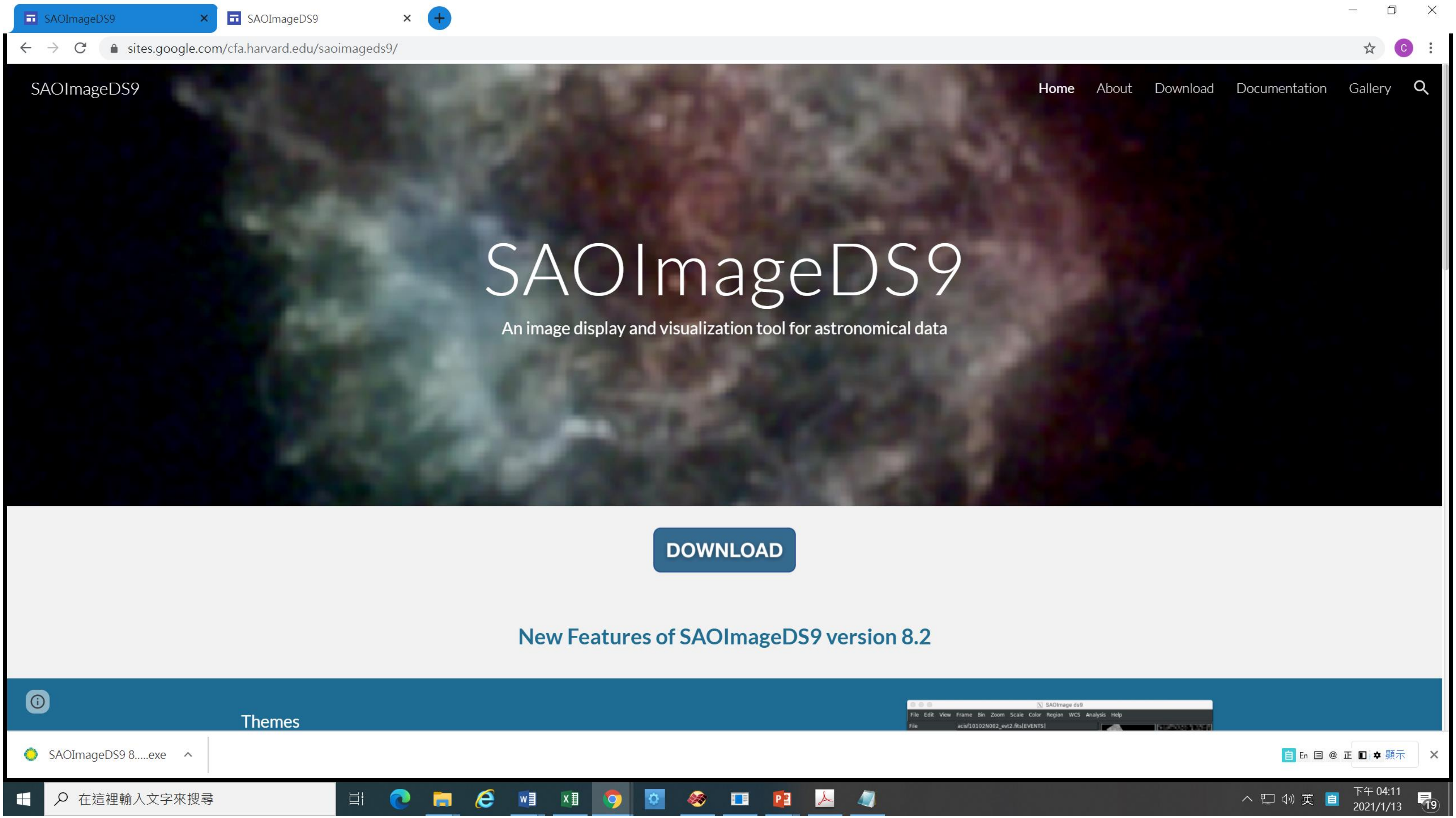
天文研究有用的工具

- SIMBAD/google/wikipedia 某天體的性質、找某類天體
- Images 影像數據庫 --- Digital Sky Survey (DSS)、PS1
  - ✓觀看影像（FITS）
- Data 數據資料庫 --- Vizier
  - ✓TOPCAT 處理「目錄式」數據 processing/analysis/visualization

應用在星團

- *Gaia* 太空望遠鏡數據（恆星的坐標、距離、運動）
- PARSEC 恆星演化計算


SAOImageDS9
SAOImageDS9
sites.google.com/cfa.harvard.edu/saoimageds9/
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Gallery
SAOImageDS9
An image display and visualization tool for astronomical data
DOWNLOAD
New Features of SAOImageDS9 version 8.2
Themes
SAOImageDS9 8.....exe
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2021/1/13

https://vizier.u-strasbg.fr

vizier.u-strasbg.fr

Portal | Simbad | VizieR | Aladin | X-Match | Other | Help

VizieR

Observatoire astronomique de Strasbourg

VizieR provides the most complete library of published astronomical catalogues --tables and associated data-- with verified and enriched data, accessible via multiple interfaces. Query tools allow the user to select relevant data tables and to extract and format records matching given criteria. Currently, 20519 catalogues are available more info

VO compatibility

Free text search catalogue name, author, ... [Find catalogues]

Position position or object name 10 " [Find catalogues] [Photometry]

Go to the classic form [Advanced search]

VizieR

- How to publish my catalog
- Help and tutorials
- View large catalogs
- Rules of usage
- Mirrors

Other related services

- TAPVizieR ?
- Photometry viewer ?
- CDS cross-match service ?
- VizieR images, spectra service ?
- VizieR using the batch mode

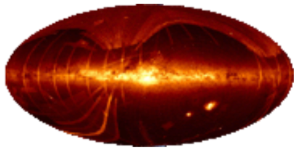
Catalogue collection access

- Catalogue collection ?
- By hierarchical organisation ?
- By acronyms or abbreviations ?
- Recently entered into VizieR ?
- Catalogs having images, spectra... ?

News

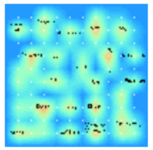
- **2 Jan** Catalogs added between 26-Dec-2020 and 02-Jan-2021
- **26 Dec** Catalogs added between 19-Dec-2020 and 26-Dec-2020
- **19 Dec** Catalogs added between 05-Dec-2020 and 19-Dec-2020
- **5 Dec** Catalogs added between 28-Nov-2020 and 05-Dec-2020
- **21 Oct** VizieR new version with time capabilities and TAP updates
- **12 Oct** Troubleshooting on the University of Strasbourg network

The VizieR mine



The VizieR Mine is a graphical interface to locate the catalogues existing on sky regions

Kohonen map



The Kohonen Self-Organizing Map groups on nearby locations of a map catalogues having similar contents.

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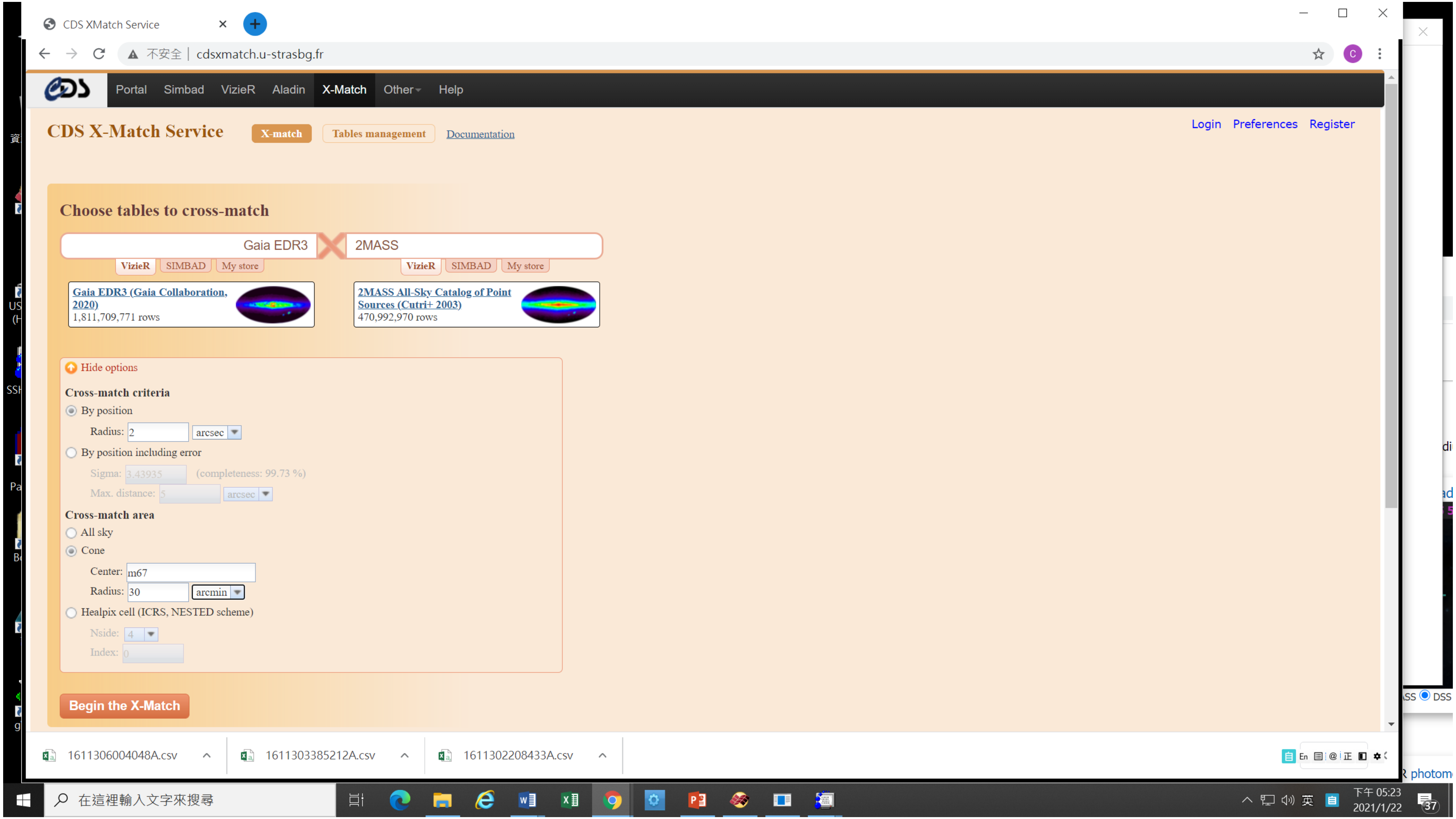
上午 11:50 2021/1/7


CDS XMatch Service
不安全 | cdsxmatch.u-strasbg.fr
Portal Simbad VizieR Aladin X-Match Other Help
CDS X-Match Service
X-match
Tables management
Documentation
Login Preferences Register
Choose tables to cross-match
Gaia EDR3
2MASS
VizieR SIMBAD My store
VizieR SIMBAD My store
Gaia EDR3 (Gaia Collaboration, 2020)
1,811,709,771 rows
2MASS All-Sky Catalog of Point Sources (Cutri+ 2003)
470,992,970 rows
Hide options
Cross-match criteria
By position
Radius: 2 arcsec
By position including error
Sigma: 3.43935 (completeness: 99.73 %)
Max. distance: 5 arcsec
Cross-match area
All sky
Cone
Center: m67
Radius: 30 arcmin
Healpix cell (ICRS, NESTED scheme)
Nside: 4
Index: 0
Begin the X-Match
1611306004048A.csv
1611303385212A.csv
1611302208433A.csv
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2021/1/22

TOPCAT

不安全 | star.bris.ac.uk/~mbt/topcat/

TOPCAT

Tool for OPerations on Catalogues And Tables

Does what you want with tables

Latest (see Version History for details)

Version 4.8 released 11 January 2021

New: **Auto mode guesses input file types better**
TOPCAT can now guess file formats by filename, so e.g. you don't need to choose "CSV" for *.csv files.
Improved: **More multithreaded operations**
The Statistics Window and Sort operation now run in parallel, and concurrent access to synthetic columns or subsets works better; performance for certain things should be better on multi-core machines.

Introduction/Tutorial Video (available August 2020)

Tutorial: **Introduction to TOPCAT**
TOPCAT introduction/demo video and accompanying slides as presented to Shristi Astronomy course.

- What is TOPCAT?
- Features
- Screenshots
- Documentation
- Frequently Asked Questions
- Mailing Lists
- Downloads
    - Jar File
    - MacOS X
    - WebStart
    - Starjava
- Version history — *Version 4.7-3 released 23 October 2020*
- Further information

What is TOPCAT?

TOPCAT is an interactive graphical viewer and editor for tabular data. Its aim is to provide most of the facilities that astronomers need for analysis and manipulation of source catalogues and other tables, though it can be used for non-astronomical data as well.

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2021/1/13

CMD 3.4 input form

不安全 | stev.oapd.inaf.it/cgi-bin/cmd

CMD 3.4 input form

A web interface dealing with stellar isochrones and their derivatives

Latest news

- NEW! (18nov20) Gaia EDR3 filtersavailable.
- (16sep20) New COLIBRI tracks from Pastorelli et al. (2020) available.
- (16sep20) Look at the new LPV section, with LPV periods from Trabucchi et al. (2017) and Trabucchi et al. (2019).

Help FAQ

Submit Reset

Evolutionary tracks

PARSEC tracks (Bressan et al. (2012)) are computed for a scaled-solar composition and following the Y=0.2485+1.78Z relation. The present solar metal content is $Z_\odot$=0.0152. Tables of evolutionary tracks are also available. **COLIBRI** tracks (Marigo et al. (2013)) extend their evolution to the end of the TP-AGB phase, for several choices of mass loss and dredge up parameters.

