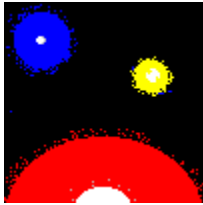


Welcome to H-R Calc for Windows 2.00



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Legal Disclaimer

What is H-R Calc for Windows?

H-R Calc for Windows is a tool which allows a user to derive a star's theoretical radius given the star's spectral class (effective temperature) and luminosity. Features of the program include:

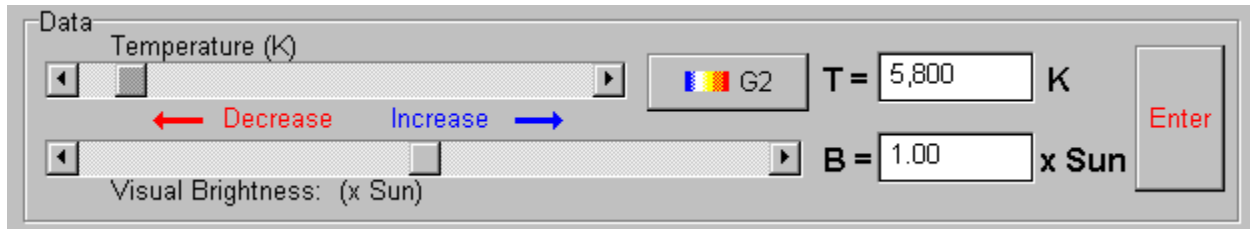
- Interactive Hertzsprung-Russell Diagram
- A user friendly interface for data entry
- Scale model graphical representation of stellar radii
- Ability to plot up to 50 stars on the H-R Diagram
- An interactive and expandable database of selected stars

This program is designed for educators, students of astronomy, amateur astronomers and anyone wishing to expand their understanding of the Hertzsprung-Russell Diagram and the relationship between stellar luminosity, effective temperatures, and stellar radii.

H-R Calc uses two data elements, effective temperature and luminosity, to calculate a star's theoretical radius. H-R Calc provides the user with considerable flexibility in the entry of these data elements. Temperature values, for instance, can be entered by choosing a spectral class, moving a slider, entering a numeric value, or by moving the mouse pointer to a specific region of the H-R Diagram. The next several topics will explain the the functions of each part of H-R Calc's graphical user interface.

Using H-R Calc for Windows

Entering temperature and luminosity values



Shown above is the interface for entering temperature and luminosity values into H-R Calc.

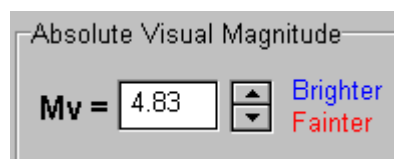
To Enter a temperature:

Use the slider to change a value in the temperature textbox then click on the **Enter** button **or** type a numeric value in the temperature textbox (2,600 to 45,000) and press Tab or Enter **or** click on the spectral class button and choose a spectral class

To Enter Luminosity

Use the slider to change the visual brightness value then click on the **Enter** button **or** type a numeric value in the visual brightness textbox (0.00001 to 150,000) and press Tab or Enter

Luminosity is also expressed in terms of absolute visual magnitude. Instead of entering a visual brightness directly, the user may enter an absolute visual magnitude. H-R Calc then calculates the visual brightness based on this entry. Use the interface shown below to enter the absolute visual magnitude.



To Enter Absolute Visual Magnitude

Type an absolute visual magnitude into the textbox and press the Tab or Enter key. **or** use the arrow buttons to change the absolute visual magnitude in 0.01 increments.

Absolute Visual Magnitude

A logarithmic scale used to denote a star's brightness in the visual part of the spectrum as measured from a distance of 10 parsecs (approximately 32.6 light years). A magnitude difference of 5.0 equates a brightness difference of 100 times. (e.g. a magnitude 0 star is 100 times as bright as a star of magnitude 5).

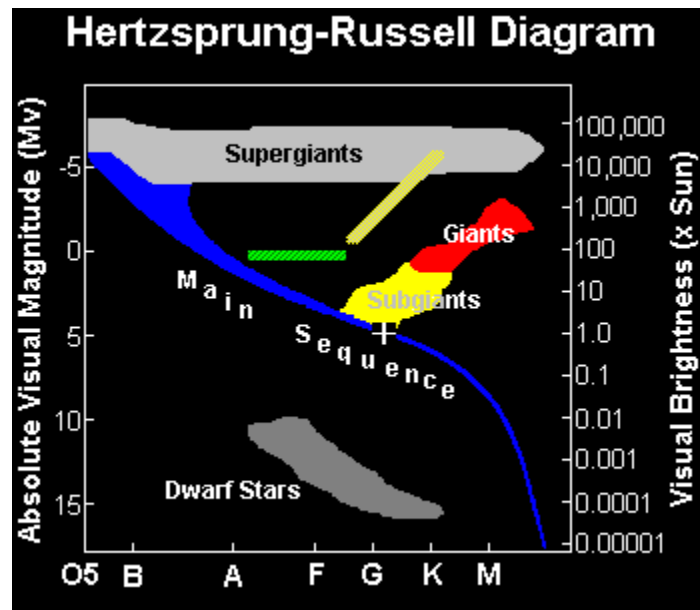
Plotted stars appear as small diamond shaped icons on the H-R Diagram.

