get_amrv

Using a grid from Bertelli's isochrones, we input observed Teff, gravity, and [Fe/H] and find out which values of a = [age, m (mass), rad (radius), vmag (absolute magnitude)] are compatible for a star with the observed values.

Syntax

GET_AMRV,t,err_t,lg,err_lg,feh,err_feh,logt_in,logg_in,logr_in,vmag_in,
a,m,rad,Mv[,boundarytouch=boundarytouch,noplot=noplot]

Return Value

a (float array with 3 elements) - 3-element vector with an estimate of log(Age[yr]), flanked by a lower an upper limits ([lowerage,age,upperage]).

m (float array with 3 elements) - 3-element vector with an estimate of the mass (initial - at birth), flanked by a lower an upper limits ([lowermass,mass,uppermass]).

rad (float array with 3 elements) - 3-element vector with an estimate of log10(radius), flanked by a lower an upper limits ([lowerrad,rad,upperrad]).

Mv (float array with 3 elements) - 3-element vector with an estimate of Mv , flanked by a lower an upper limits ([lowerMv,Mv,upperMv]).

Arguments

t (float) - Teff (K)

err_t (float) - Uncertainty in Teff (K)

lg (float) - logg (g in cm s^2)

err_lg (float) - Uncertainty in logg

feh (float) - [Fe/H] = alog10(NFe/NH)-alog10$(NFe/NH)_\odot$

err_feh (float) - Uncertainty in [Fe/H] (must be at least 0.25 dex)

logt_in (fltarr(17,73,1800)) log10(Teff) as a function of [Fe/H], log(age[ayr]), Mass/Msun (This array is read from the data base in file bert_big.xdr)

logg_in (fltarr(17,73,1800)) log10(g) as a function of [Fe/H], log(age[ayr]), Mass/Msun (This array is read from the data base in file bert_big.xdr)

logr_in- (fltarr(17,73,1800)) log10(radius) as a function of [Fe/H], log(age[ayr]), Mass/Msun (This array is read from the data base in file bert_big.xdr)

vmag_in- (fltarr(17,73,1800)) Mv as a function of [Fe/H], log(age[ayr]), Mass/Msun (This array is read from the data base in file bert_big.xdr)

Keywords

- boundarytouch – This keyword returns a non-zero value when retrieved parameters gets solutions that touch the grid boundaries - an indication that the solution is likely biased.
- noplot – When on, this skips the plot that is produced by default.

1 Discussion

This code produces an estimation of ages, masses, radii and absolute magnitudes of a star based on stellar evolutionary calculations, and the values (and uncertainties) of the stellar atmospheric parameters: Teff, logg, and [Fe/H]. The calculations are based on scaled-solar evolution models (Bertelli et al. 1994). A probability distribution is created for each parameter based on the compatibility with stellar evolution models.

The models, interpolated to increase sampling in mass and age, are packed into the file `bert_big.xdr`, which can be downloaded from
`http://hebe.as.utexas.edu/stools/data/bert_big.xdr`.

A more detailed description can be found in Allende Prieto et al. (2004 – appendix B) and Section 4.5 of Reddy et al. (2006), as well as the discussion in Appendix A of Ramirez et al. (2007).

Example

1. One needs to read the grid of resampled isochrones

   IDL>restore,'bert_big.xdr'

   IDL> help

   BVCL FLOAT = Array[17, 73, 600]

   LOGG FLOAT = Array[17, 73, 600]

LOGR FLOAT = Array[17, 73, 600]

LOGT FLOAT = Array[17, 73, 600]

MASA FLOAT = Array[17, 73, 600]

VMAG FLOAT = Array[17, 73, 600]

Compiled Procedures:

$MAIN$

Compiled Functions:

2. Now one provides as input the effective temperature (and its 1sigma uncertainty), the surface gravity, (and its uncertainty) and the metallicity (plus uncertainty; with a minimum value of 0.25 dex, in order to have a minimum sampling of the isochrones). For example, for a solar-like star with a 100 K uncertainy in Teff and a 0.1 dex uncertainty in logg ...

   IDL>get_amrv,5777.,100.,4.437,0.100,0.0,0.3,logt,logg,logr,vmag,a,m,r,Mv

   On output, one gets a plot of the prob. distr. for log10(age[yr]), mass [solar masses] (m), log10(radius[solar R]) (r) and absolute V magnitude (Mv). The output arrays (a,m,r,Mv) give three values each: lower limit, mean, and upper limit, where the lower/upper limits correspond to 2sigma margins for a Gaussian (see estimator_simple.pro for details).

Version History

Carlos Allende Prieto, Sep/Dec 2002

References

Allende Prieto et al., 2004, A&A, 420, 183

Bertelli et al. 1994, 1994, A&AS, 106, 275

Ramírez et al., 2007, A&A 465, 271

Reddy et al. 2006, MNRAS, 367, 1329