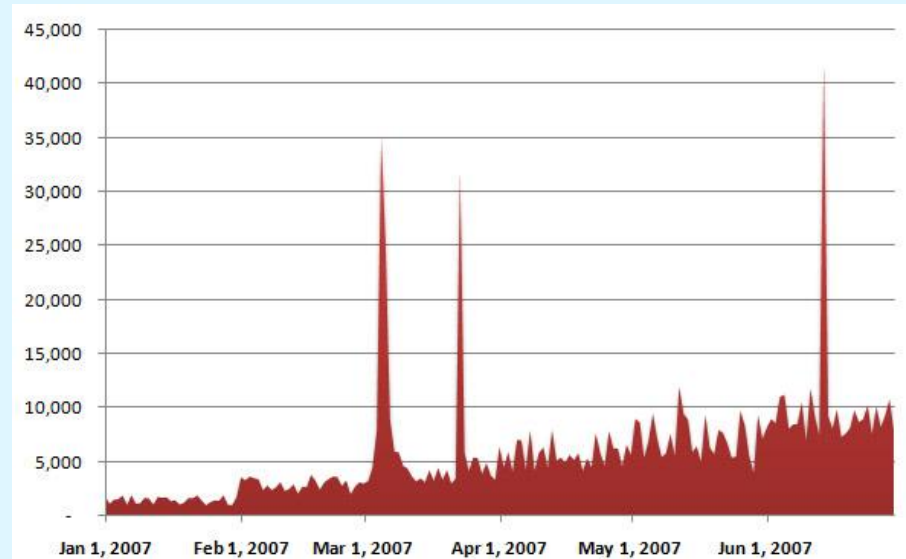
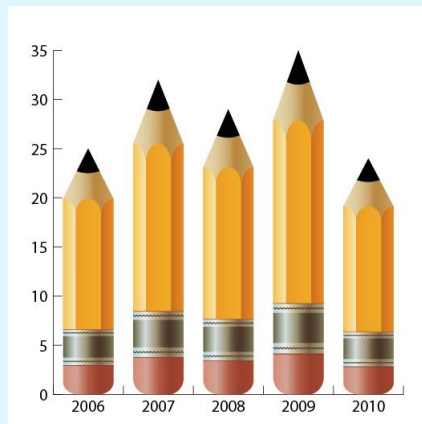
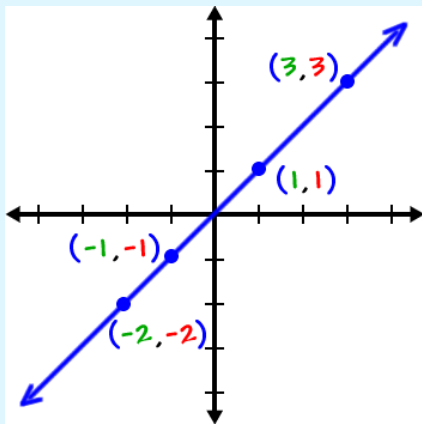
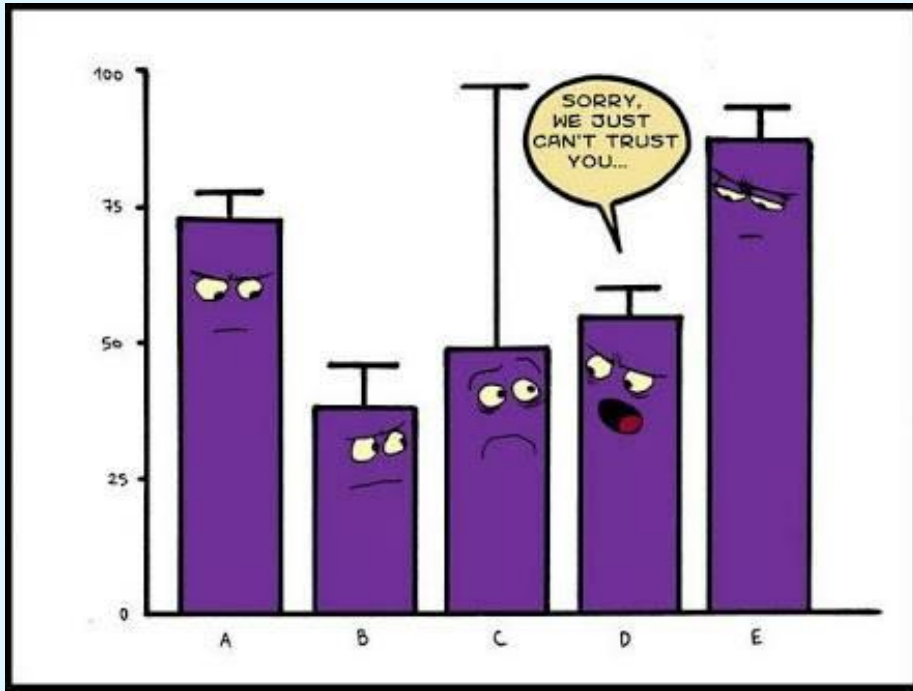
FACULTY OF EDUCATION
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Graphs / plots / diagrams are everywhere...