Hertzsprung-Russell Diagram

A diagram which plots stars according to their temperatures and absolute visual magnitudes. The horizontal axis of the diagram denotes stellar temperature, with the hottest region on the left end of the diagram. The vertical axis denotes stellar luminosity, usually expressed as absolute visual magnitude.

Using H-R Calc for Windows

The Interactive H-R Diagram



The H-R Diagram pictured above is used by H-R Calc in two ways:

- (1) As a data entry mechanism
- (2) As a means of displaying the properties of a stellar object

To enter data using the H-R diagram, simply:

- (a) Move the mouse cursor to any portion of the diagram
- (b) Click the left mouse button
- (c) H-R Calc then derives a theoretical radius for the star

To view properties of a plotted star

- (a) Move the mouse cursor over a plotted star
- (b) A small label with the star's name will appear
- (c) Hold down the left mouse button to view information related to the star

A crosshair marker is always visible on the H-R Diagram. This marker reflects the currently selected temperature and luminosity values.

Notice that when the cursor is moved across the H-R diagram, a legend and an information panel containing current values appears. The panel containing current values is useful in precisely positioning the cursor.

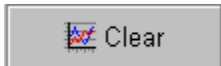
Using H-R Calc for Windows

Plotting A Star

Sometimes a user may wish to plot stars on the H-R diagram in order to view temperature-luminosity relationships among these stars.



In order to plot a given star, click on Plot



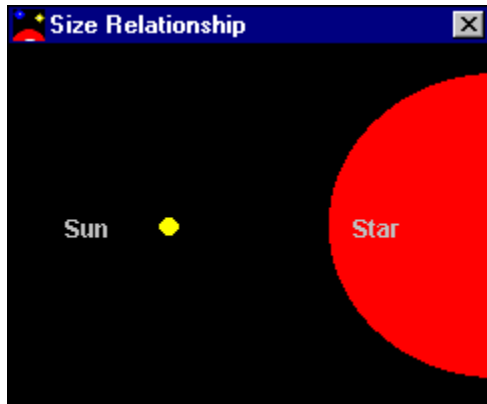
To clear all stars plotted by the user, click on Clear

Note that the "Clear" button will only clear the stars plotted using plot. Reference stars remain, even after clearing the H-R Diagram. To hide the predefined reference stars, use the Options menu and toggle the "Show Reference Stars" option.

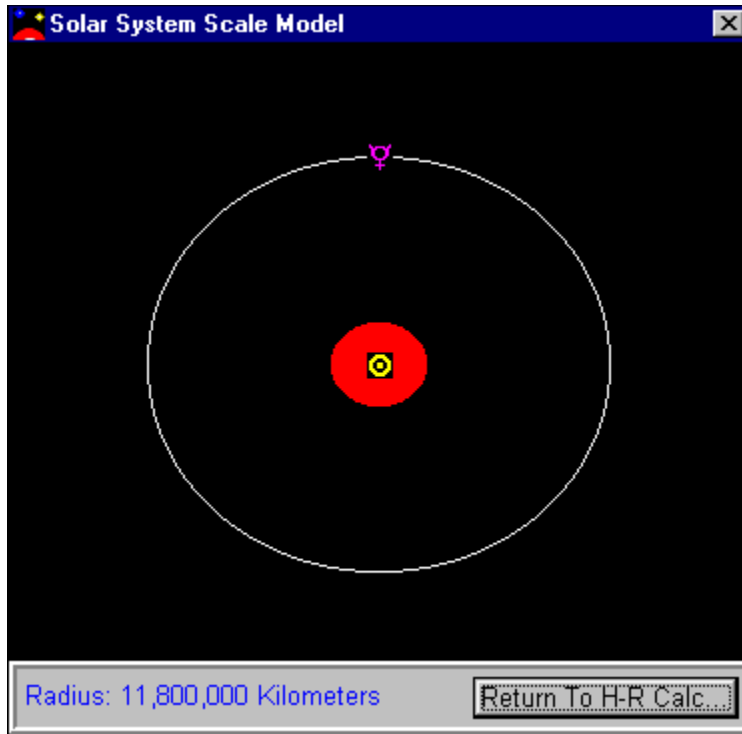
Using H-R Calc for Windows

Viewing Size Relationships and Scale Models

H-R Calc is capable of displaying graphical scale models and size relationships of stellar objects. There are two buttons labeled "Relative Size" and "Scale Model" which enable these graphical models.