Available sets of tracks:

PARSEC	**COLIBRI**
going from the PMS to either the 1st TP, or C-ignition:	add the TP-AGB evolution, from the 1st TP to the total loss of envelope:
◉ PARSEC version 1.2S Available for 0.0001≤Z≤0.06 (-2.2≤[M/H]≤+0.5); for 0.0001≤Z≤0.02 the mass range is 0.1≤$M/M_\odot$<350; for 0.03≤Z≤0.04 0.1≤$M/M_\odot$<150, and for Z=0.06 0.1≤$M/M_\odot$<20 (cf. Tang et al. (2014) for 0.001≤Z≤0.004, and Chen et al. (2015) for other Z). With revised and calibrated surface boundary conditions in low-mass dwarfs (Chen et al. (2014)).	◉ + COLIBRI S_37 (Pastorelli et al. (2020)) for 0.008≤Z≤0.02, + COLIBRI S_35 (Pastorelli et al. (2019)) for 0.0005≤Z≤0.006 + COLIBRI PR16 (Marigo et al. (2013), Rosenfield et al. (2016)) for Z≤0.0002 and Z≥0.03)
	○ + COLIBRI S_35 (Pastorelli et al. (2019)) (limited to 0.0005≤Z≤0.03)
	○ + COLIBRI S_07 (Pastorelli et al. (2019)) (limited to 0.0005≤Z≤0.03)
	○ + COLIBRI PR16 (Marigo et al. (2013) and Rosenfield et al. (2016)) (limited to 0.0001≤Z≤0.06)
	○ No (no limitation in Z)

topcat-full.jar

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CMD 3.4 input form

stev.oapd.inaf.it/cgi-bin/cmd

Photometric system

Choose among the available photometric systems: Gaia EDR3 (all Vegamags, Gaia passbands from ESA/Gaia website) They are briefly described here.

Available sets of bolometric corrections:

version	short description	spectral libraries		
		for "normal stars"	for cool giants	for very hot stars and WRs
◉ **YBC** (Chen et al. (in prep.))	This option expands and supersedes the NBC tables from Chen et al. (2014). All details in the YBC web interface, which provides more options with the stellar spectral libraries (eg., Kurucz only or Phoenix only).	An mix of ATLAS9 ODFNEW (Castelli & Kurucz (2004)) and PHOENIX BT-Settl (Allard et al. (2012))	O-rich and C-rich spectra from COMARCS, Aringer et al. (2009) and Aringer et al. (2016)	from Chen et al. (2015), O, B star models computed with WM-basic, WR star models from PoWR
○ **OBC**	The library used in most Padova+PARSEC isochrones, described in Girardi et al. (2002) and then expanded until Marigo et al. (2017)	Mostly based on ATLAS9 ODFNEW from Castelli & Kurucz (2004), as described on Girardi et al. (2008)	O-rich and C-rich spectra from COMARCS, Aringer et al. (2009) and Aringer et al. (2016)	blackbodies...

Circumstellar dust

This will only affect stars in the TP-AGB phase and with significant mass loss. In the case of Bressan et al. (1998) and Groenewegen (2006), the RT calculations are applied using the scaling relations described in Marigo et al. (2008) (see alsp Pastorelli et al. (2019)). In the case of Nanni et al. (2016), the dust growth model is fixed for M stars, while one can choose between a few sets of optical data for C stars.

Available dust compositions:

	for M stars	**for C stars**
Using scaling relations as in Marigo et al. (2008):	○ No dust	○ No dust
	○ Silicates as in Bressan et al. (1998)	○ Graphites as in Bressan et al. (1998)
	○ 100% AlOx as in Groenewegen (2006)	○ 100% AMC as in Groenewegen (2006)
	◉ 60% Silicate + 40% AlOx as in Groenewegen (2006)	◉ 85% AMC + 15% SiC as in Groenewegen (2006)
	○ 100% Silicate as in Groenewegen (2006)	
Warning: The options for C-star dust below should be discarded in the light of the results of Nanni (2018).		
Using Nanni et al.'s dust growth models:	**For M stars:** Pyroxene, olivine, quartz, periclase, iron:	**For C stars:** For the following choices of optical sets for amorphous carbon dust (and including SiC, iron):

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CMD 3.4 input form

stev.oapd.inaf.it/cgi-bin/cmd

○ Add just the fundamental mode and first overtone periods, using the preliminary fitting formula described in Marigo et al. (2017).

◉ Add LPV periods from the fundamental mode to the 4th overtone, using the fitting formulas from Trabucchi et al. (2019). NOTE: As a more complete alternative, you can use Trabucchi's pulsation code., which will include the growth rates.

Initial mass function

The IMF will be used to compute the stellar occupation along the isochrones, and to compute integrated magnitudes, LFs, etc. (see section Output below)

IMF for single stars: [Kroupa (2001, 2002) canonical two-part-power law IMF, corrected for unresolved binaries]

Ages/metallicities

Choose your metallicity values using the approximation [M/H]=log(Z/X)-log(Z/X)$_\odot$, with (Z/X)$_\odot$=0.0207 and Y=0.2485+1.78Z for PARSEC tracks.

Input form for multiple values of ages/metallicities (up to a maximum of 1e4 isochrones):

		initial value	final value	step (use 0 for a single value)
ages	○ linear age (yr) =	1.0e9 yr	1.0e10 yr	0.0 yr
	◉ log(age/yr) =	6 dex	10 dex	1 dex
metallicities	◉ metal fraction Z =	0.0152	0.03	0.0
	○ [M/H] =	-2 dex	0.3 dex	0.0 dex

Output

Kind of output:

◉ Isochrone tables: stellar parameters as a function of initial mass

○ Luminosity functions: star counts expected, in the interval from [-15] to [20] mag, with bins [0.5] mag wide, per 1 Msun of stellar population

○ Simulated populations with a total mass of [1.0e4] Msun

☐ gzip the output file (Files above 50 Mby will always be gzipped!)

[Submit] [Reset]

This service is mantained by Léo Girardi at the Osservatorio Astronomico di Padova.
Questions, comments and special requests should be directed to leo.girardi@oapd·inaf·it .
Last modified: Wed Nov 18 10:22:21 2020

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2021/1/13

CMD 3.4 output

stev.oapd.inaf.it/cgi-bin/cmd_3.4

CMD 3.4 output

Results

Your job was submitted on Wed Jan 13 10:05:04 CET 2021
Your job was completed on Wed Jan 13 10:05:14 CET 2021 .
The results are available at output368009173617.dat, and will be deleted in 2 h from now.

Output header:

```
# File generated by CMD 3.4 (http://stev.oapd.inaf.it/cmd) on Wed Jan 13 10:05:04 CET 2021
# isochrones based on PARSEC release v1.2S +  COLIBRI S_37 + S_35 + PR16
# Basic references: Bressan et al. (2012), MNRAS, 427, 127 + Chen et al. (2014, 2015), MNRAS, 444, 2525 + MNRAS, 452, 1068 + Tang et al. (2014), MNRAS, 445, 4287 + Marigo et al. (2017), ApJ, 835, 77 + Pastorelli al. (2019), MNRAS, 485, 5666 + Pastorel
# Thermal pulse cycles included
# On RGB, assumed Reimers mass loss with efficiency eta=0.2
# LPV periods and growth rates added cf. Trabucchi et al. (2019)
# Photometric system: Gaia EDR3 (all Vegamags, Gaia passbands from ESA/Gaia website)
# Using YBC version of bolometric corrections as in Chen et al. (2019)
# O-rich circumstellar dpmod60alox40 dust from Groenewegen (2006)
# C-rich circumstellar AMCSIC15 dust from Groenewegen (2006)
# IMF: Kroupa (2001, 2002) + Kroupa et al. (2013) canonical two-part-power law IMF corrected for unresolved binaries
# Kind of output: isochrone tables
```

Useful system parameters

Filter	G	G_BP	G_RP
λ_{eff} (Å)	6422.01	5335.42	7739.17
ω_{eff} (Å)	3620	2060	2500
A_λ/A_V	0.86117	1.06126	0.64753

These values are for a G2V star, using Cardelli et al. (1989) + O'Donnell (1994) extinction curve with Rv=3.1.

Back to input form

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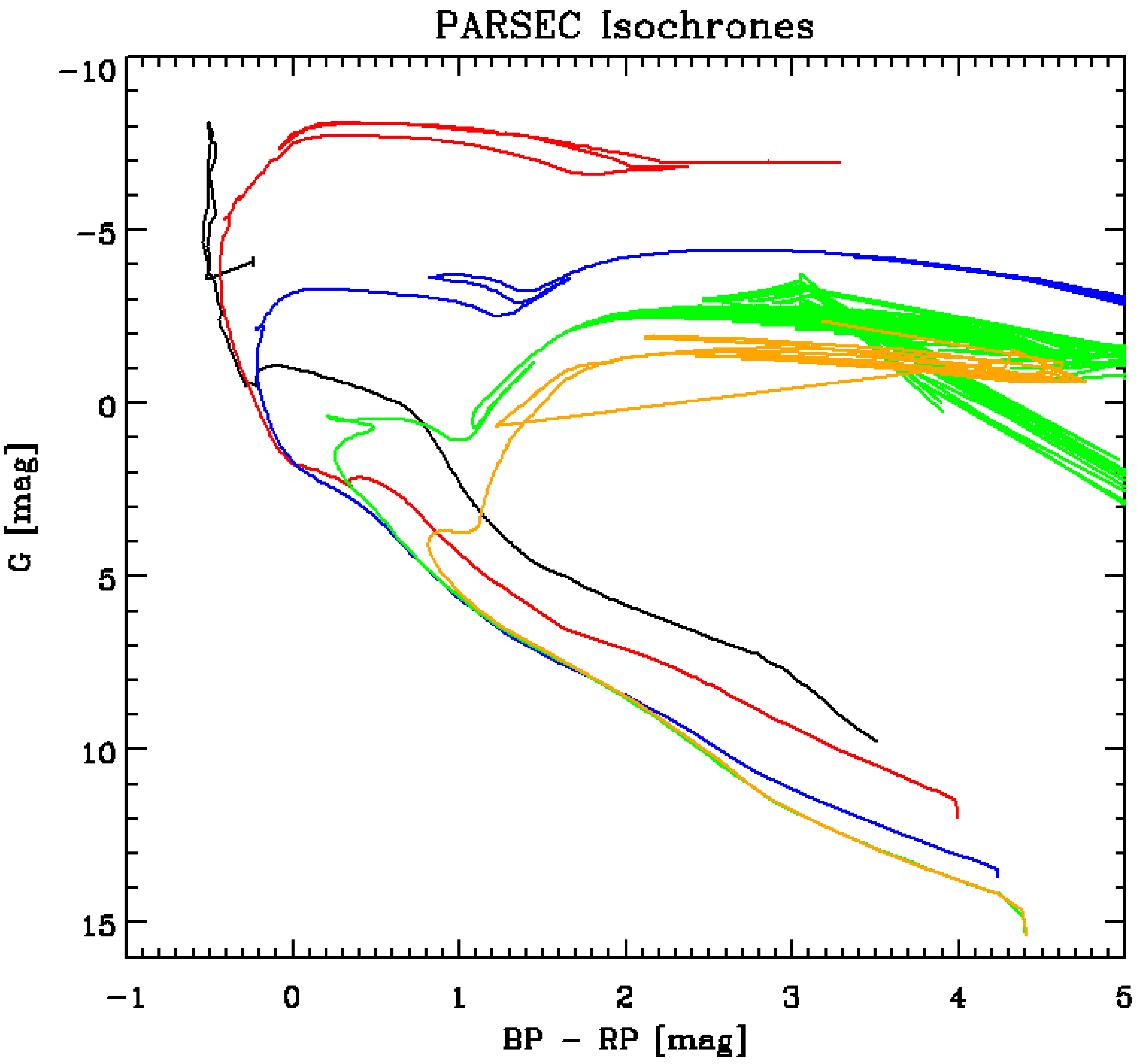
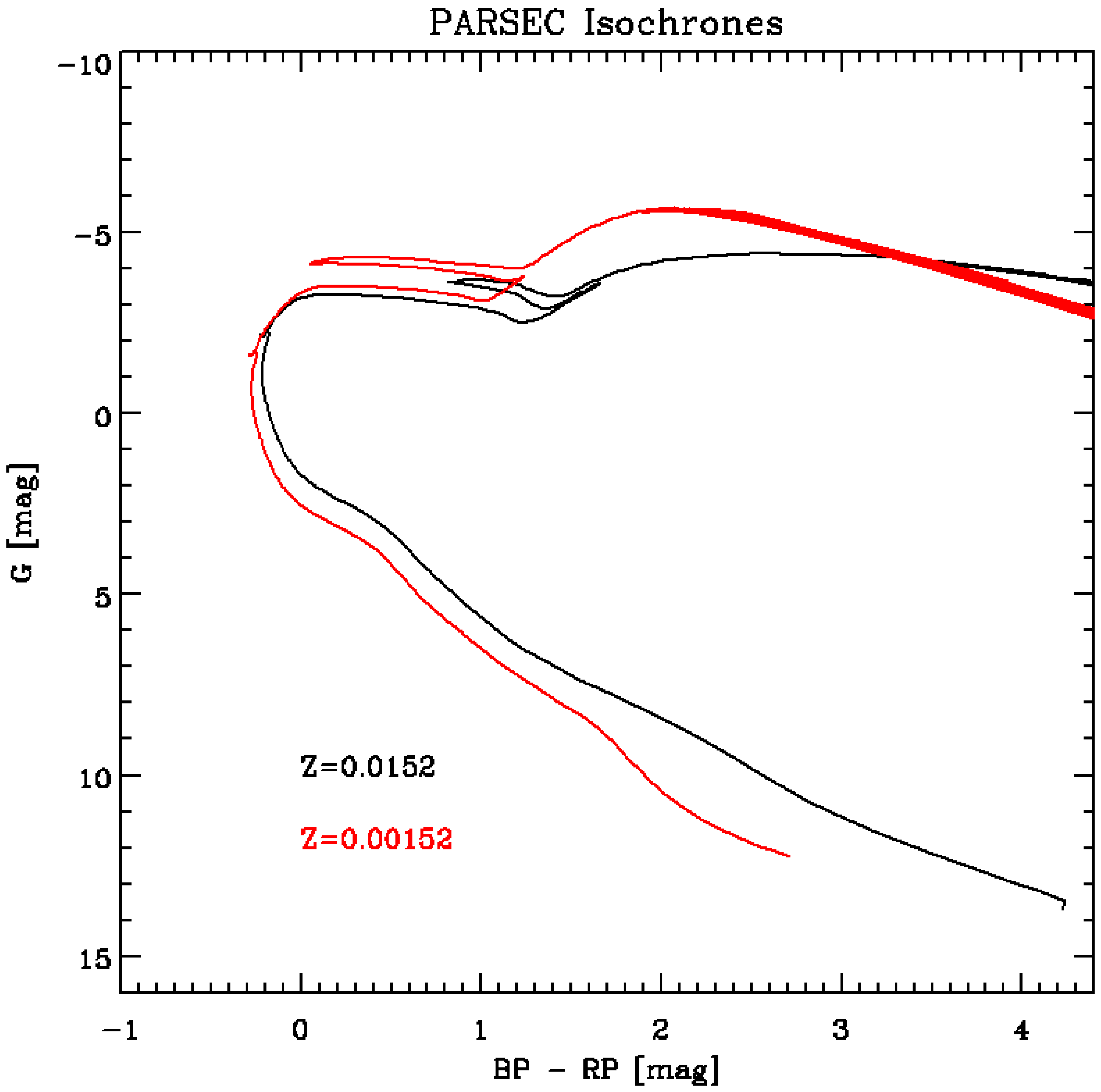