What Students Should Know About It?

Educational Framework Programme for Grammar 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

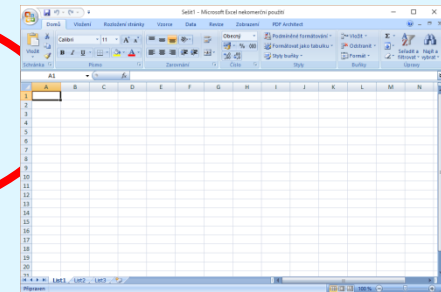


Real Data



Students

Application software



Graphs Visualization



Where to easily get Real Data?



Portal Simbad VizieR Aladin X-Match Other Help

Access to Astronomical Catalogues

← Click to display the menu

keywords, author names, catalogues ... [\(or browse the list of catalogues\)](#)

The *Strasbourg astronomical Data Center (CDS)* collects and distributes astronomical data catalogues, related to observations of stars and galaxies, other galactic and extragalactic objects, solar system bodies and atomic data. It is also a repository of the [IAU Commission 27 Archive of Unpublished Observations of Variable Stars](#)

Access to Catalogues

Alternative accesses:

- [browse the list of catalogues](#), and get access to summary descriptions of each individual catalogue, or restrict to the list of [recently added catalogues](#).
- retrieve the catalogues associated to the [acronyms](#) used throughout the literature, the [Simbad](#) and [NED](#) databases.
- find and query catalogues through [VizieR](#) (or with the [VizieR toolbar](#) below)
- interrogate and query the collection of data with [client routines](#) that can easily be installed on your local Unix workstation.

Note: Some of the catalogues are not (yet) available on-line. These ones should be requested by electronic mail to: question@simbad.u-strasbg.fr

Statistical Summary

- **15179** catalogues available from CDS ...
- ... of which **14461** are available on-line (as full ASCII or FITS files) ...
- ... of which **14182** are also available through the Vizier browser.

15 179

Scientists producing computer-readable catalogues are encouraged to make their astronomical data available for distribution to the worldwide astronomical community through the international astronomical data centers.

For a rapid insertion into the data center archives and into the [VizieR](#) facility, the authors are advised to have a look at the [guidelines for the preparation and submission](#) of catalogues.

catalogue service

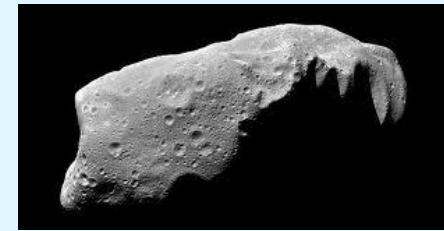
© UDS/CNRS
✉ [Contact](#)

cdsarc.u-strasbg.fr/viz-bin/Cat



Catalogues on Astronomia web pages

- **MPC** = 439 830 minor planets
(111 MB, updated monthly)
- **HIPPARCOS** = 118 218 stars
(60 MB, static)
- **SIMBAD (*)** = 118 194 stars
(29 MB, updated weekly)
- **NGC** = 7840 objects
(2 MB, 400 MB images, static)
- **Messier** = 110 objects
(615 MB images)



Two ways how to use data from catalogues of stars...