After calculating a radius, just click on the "Relative Size" button to view the relative size model shown above. This model is especially useful if a calculated stellar radius is less than 1 solar radius.



Clicking on the "Scale Model" button shows a window much like the one above. This model is helpful in visualizing the dimensions of a giant or supergiant star and shows the stars size in relation to planetary orbits. The "Scale Model" key is active for objects with radii between 7 solar radii and 2000 solar radii. White circles indicate average distances of planetary orbits. Placing the mouse cursor over a planet's symbol reveals the planet's name.

Using H-R Calc for Windows

Saving and Adding Data

H-R Calc for Windows uses a database to store data on selected stars. You may add your own stars to the file by clicking on the “Save Data” button shown below.



After clicking on this button, the data entry dialog box shown below appears. Enter a name for the star, an alternate or Greek designation, and comments. The star's absolute visual magnitude, spectral class, and luminosity class are already filled in for you. You may edit these fields if you wish.

A screenshot of the 'Data Entry' dialog box. The title bar reads 'Data Entry'. It contains several input fields: 'Star Name' with 'Antares', 'Greek / Alternate Designation' with 'Alpha Sco', 'Absolute Visual Magnitude' with 'Mv = -6.29', 'Spectral Class' with a dropdown menu showing 'M3' selected, and 'Luminosity Class' with a dropdown menu showing 'I'. Below these is a 'Remarks and Notes' text area containing 'A quite remarkable star!'. On the right side, there are three buttons: 'Save' (blue text), 'Clear', and 'Exit' (red text).

To save the current data, press Save.

To clear all the fields, press Clear.

To close the dialog without saving data, press Exit.

Note that the menu choice **Add Data** under the **File** menu allows the user to save many records in succession. This feature is useful for adding several different stars to the database from other information sources such as a book. In this case, you should have the star's spectral class and absolute visual magnitude data available for entry into the interface.

Using H-R Calc for Windows

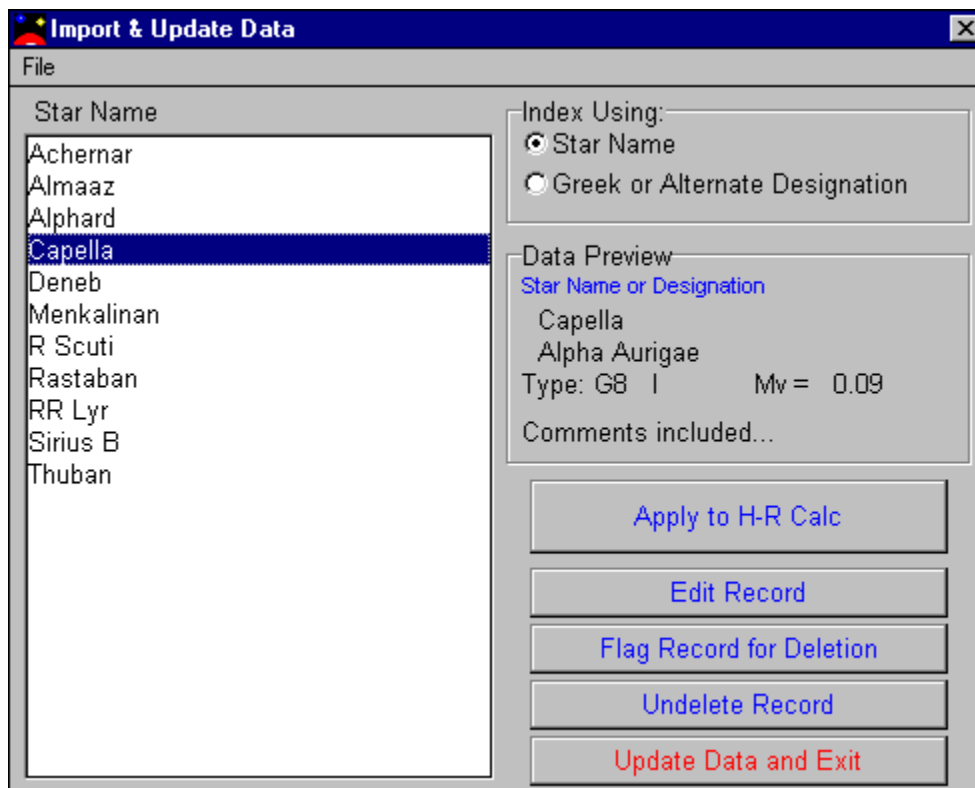
Importing and Updating Data

In order to load data into H-R Calc from the database, click on the “Import” button shown below.