PARSEC Isochrones
G [mag]
BP − RP [mag]
−10
−5
0
5
10
15
−1
0
1
2
3
4
5


PARSEC Isochrones
-10
-5
0
5
10
15
-1
0
1
2
3
4
G [mag]
BP − RP [mag]
Z=0.0152
Z=0.00152

「金屬豐度低」
→ 較熱、較亮

以M67為例

- 什麼樣的天體
- 在天空何處（赤經、赤緯；銀經、銀緯）；何時適合觀看
- 距離
- 大小（角度、實際長度）
- 年齡
- 多少成員星
- 豐度
- 怎麼運動（看起來、實際）
- 多少比例是雙星、是變星周圍有行星
- 有哪些X射線源、紅外源
- 是否有共存的分子雲

- https://www.astro.ncu.edu.tw/~wchen//Data/HiTeachers2021/m67twomassDR3_30min.csv
- https://www.astro.ncu.edu.tw/~wchen//Data/HiTeachers2021/taurus2massDR3_30min.csv

To Identify Members in a Star Cluster

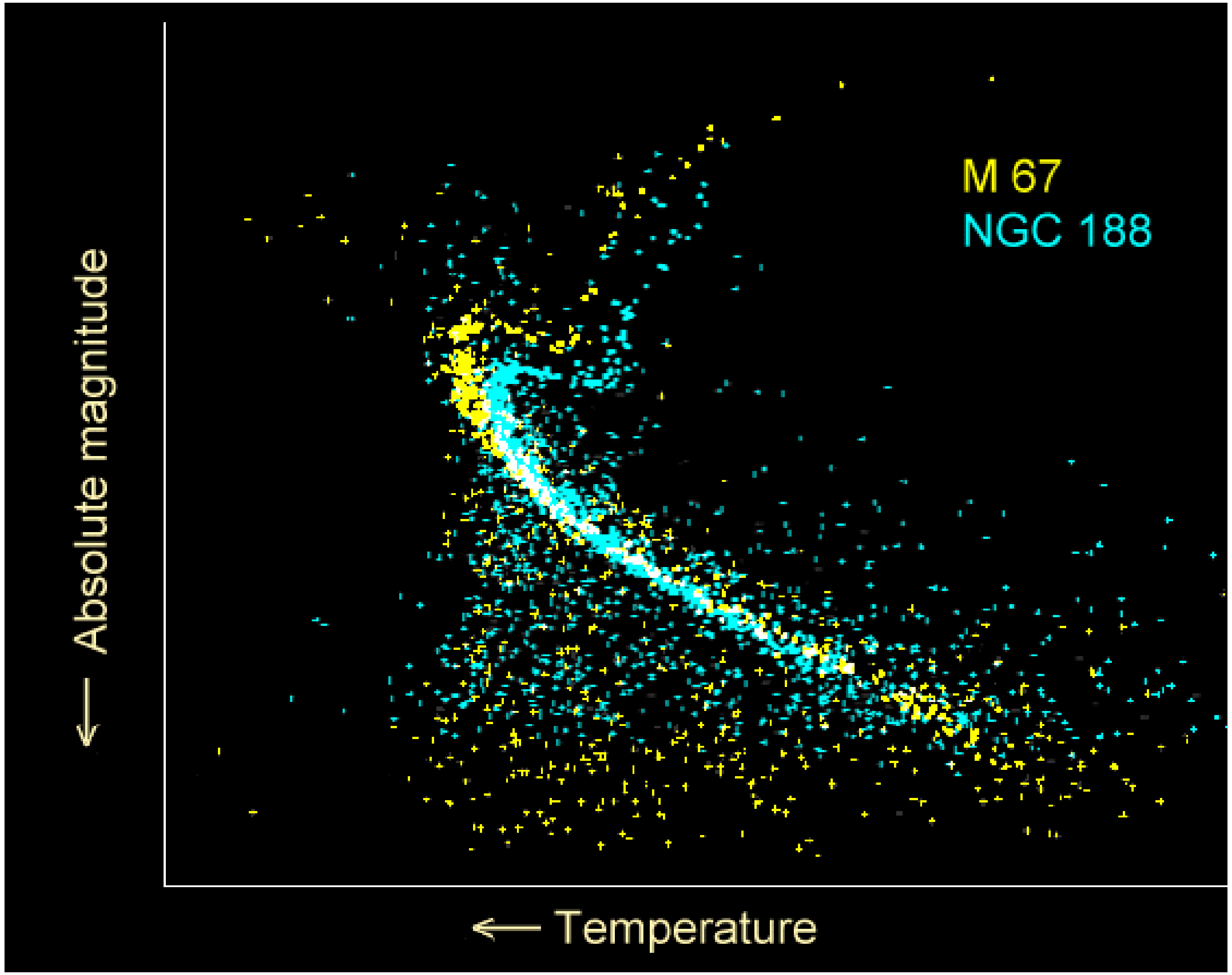
Member stars are grouped in at least 6-dimensional space, 3 in location (position and distance) and 3 in motion (proper motion and radial velocity) (and in metalicity, etc.)

➔ To secure the member list, find

- grouping in space (sky coordinates + distance)
- grouping of proper motions (and radial velocity)
- grouping along the main sequence/isochrone (CMD)

Members: similar in positions and in space motions …

A Case Study M67 an OC ~4 Gyr old (i.e., solar age), [Fe/H] = −0.1, distance 800 to 900 pc, an apparent angular diameter > 30’



2 old OCs

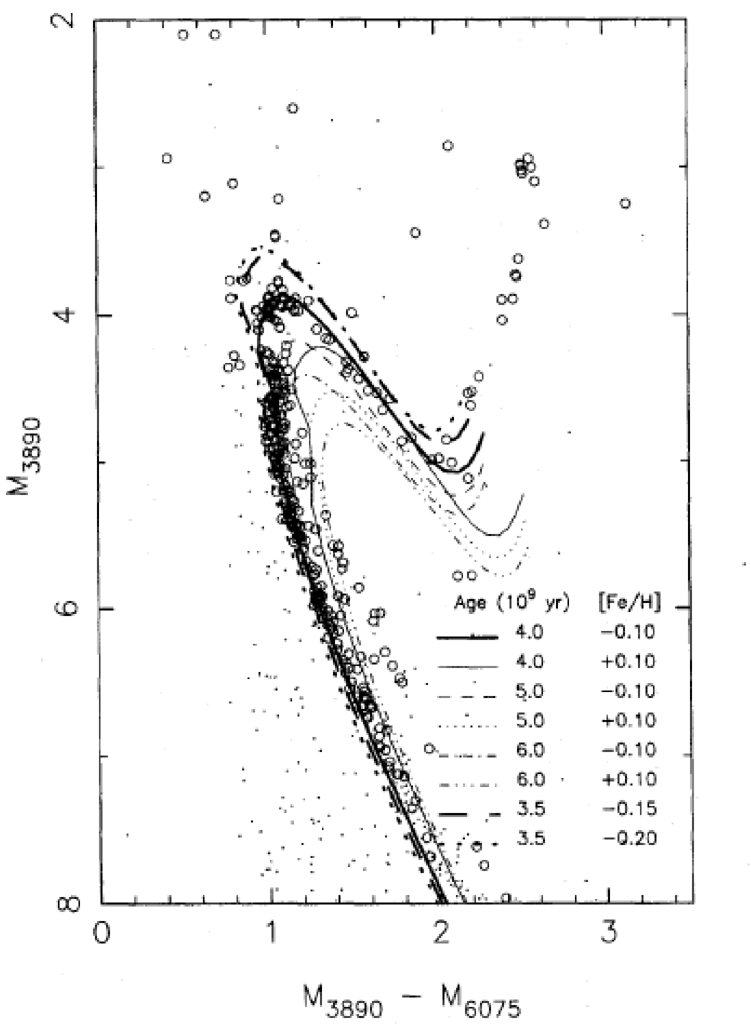


FIG. 10. Worthey-VandenBerg-Kurucz isochrone models fit to the observed $(m_{3890}-m_{6075})$ vs m_{3890} CMD. $(m-M)_0=9.47$ and $E(B-V)=0.05$ are assumed; see text for details. The values of age and [Fe/H] of each isochrone are shown in the graphs. Data for stars with known membership probabilities $\geqslant 80\%$ are plotted as open circles; all other stars are plotted as dots.

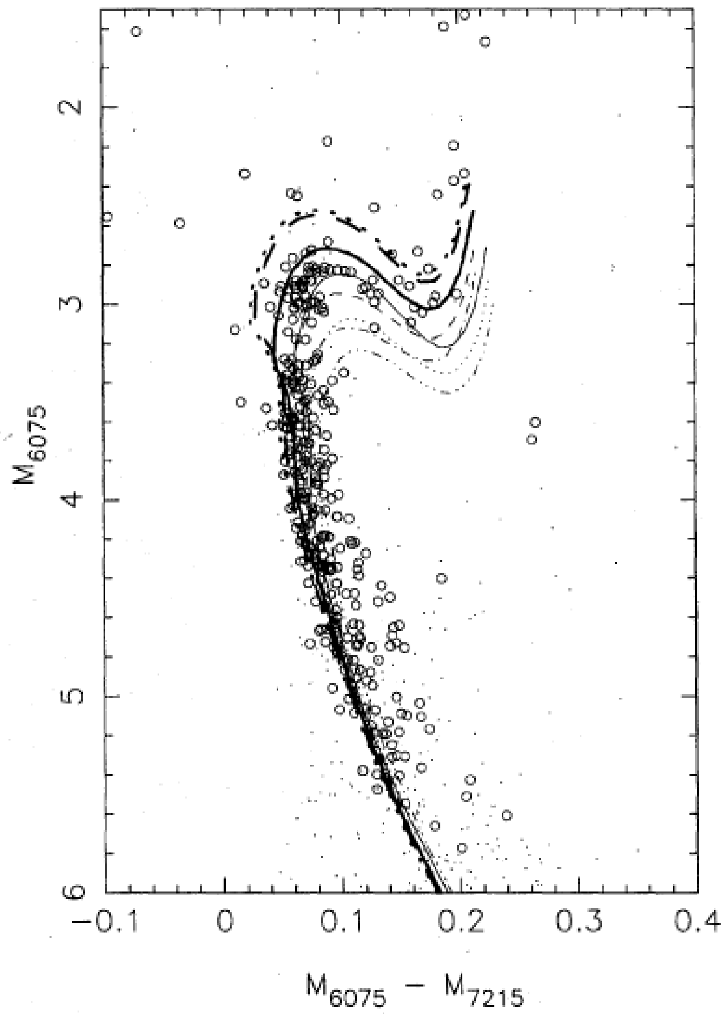
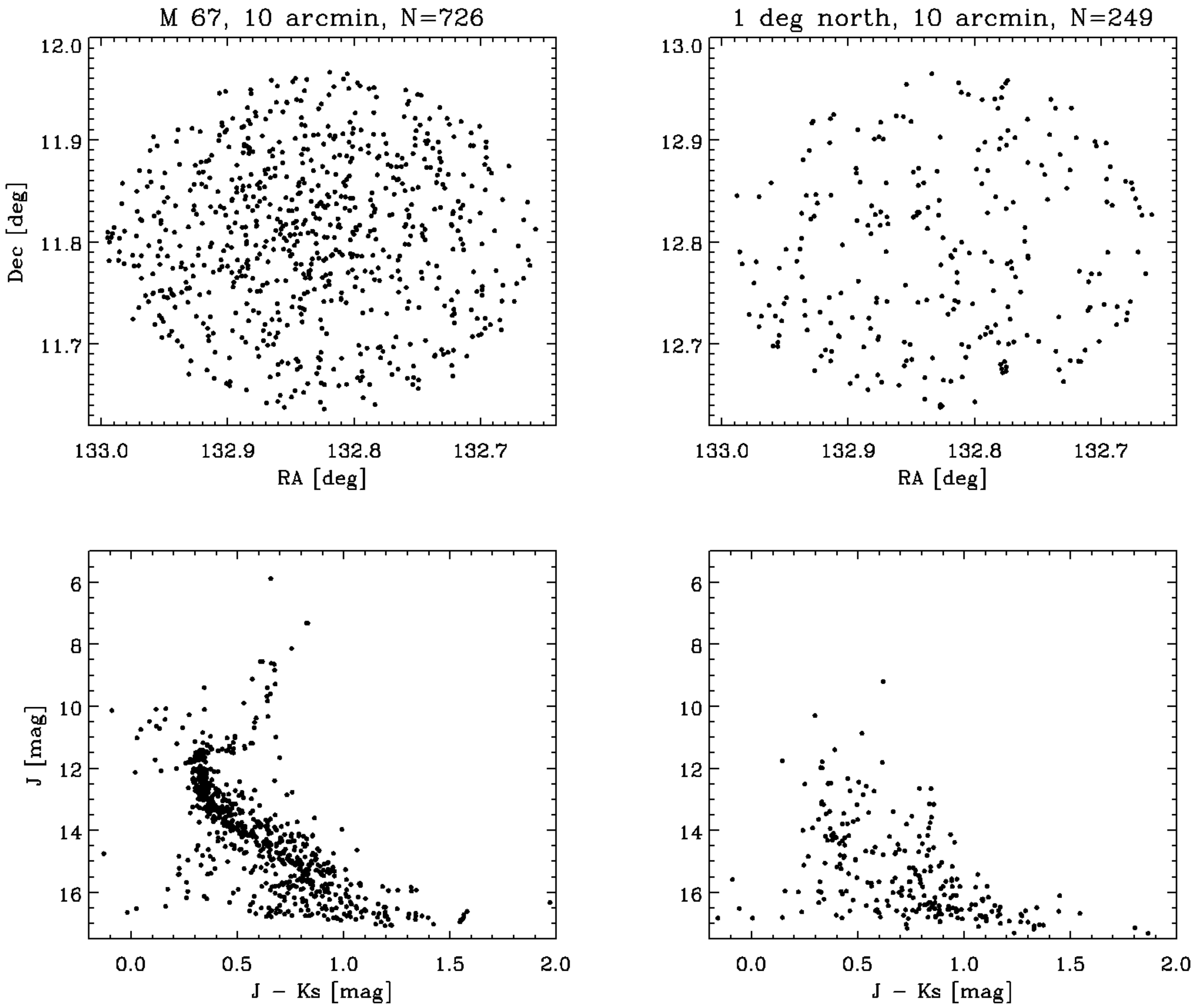


FIG. 11. Worthey-VandenBerg-Kurucz isochrone models fit to the observed $(m_{6075}-m_{7215})$ vs m_{6075} CMD. Same models, distance modulus and [Fe/H] as for Fig. 10.