Raw Real Data Usage

1

H-R DIAGRAM I WORKSHEET

Name: _____
School, class: _____
Date: _____

1 Advanced Search of HIPPARCOS Catalogue of Stars

Explore Search and Advanced Search of the HIPPARCOS Catalogue of Stars available on the Astronomy web pages (astronomia.zcu.cz → Catalogues_in_education → Online Applications → Stars → Online H-R diagram & Advanced Search of the HIPPARCOS Catalogue).

Which values do you need to be able to construct a Hertzsprung-Russell (H-R) diagram?

Note: Mon (astronom) For English!

3 Preparation of data for construction of H-R diagram

Open the prepared CSV file in an Excel spreadsheet. To construct a H-R diagram you need to know the star's luminosity (absolute magnitude) and effective temperature (spectral type or colour index). From the catalogue it is possible to obtain the absolute magnitude (calculated in column M from the apparent magnitude - column Vmag and distance to star calculated from the parallax - column Plx) and colour index (directly in column B-V).

By using it for the colour index

Note: Setu and number

Distance to star r can be calculated from the parallax π using the formula $r = 1/\pi$, where distance is in parsecs (pc). Parallax π is given in arc seconds in column Plx. Note: value of the parallax in the catalogue is in μ arcseconds. Mark the new column as r .

Absolute magnitude M can be calculated using the formula $M = m + 5 \cdot [1 - \log(r)]$, where apparent magnitude m is in column Vmag. Mark the new column as M .

What values reach the What real values can it

5 Construction of H-R diagram for distant stars

Use the same procedure from exercise 4 to construct a H-R diagram for distant stars at distances from 100 pc to 400 pc. To obtain data from the HIPPARCOS Catalogue of Stars decide on the correct value of the parallax (Plx). Use the same scale of axes as in fig. 2.

Note: Be mindful of limits in Excel 2008: max 65,535 rows per list, 32,000 items for 2D graph (Scatter plot is a part of it). For Excel 2007 and Excel 2010 the limits are 1,048,576 rows per list; number of items for the 2D graph is the same.

4 Construction of H-R diagram

Create a Scatter plot in Excel

Note: For the horizontal "Absolute magnitude" Decide to use a suitable

How many stars do you Describe each area of it

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

Star Name, Designation, etc. Apparent magnitude (m) Absolute magnitude (M) Parallax (π) ["] Distance r [pc] Colour index Spectral type Constellation (abbreviations)

Sun

Fig. 2. Hertzsprung-Russell diagram

Describe each area of the H-R diagram Are there differences between the two? Why? Explain the reasons!

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 or how to improve it?