The “Import and Update Data” dialog will appear. As its name implies, this dialog serves two functions:

- (1) to import data into H-R Calc
- (2) to allow the user to edit or delete database records



Description of Controls:

Listbox: Choose a star from the listbox you wish to edit, import or delete.

Index Using: Choose “Star Name” to list stars by their common name, or choose “Greek / Alternate Designation” to list stars by their alternate name.

Apply to H-R Calc: Click on this control to load this particular star into H-R Calc.

Edit Record: Used to bring up the “Update Data” dialog in which the user can change data within the chosen record.

Flag Record for Deletion: Used to flag a record for deletion. Record is deleted when the user clicks the “Update Data and Exit” button.

Undelete Record: Used to restore a record which was flagged for deletion. Note that it is not possible to restore a record after the “Update Data and Exit” button has been pressed.

Update Data and Exit: Click on this control to delete all records that were flagged for deletion. After records are deleted, you are returned to the main H-R Calc interface.

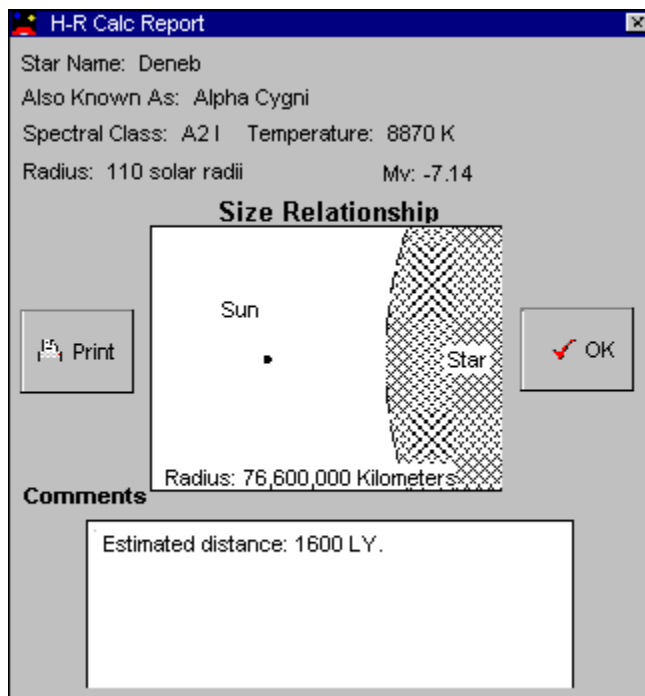
Using H-R Calc for Windows

Viewing and Printing Data

H-R Calc allows you to view and print data if you wish. This is accomplished by the “Info” button shown below.



Pressing this button brings up the “H-R Calc Report” dialog shown below:



This dialog has only two controls: the “Print” button and the “OK” button. [Print](#) will send the report to the printer. [OK](#) will close the dialog and return to the main interface of H-R Calc.

Theory and Formulae

The formula used by this application to approximate a stellar radius is given below:

$$\log R = \frac{5700}{T} - C - 0.2Mv + 0.5\log(1 - 10^{-14,700 / T})$$

Variables:

- T: stellar effective temperature expressed in degrees Kelvin
- R: theoretical stellar radius expressed in solar radii
- Mv: the absolute visual magnitude of the star

Given the effective temperature of a star, T, and the star's absolute visual magnitude, Mv, we can solve for the theoretical radius R. The constant C is set to 0.02 so that the equation will yield a theoretical radius of 1.00 when T is 5780K and Mv=4.83 (these values correspond to our sun). The portion of the equation highlighted in blue is a correction factor applied to stars with an effective temperature greater than 8500K.

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Thank you for using H-R Calc for Windows.

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Using H-R Calc for Windows

Main Menu Items

Here is a description of the items contained in H-R Calc's main menu:

File

- Add Data:** add one or more records to the database
- Edit / Import Data:** load or edit data in the database
- Save To File:** saves current star in H-R Calc to the database
- Print:** sends report to printer
- Close:** exits H-R Calc

Options

- Show Reference Stars:** toggles reference stars on or off
- Show Hints:** toggles hints (small yellow tags next to controls) on or off
- Units:** allows you to select Km or Miles for calculated stellar radii

Help

- Contents:** starts help feature (Contents topic)
- Topic Search:** search for help on a particular topic
- About:** displays title screen and copyright information