Fan+96 BATC

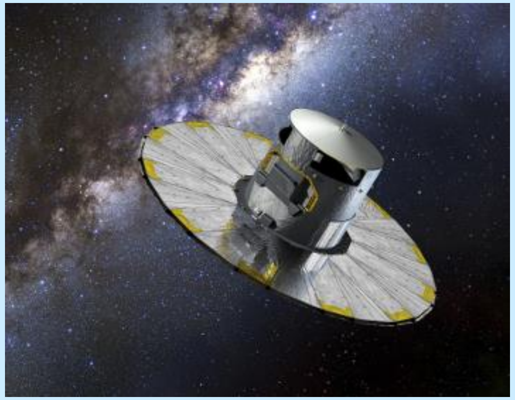
Two Micron All Sky Survey (2MASS) data

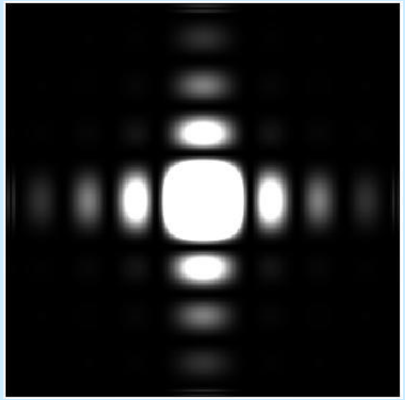
M67 field vs a Galactic field



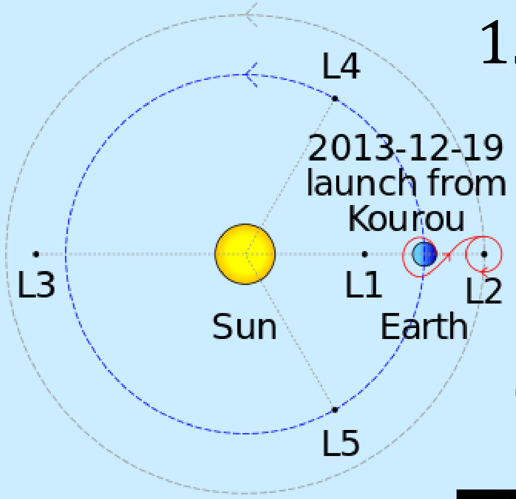
Gaia (Space Telescope)

- ✓ 2013 to 2022? by ESA
- ✓ High-precision astrometry (position) → distance + motion → 3D map of MW and beyond; quasars, exoplanets
- ✓ < 20 mag (1% MW)
- ✓ *G*, *BP*, *RP* photometry + spectroscopy → $L, T_{\rm eff}, g, [M/H]$, and RV
- ✓ Latest DR2 in 2018