Browser

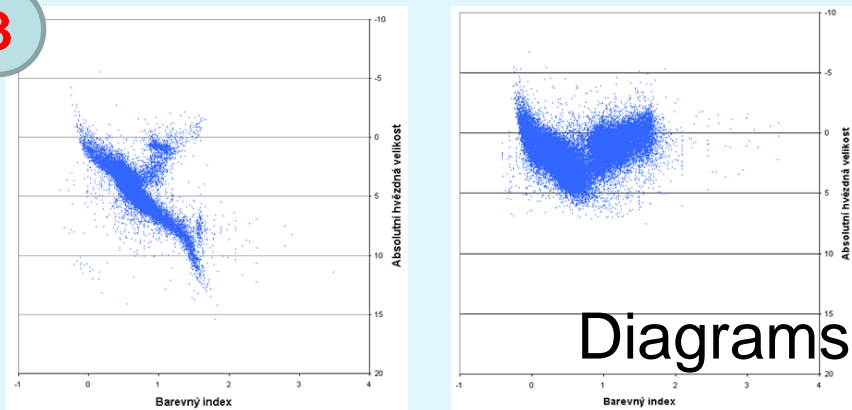
Worksheet with Procedure & Questions

2

Excel Spreadsheet

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	
Astronomia, katalog HIPPARCOS, 12.53.56, 23. 2. 2011																										
Vyhledání: nalezeno 22 982 záznamů																										
3	4	5	6	7	8	9	10	11	12	13	14	15	16													
HIP	označení	jméno hvězdy	RAhms	DEdms	Vmag	RAdeg	DEdeg	Plx	pmRA	pmDE	B-V	HD	SpType	souhvězdí												
00 00 00,81			-19 29 55,8	9,27	0,0038	-19,499	21,9	181,21	-0,93	0,999	224690	K3V														
00 00 04,25			+03 56 47,4	12,31	0,0191	3,94649	19,8	226,29	-12,64	1,336	160V															
00 00 05,41			+20 02 11,9	9,84	0,0225	20,0366	17,74	-208,12	-200,79	0,74	GO															
00 00 08,70			-50 52 01,5	8,59	0,0363	-50,867	10,76	42,23	40,02	0,489	224717	F6V														
00 00 12,75			-04 03 13,5	11,03	0,0531	-4,0537	19,93	-127,22	23,78	1,567	KS															
00 00 15,11			+23 31 45,4	8,51	0,0263	23,5293	10,76	36	-22,98	0,516	224723	GO														
00 00 17,86			+13 18 44,0	7,57	0,0744	13,3122	12,21	54,15	9,65	0,456	224742	F2V														
00 00 19,05			-44 17 25,1	6,28	0,0794	-44,29	13,74	58,36	-108,64	0,763	224750	G3IV														
00 00 23,87			+26 55 05,7	6,43	0,0895	26,8182	12,71	42,2	-53,47	0,514	224758	F7,5IV-V														
00 00 26,65			-79 03 42,6	8,65	0,111	-79,062	23,84	162,3	-62,4	0,778	224752	G6V														
00 00 26,85			-16 41 48,9	7,46	0,1119	-16,897	10,98	169,72	-32,54	0,475	224763	F3V														
00 00 32,21			-72 12 09,8	9,59	0,1342	-72,203	15,1	-37,2	-2,78		224766	G6/G8V														

3



Czech / English versions



Online Application Real Data Usage

1

Astronomia KATALOGY / CATALOGUES

..ostatni

Obtížnost Testy

Novinky Hledání

..in education > Search results

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	SpTyp
			h m s	d m s	mag	°	°	mas	mas/yr	mas/yr	mag	
32349	α CMa, θ CMa	Sirius	08 45 09 25	-16 42 47 3	-1.44	-101.288 541 05	-16.713 143 08	379.21	-546.01	-1.223.08	0.009	A0m, full

Another alternative names: Sirius, Canicula, Aschere

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

HIP	Type	Coordinates	Proper motion	Plx	Magnitude	SpTyp	HRD
		h m s d m s	mas/y mas	mag			
32349	**	ICRS (J2000) RA: 08 45 08 91728 DE: -16 42 58 01717 FK5 (J2000) RA: 08 45 08 917 DE: -16 42 58 02 FK4 (B1950) RA: 08 42 58 72 DE: -16 38 45 4	RA: -546.01 379.21 DE: -1.223.07	379.21	U: -1.51 B: -1.46 V: -1.46 R: -1.46 I: -1.43 J: -1.38 H: -1.33 K: -1.35	A1V+0A	

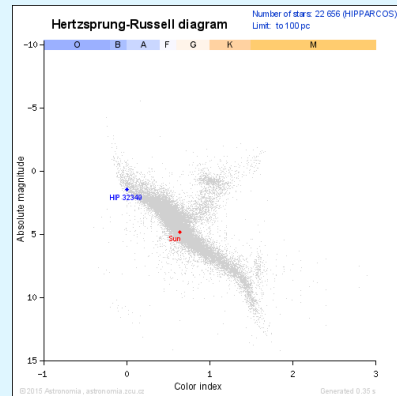
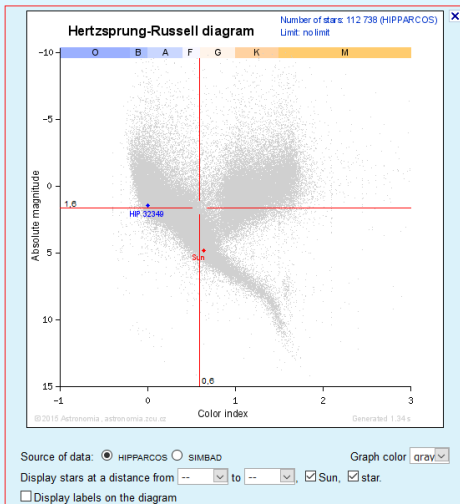
Note: SIMBAD database check performed on 12. 9. 2015, 1:00; last update held on 14. 2. 2014, 1:02