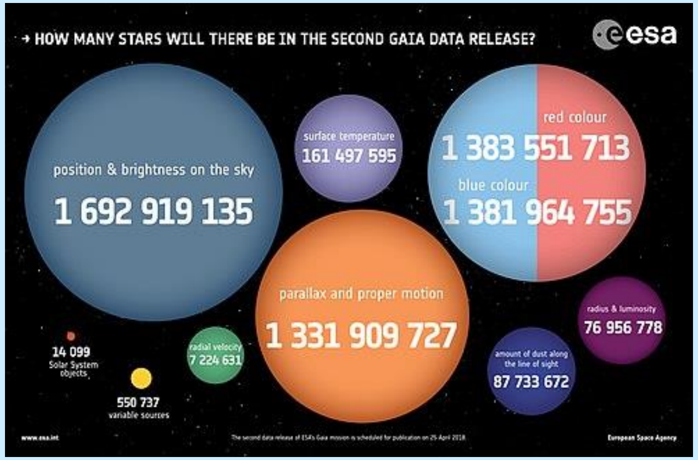




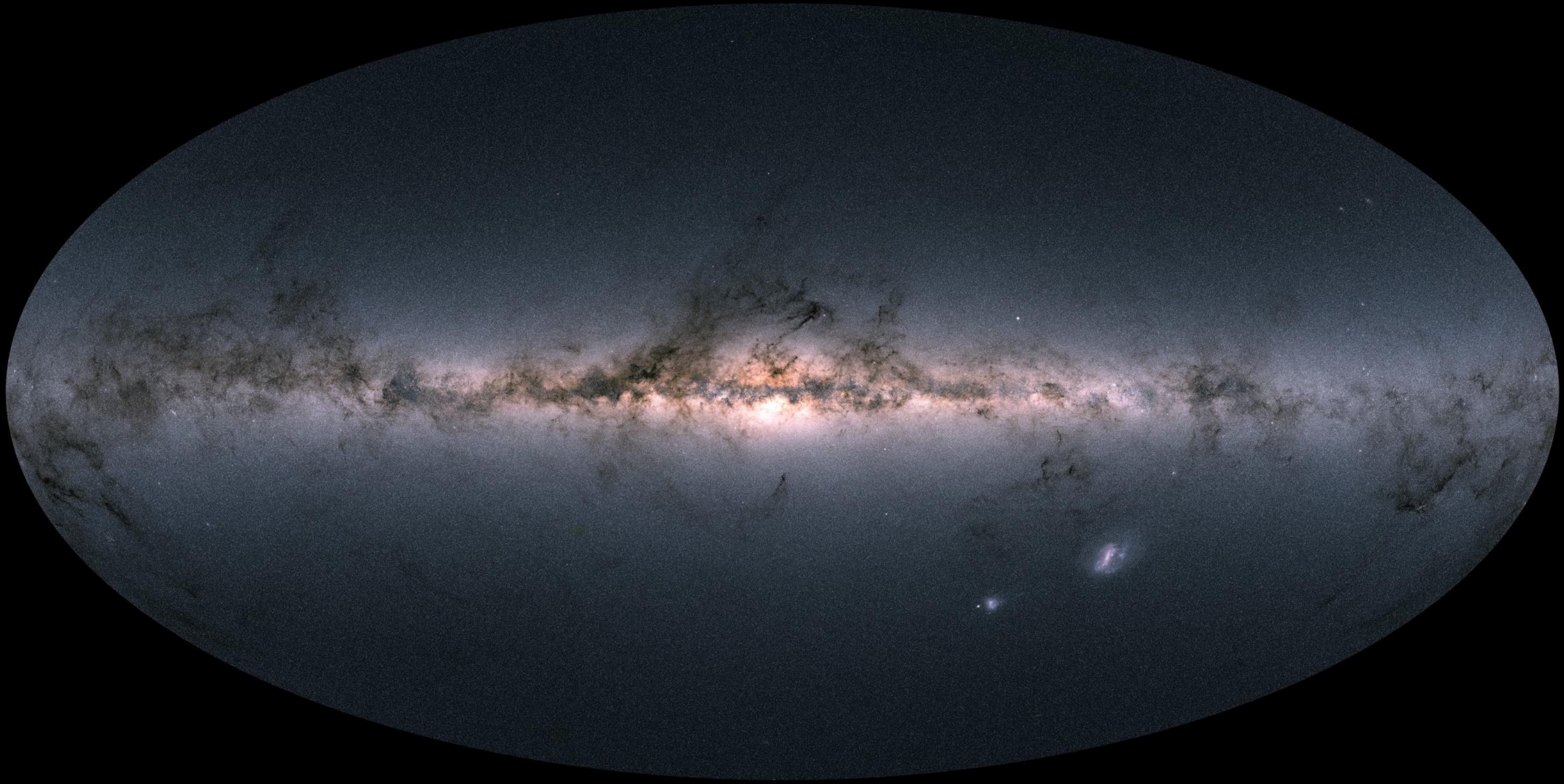
1.45 m × 0.5 m primary



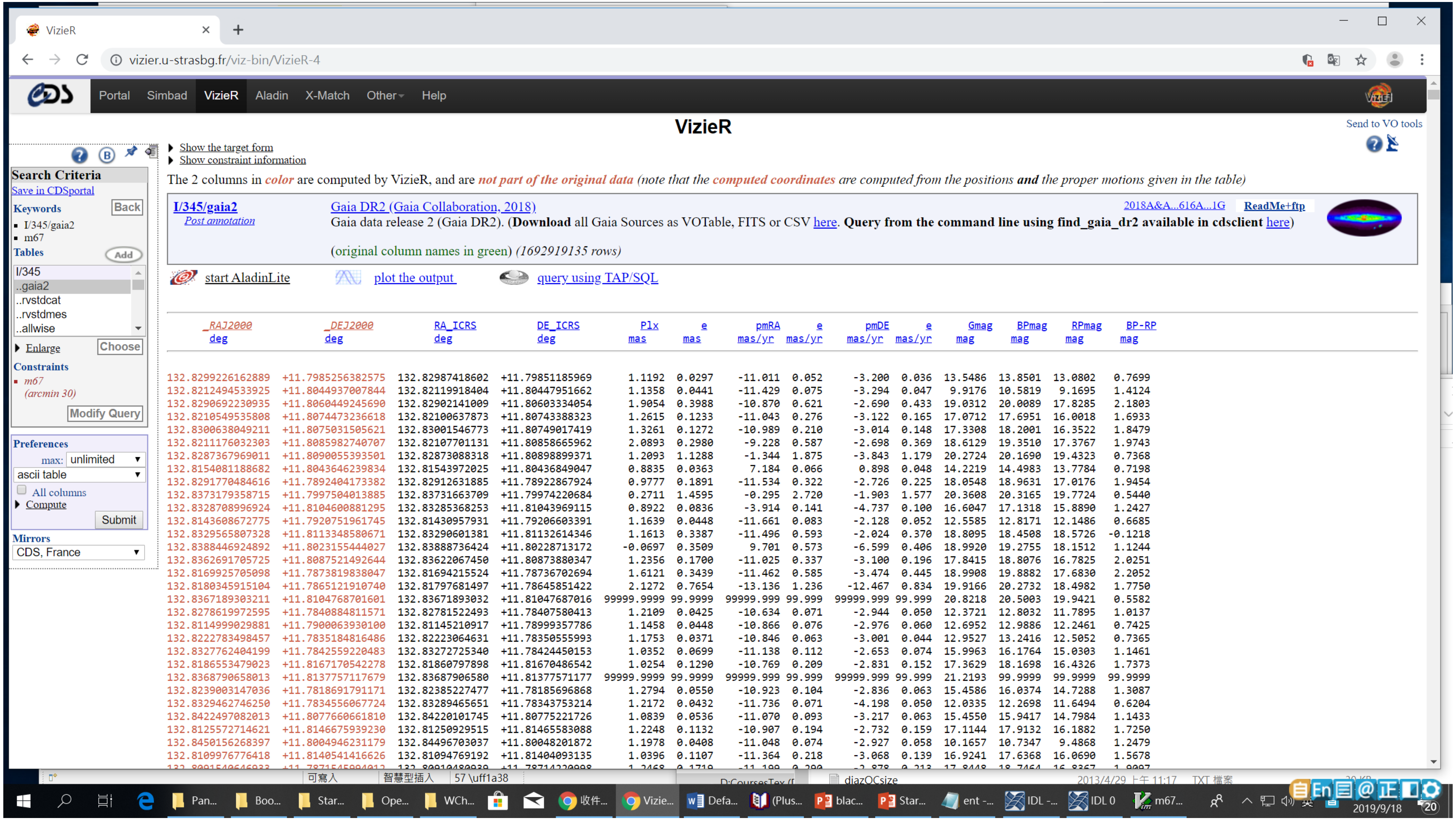
Orbit @Sun-Earth L2



Gaia's Sky in Color



Gaia data vizier and the cross-match tool



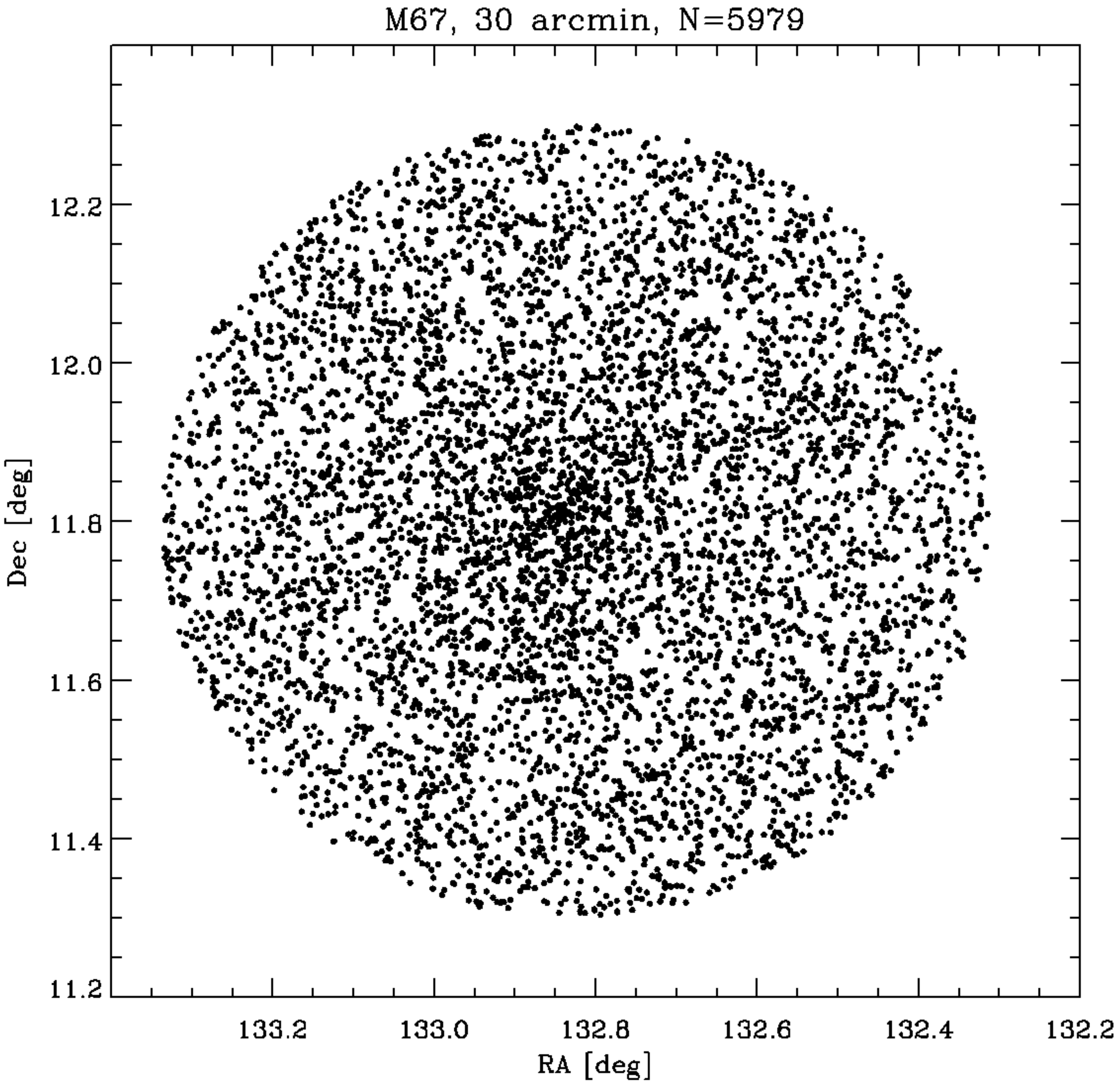
_RAJ2000 deg	_DEJ2000 deg	RA_ICRS deg	DE_ICRS deg	Plx mas	e mas	pmRA mas/yr	e mas/yr	pmDE mas/yr	e mas/yr	Gmag mag	BPmag mag	RPmag mag	BP-RP mag
132.8299226162889	+11.7985256382575	132.82987418602	+11.79851185969	1.1192	0.0297	-11.011	0.052	-3.200	0.036	13.5486	13.8501	13.0802	0.7699
132.8212494533925	+11.8044937007844	132.82119918404	+11.80447951662	1.1358	0.0441	-11.429	0.075	-3.294	0.047	9.9176	10.5819	9.1695	1.4124
132.8290692230935	+11.8060449245690	132.82902141009	+11.80603334054	1.9054	0.3988	-10.870	0.621	-2.690	0.433	19.0312	20.0089	17.8285	2.1803
132.8210549535808	+11.8074473236618	132.82100637873	+11.80743388323	1.2615	0.1233	-11.043	0.276	-3.122	0.165	17.0712	17.6951	16.0018	1.6933
132.8300638049211	+11.8075031505621	132.83001546773	+11.80749017419	1.3261	0.1272	-10.989	0.210	-3.014	0.148	17.3308	18.2001	16.3522	1.8479
132.8211176032303	+11.8085982740707	132.82107701131	+11.80858665962	2.0893	0.2980	-9.228	0.587	-2.698	0.369	18.6129	19.3510	17.3767	1.9743
132.8287367969011	+11.8090055393501	132.82873088318	+11.80898899371	1.2093	1.1288	-1.344	1.875	-3.843	1.179	20.2724	20.1690	19.4323	0.7368
132.8154081188682	+11.8043646239834	132.81543972025	+11.80436849047	0.8835	0.0363	7.184	0.066	0.898	0.048	14.2219	14.4983	13.7784	0.7198
132.8291770484616	+11.7892404173382	132.82912631885	+11.78922867924	0.9777	0.1891	-11.534	0.322	-2.726	0.225	18.0548	18.9631	17.0176	1.9454
132.8373179358715	+11.7997504013885	132.83731663709	+11.79974220684	0.2711	1.4595	-0.295	2.720	-1.903	1.577	20.3608	20.3165	19.7724	0.5440
132.8328708996924	+11.8104600881295	132.83285368253	+11.81043969115	0.8922	0.0836	-3.914	0.141	-4.737	0.100	16.6047	17.1318	15.8890	1.2427
132.8143608672775	+11.7920751961745	132.81430957931	+11.79206603391	1.1639	0.0448	-11.661	0.083	-2.128	0.052	12.5585	12.8171	12.1486	0.6685
132.8329565807328	+11.8113348580671	132.83290601381	+11.81132614346	1.1613	0.3387	-11.496	0.593	-2.024	0.370	18.8095	18.4508	18.5726	-0.1218
132.8388446924892	+11.8023155444027	132.83888736424	+11.80228713172	-0.0697	0.3509	9.701	0.573	-6.599	0.406	18.9920	19.2755	18.1512	1.1244
132.8362691705725	+11.8087521492644	132.83622067450	+11.80873880347	1.2356	0.1700	-11.025	0.337	-3.100	0.196	17.8415	18.8076	16.7825	2.0251
132.8169925705098	+11.7873819838047	132.81694215524	+11.78736702694	1.6121	0.3439	-11.462	0.585	-3.474	0.445	18.9908	19.8882	17.6830	2.2052
132.8180345915104	+11.7865121910740	132.81797681497	+11.78645851422	2.1272	0.7654	-13.136	1.236	-12.467	0.834	19.9166	20.2732	18.4982	1.7750
132.8367189303211	+11.8104768701601	132.83671893032	+11.81047687016	99999.9999	99.9999	99999.999	99.999	99999.999	99.999	20.8218	20.5003	19.9421	0.5582
132.8278619972595	+11.7840884811571	132.82781522493	+11.78407580413	1.2109	0.0425	-10.634	0.071	-2.944	0.050	12.3721	12.8032	11.7895	1.0137
132.8114999029881	+11.7900063930100	132.81145210917	+11.78999357786	1.1458	0.0448	-10.866	0.076	-2.976	0.060	12.6952	12.9886	12.2461	0.7425
132.8222783498457	+11.7835184816486	132.82223064631	+11.78350555993	1.1753	0.0371	-10.846	0.063	-3.001	0.044	12.9527	13.2416	12.5052	0.7365
132.8327762404199	+11.7842559220483	132.83272725340	+11.78424450153	1.0352	0.0699	-11.138	0.112	-2.653	0.074	15.9963	16.1764	15.0303	1.1461
132.8186553479023	+11.8167170542278	132.81860797898	+11.81670486542	1.0254	0.1290	-10.769	0.209	-2.831	0.152	17.3629	18.1698	16.4326	1.7373
132.8368790658013	+11.8137757117679	132.83687906580	+11.81377571177	99999.9999	99.9999	99999.999	99.999	99999.999	99.999	21.2193	99.9999	99.9999	99.9999
132.8239003147036	+11.7818691791171	132.82385227477	+11.78185696868	1.2794	0.0550	-10.923	0.104	-2.836	0.063	15.4586	16.0374	14.7288	1.3087
132.8329462746250	+11.7834556067724	132.83289465651	+11.78343753214	1.2172	0.0432	-11.736	0.071	-4.198	0.050	12.0335	12.2698	11.6494	0.6204
132.8422497082013	+11.8077660661810	132.84220101745	+11.80775221726	1.0839	0.0536	-11.070	0.093	-3.217	0.063	15.4550	15.9417	14.7984	1.1433
132.8125572714621	+11.8146675939230	132.81250929515	+11.81465583088	1.2248	0.1132	-10.907	0.194	-2.732	0.159	17.1144	17.9132	16.1882	1.7250
132.8450156268397	+11.8004946231179	132.84496703037	+11.80048201872	1.1978	0.0408	-11.048	0.074	-2.927	0.058	10.1657	10.7347	9.4868	1.2479
132.8109976776418	+11.8140541416626	132.81094769192	+11.81404093135	1.0396	0.1107	-11.364	0.218	-3.068	0.139	16.9241	17.6368	16.0690	1.5678

Gaia positions

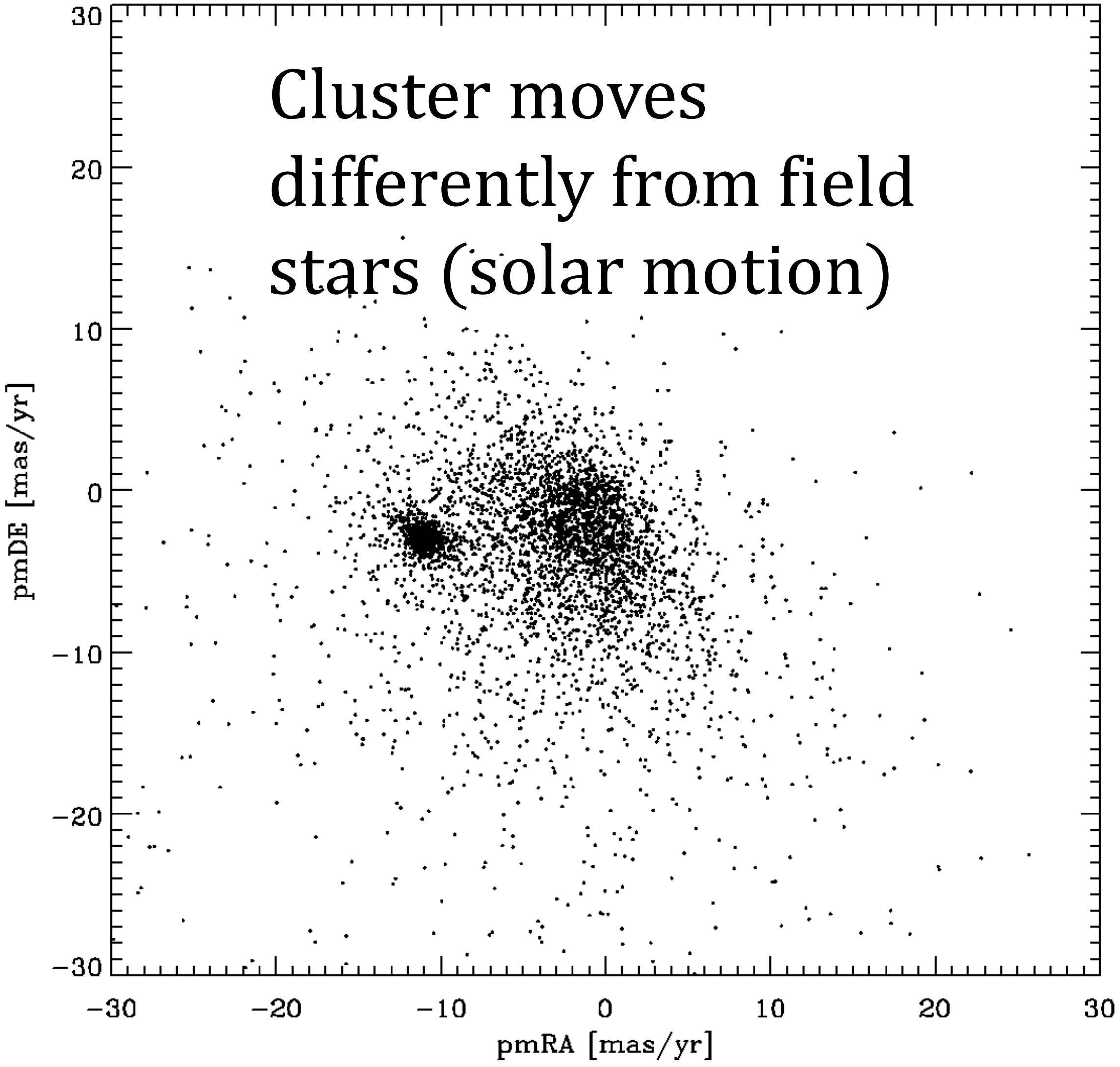
All stars within 1 deg field ...

Concentration at center (the cluster) obvious

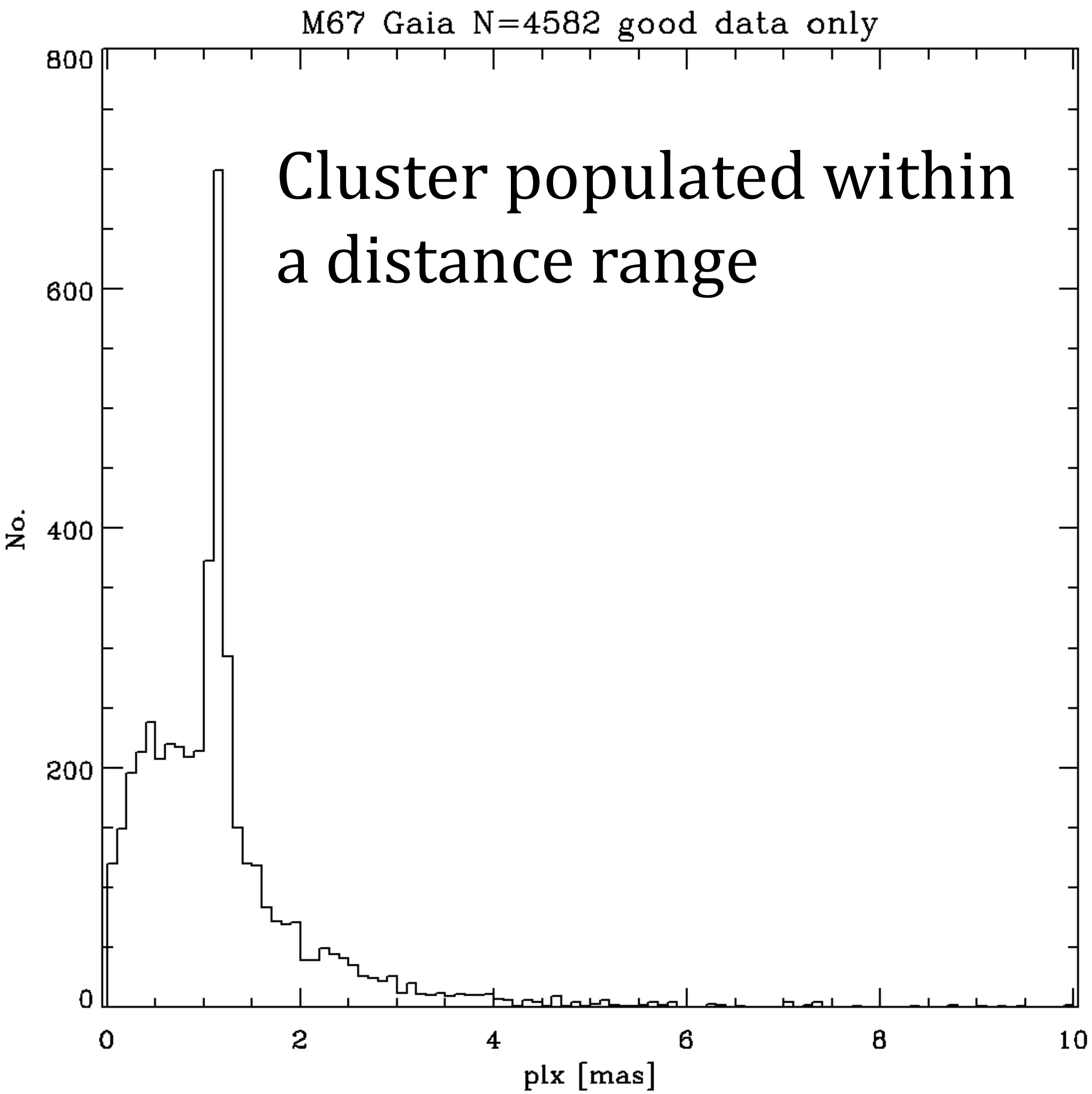
Extended shape?



Gaia proper motions

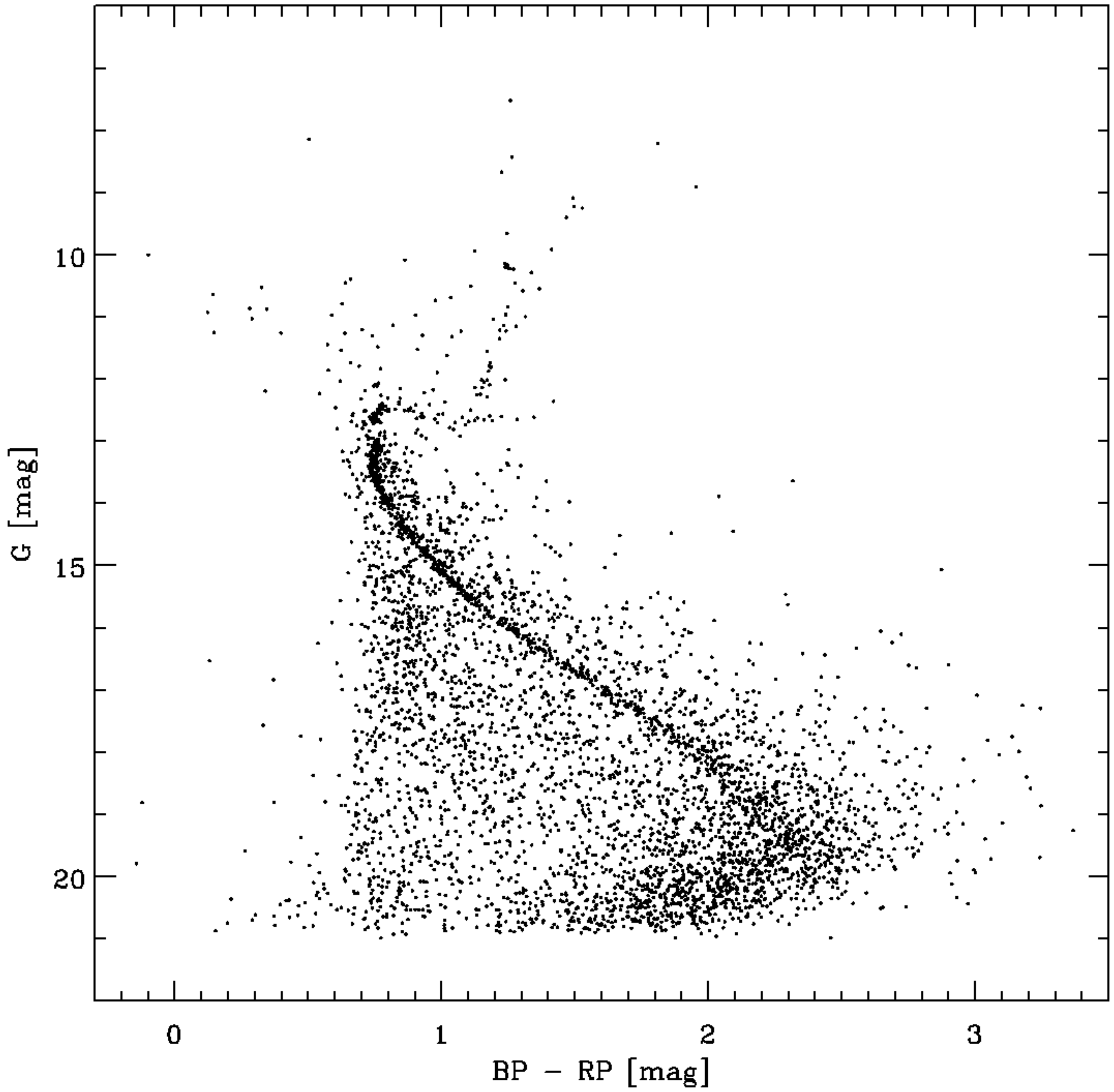


Gaia parallaxes



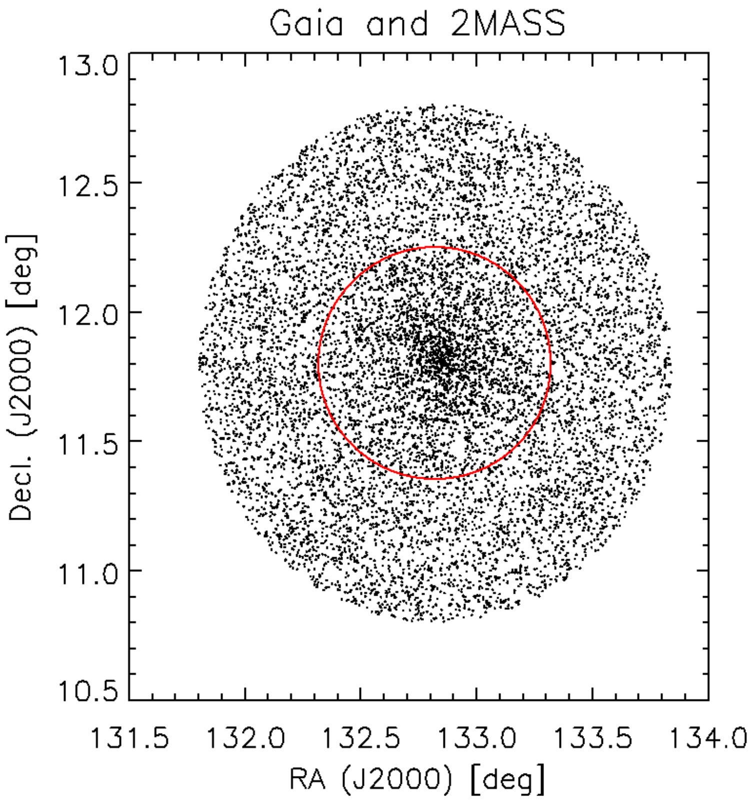
Gaia CMD

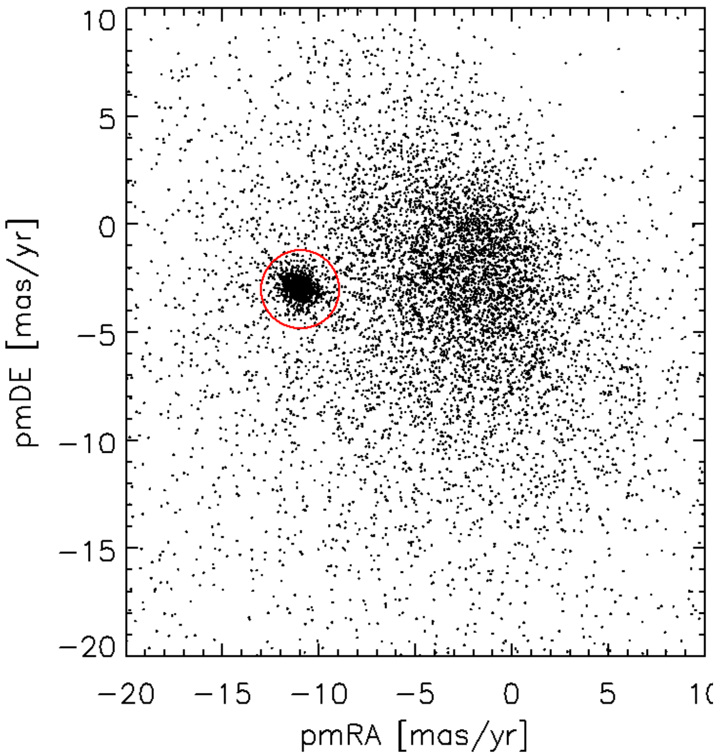
The cluster sequence stands out clearly in the CMD, though there are many contaminations, i.e., non-members.

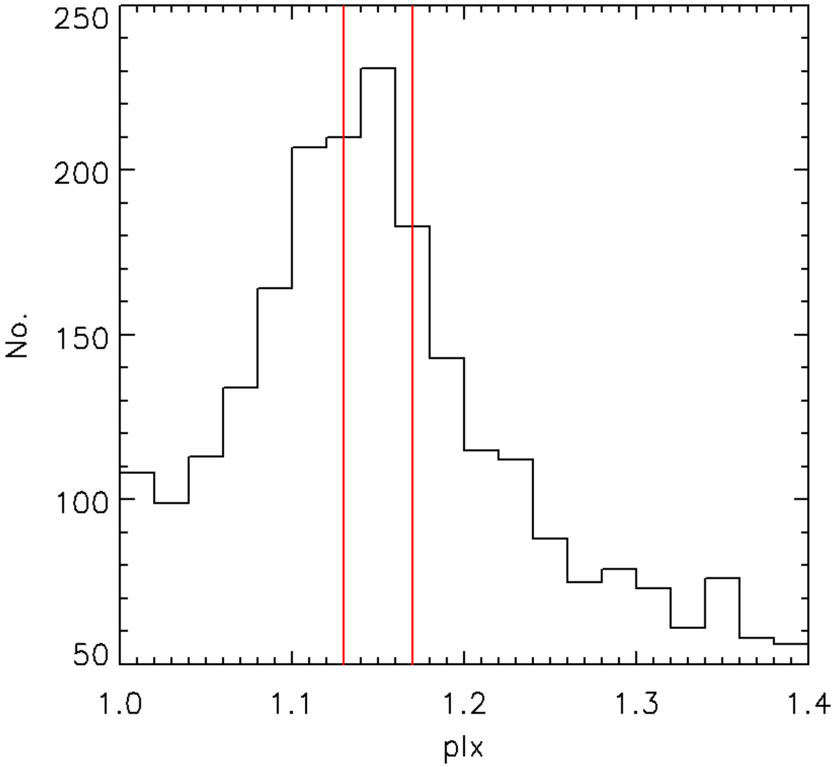


With some preliminary selection criteria in sky coordinates, proper motion, and parallax …

```
ok=WHERE( plx LT 10 and plx
GT 0 and plx LT 1.5 and plx
GT 0.5 and  ABS(pmra+12) LT
5 and ABS(pmde+4) LT 5 )
```