Back

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

© 2015 Astronomický katalogy (Autorský tým) W3C XHTML 1.0 W3C CSS RSS

2



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 (indicate the location of selected whether the star is brighter than the Sun or not)

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?

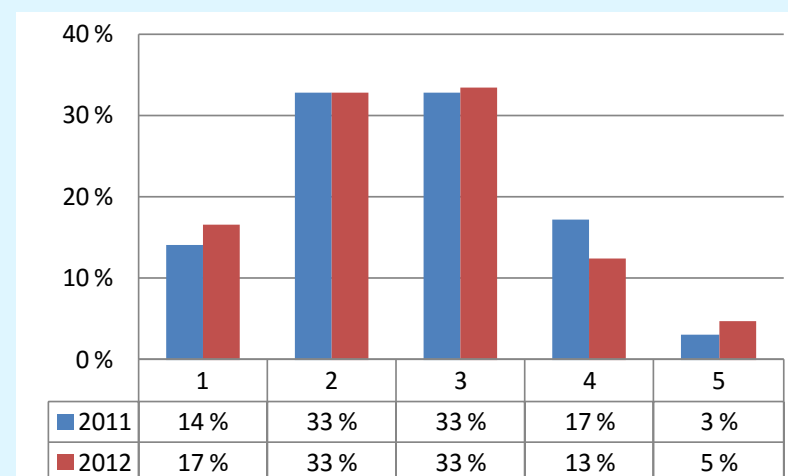
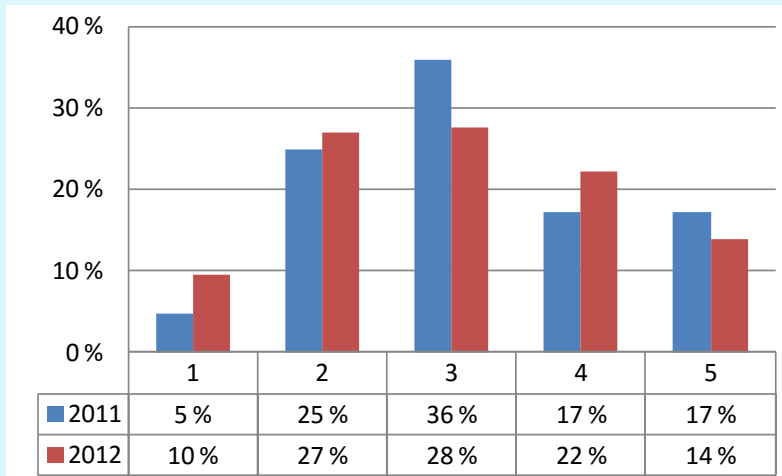
2



Data Analysis & Comparison



complexity (left) / usefulness (right)






Conclusion

- Physics (Astronomy) & ICT together (increase hours)
- Usage of real data from satellites (or ground projects) incl. all errors and limitations
- Comment: *“It is not possible to find answers on Wikipedia”*
- Internet browser and spreadsheets usage
 - improve students skill & reach expected outcomes



Multimedia Textbook **Astronomia**

 **Catalogues**

Astronomia.zcu.cz

ASTRONOMICKÝ SERVER FAKULTY PEDAGOGICKÉ ZČU V PLZNI

Planety

Galaxie

Hvězdy



Planets

Galaxies

Stars

Astronomical photos

Astronomers

Spacecrafts

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