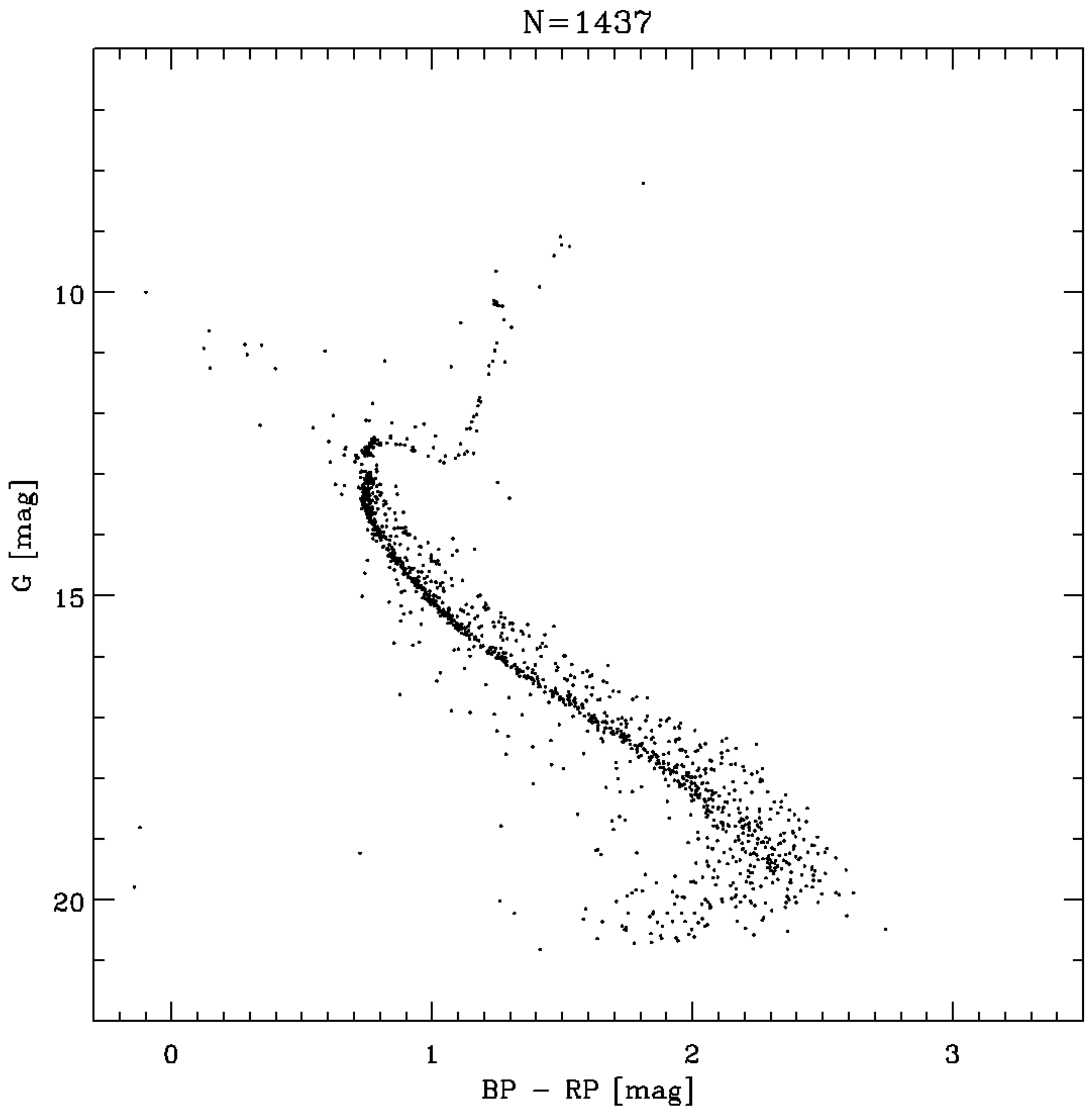


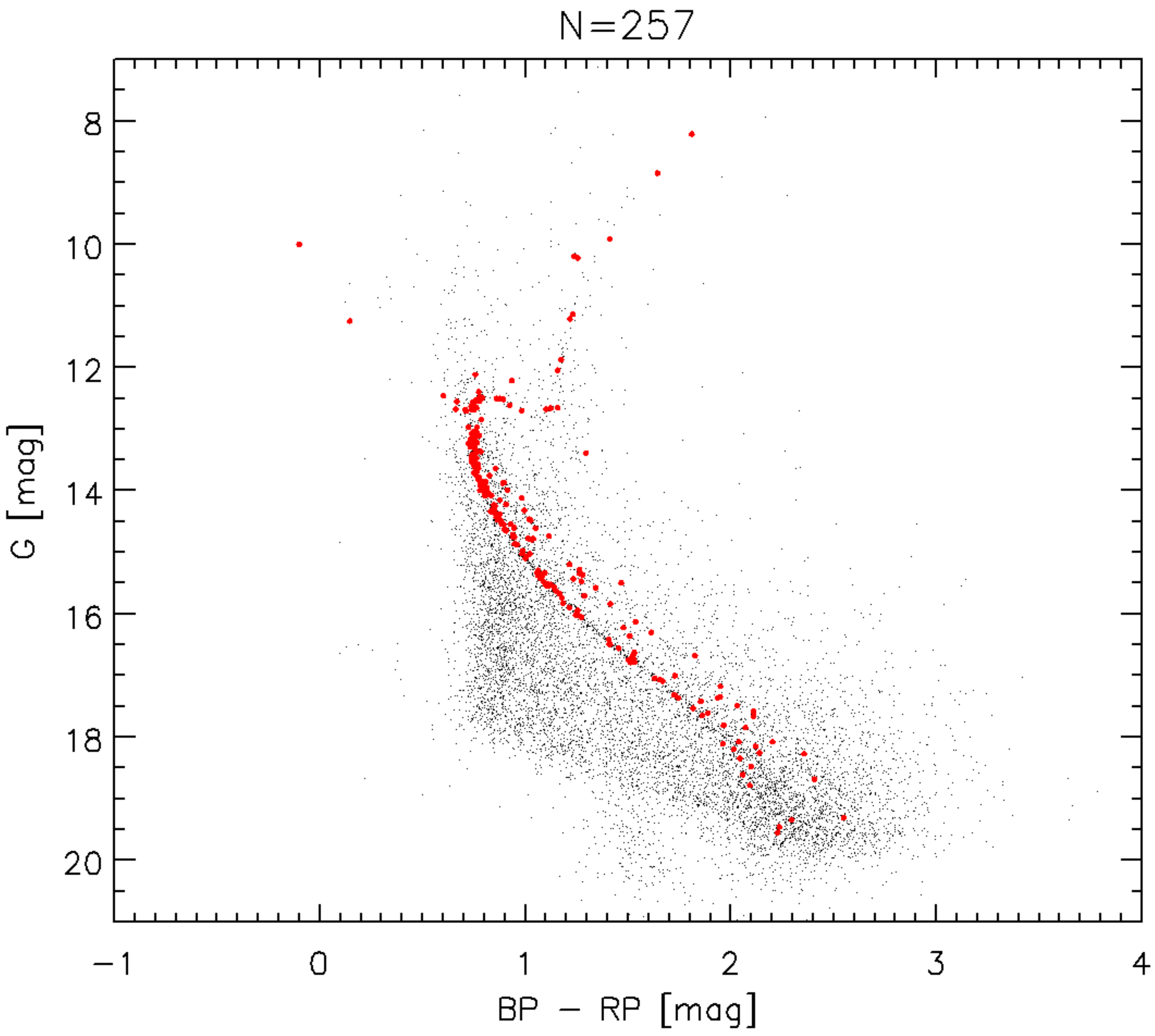


plx(max)=1.15 → d=870 pc

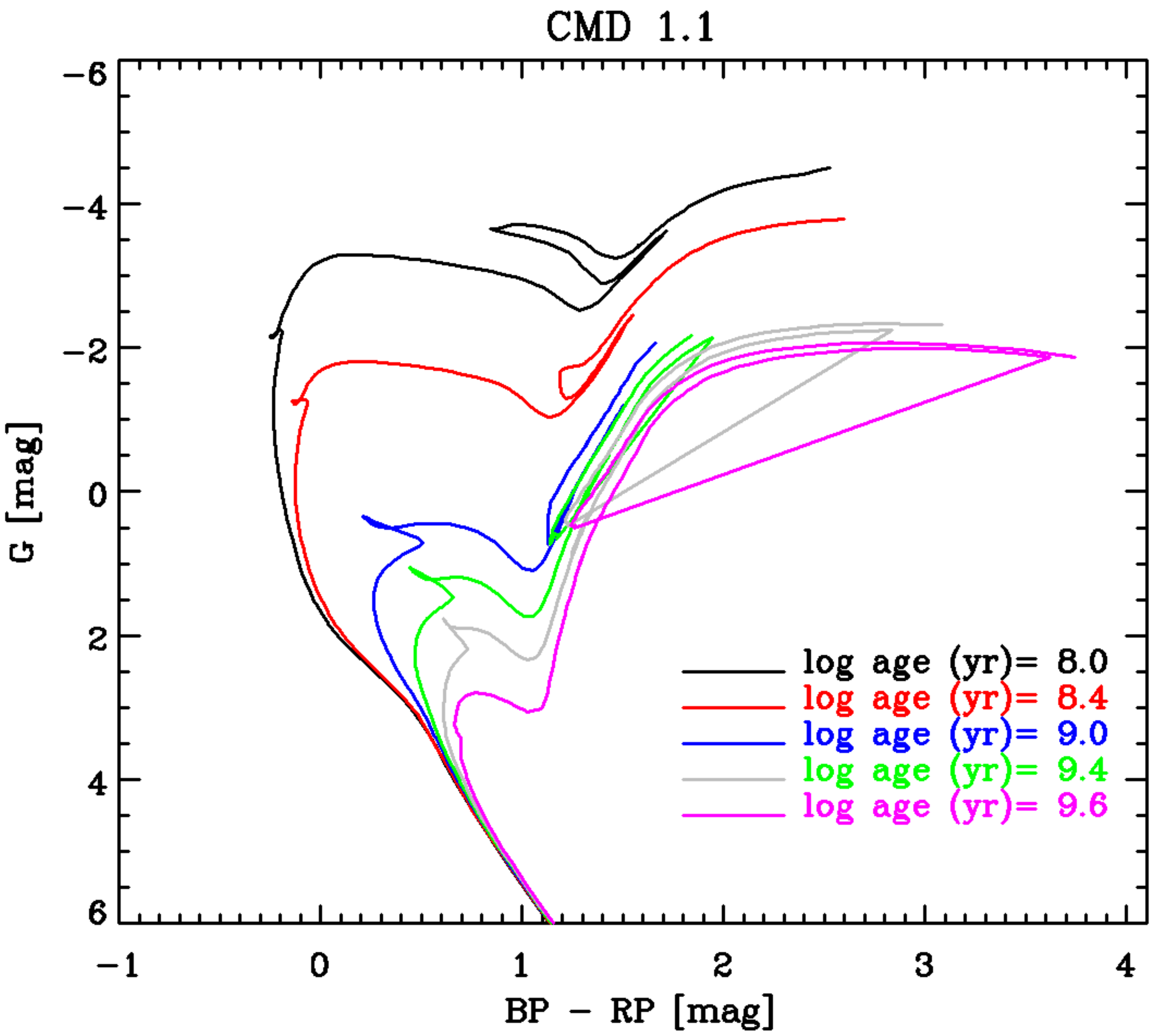
Iterative membership selection

- ✓ Age and distance
- ✓ Blue stragglers
- ✓ Red clump giants
- ✓ "Blue clump"?
- ✓ Binaries
- ✓ White dwarfs?
- ✓ Brown dwarfs?





N=257
G [mag]
BP − RP [mag]
8
10
12
14
16
18
20
−1
0
1
2
3
4



CMD 1.1
G [mag]
BP − RP [mag]
−6
−4
−2
0
2
4
6
−1
0
1
2
3
4
log age (yr)= 8.0
log age (yr)= 8.4
log age (yr)= 9.0
log age (yr)= 9.4
log age (yr)= 9.6

CTTSs characterized by infrared excess in the SEDs

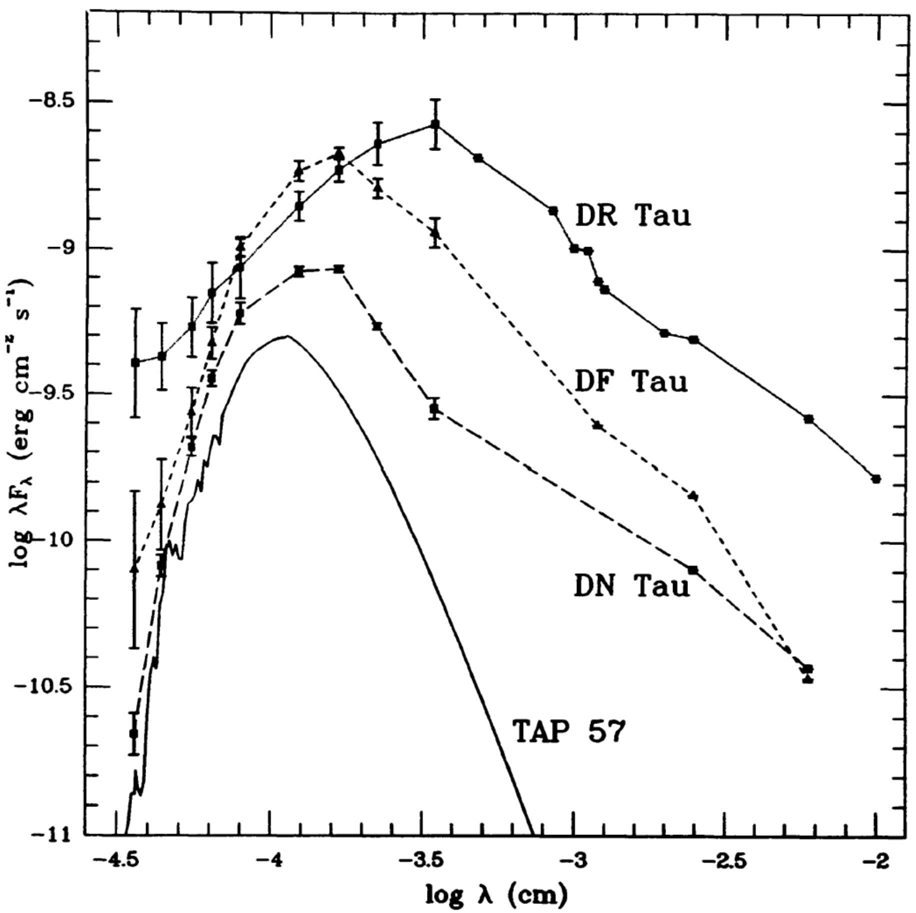


Figure 3 Observed spectral energy distributions from 3600 Å to 100 μm of the stars whose spectra are shown in Figure 2. The energy distribution of the K7V WTTS TAP 57, shown as a solid line, has been displaced downward by 0.3 dex. The filled symbols are simultaneous (for DN Tau and DF Tau) or averaged (for DR Tau) photometric data (cf. Bertout et al. 1988) supplemented by *IRAS* data (Rucinski 1985). When available, observed variability is indicated by error bars. When compared with WTTSs such as TAP 57, CTTSs display prominent ultraviolet and infrared excesses. Excess continuum flux and optical emission-line activity are often correlated.

… and also <u>UV excess</u>
→ spectral "veiling"

Bertout (1989)

利用「紅外超量」infrared excess 指認年輕恆星

- M67 方向 直徑30角分；星團區＝成員＋場星

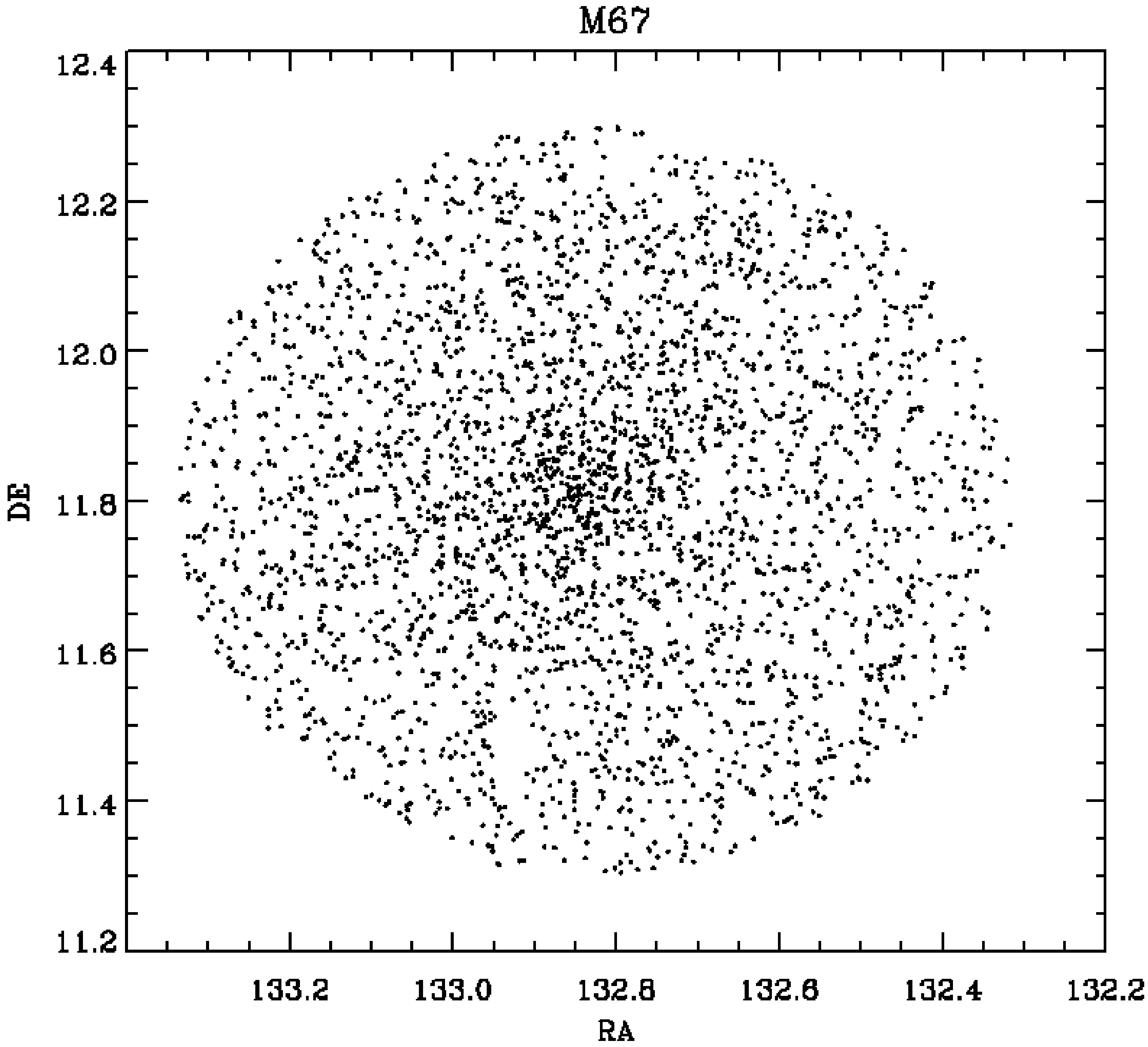
✓Gaia eDR3（選擇下載「需要」的參數）

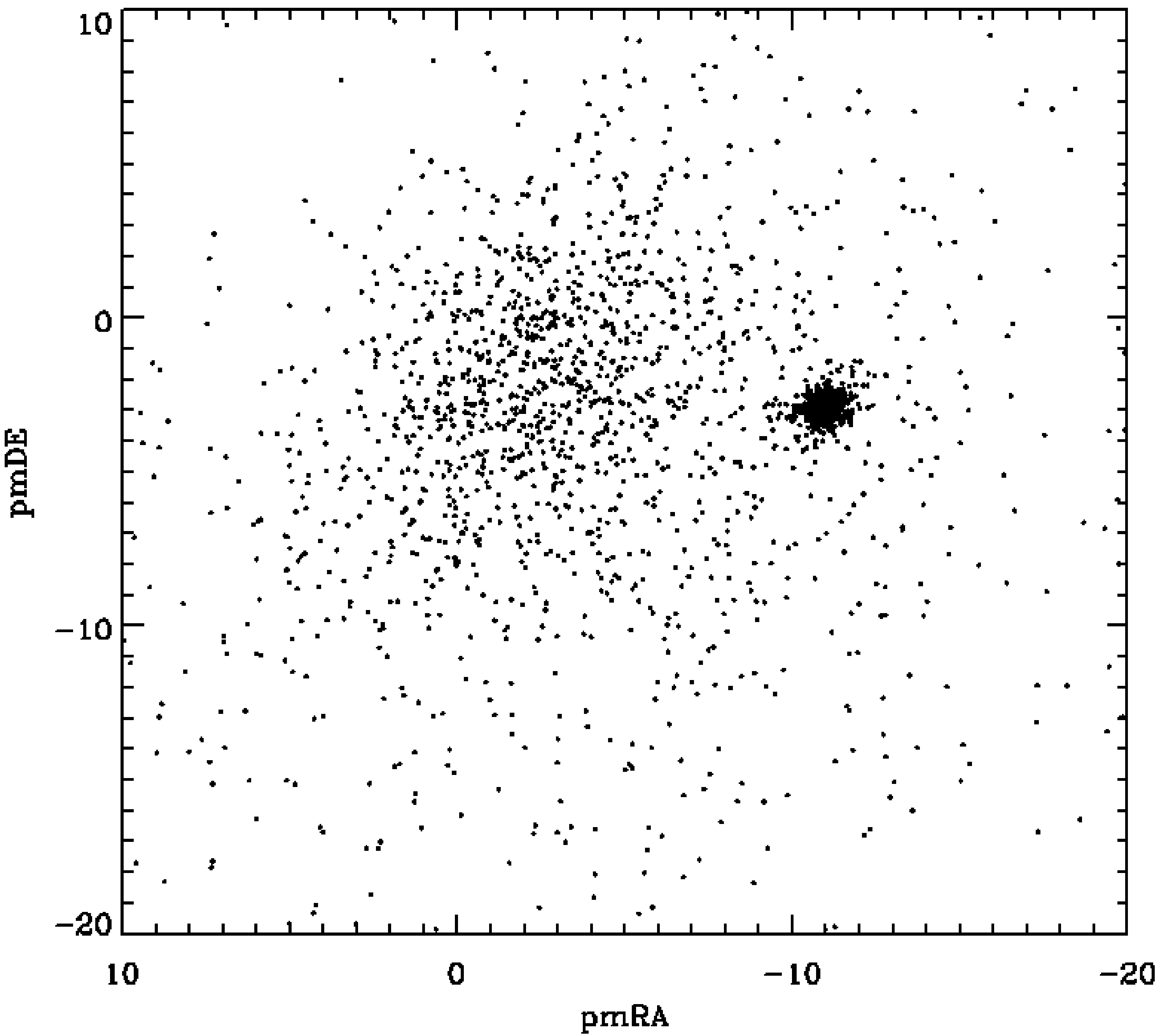
✓ 先少量，然後無限制、999 filled，可以下載道 CDSportal

✓2MASS data, 同樣天區

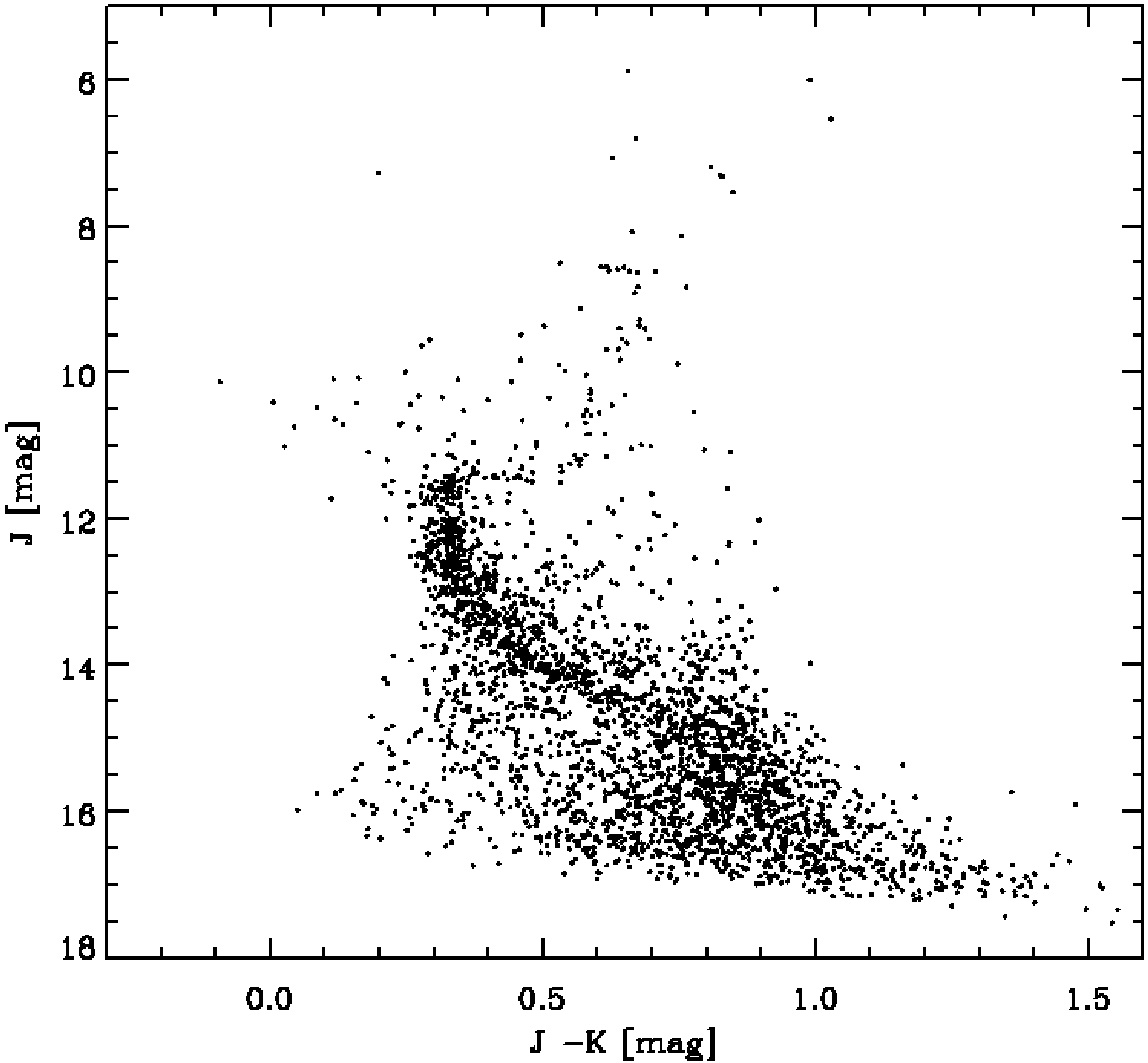
✓Cross-match 結合兩個目錄，也就是同樣一顆星有兩筆數據庫的資料

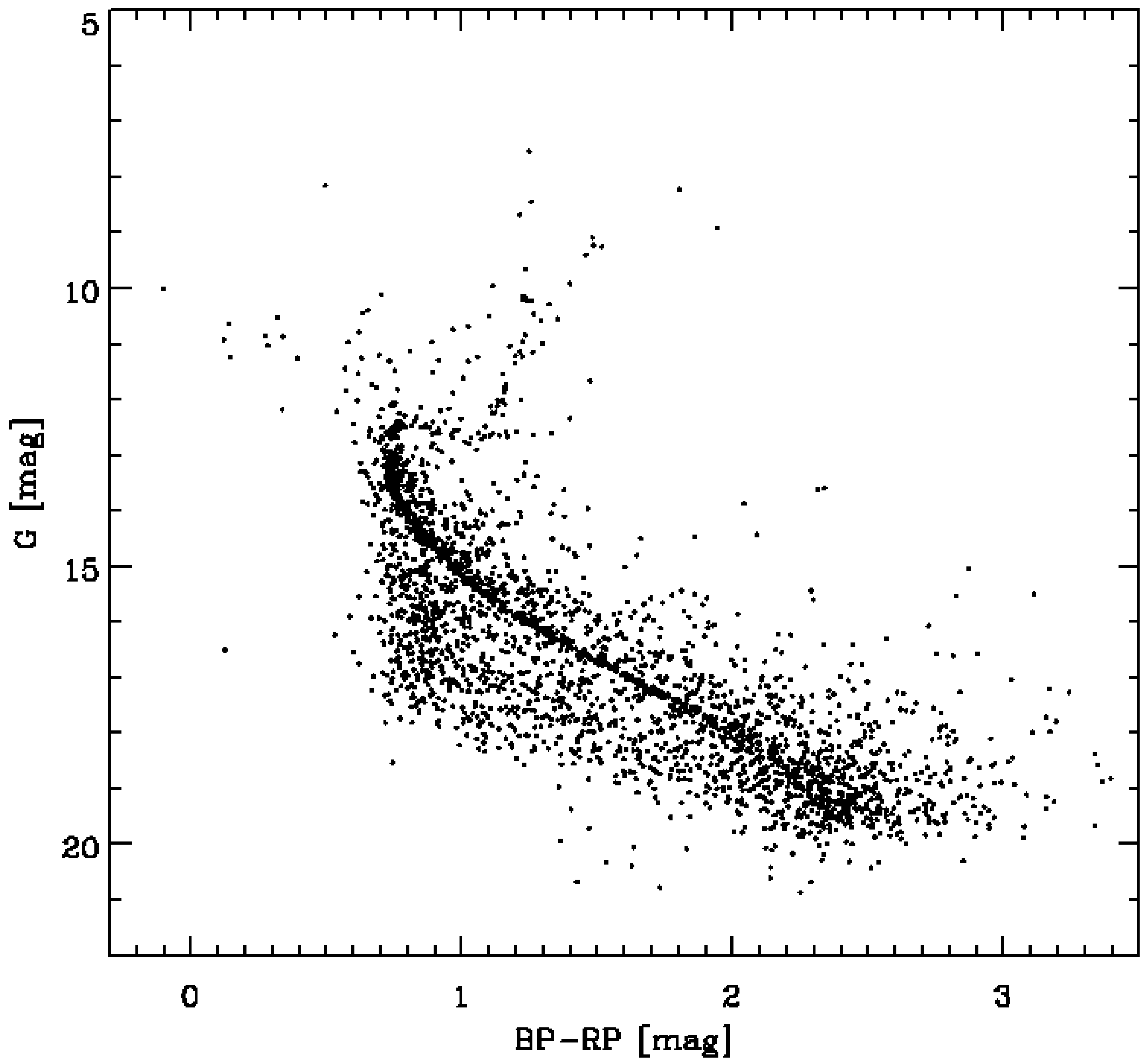
- Do the same for the Taurus cloud, and identify young stellar candidates.


M67
DE
RA
12.4
12.2
12.0
11.8
11.6
11.4
11.2
133.2
133.0
132.8
132.6
132.4
132.2



10
0
−10
−20
pmDE
10
0
−10
−20
pmRA


6
8
10
12
14
16
18
J [mag]
0.0
0.5
1.0
1.5
J −K [mag]



5
10
15
20
0
1
2
3
G [mag]
BP−RP [mag]