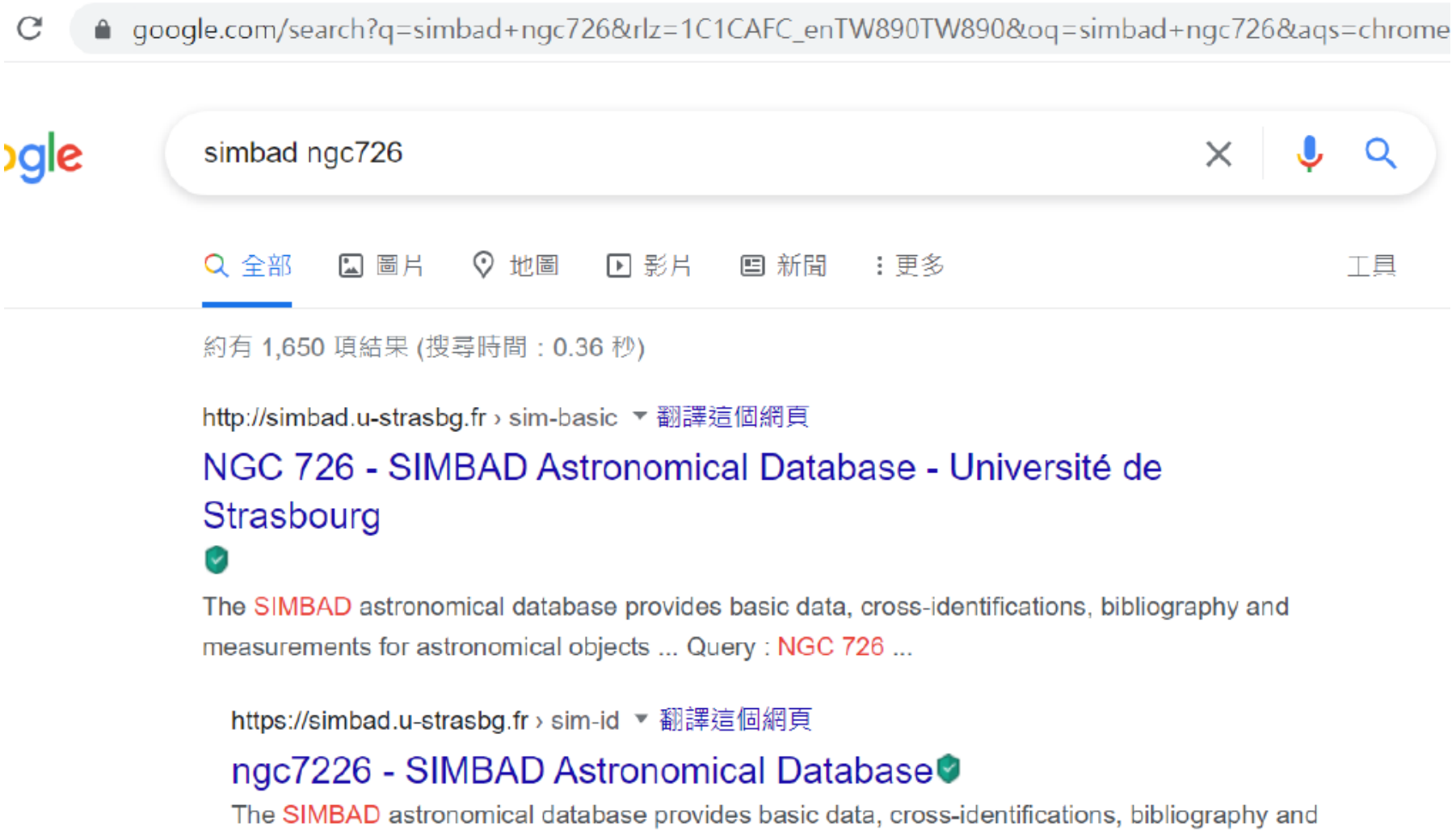
天文研究有用的工具

- SIMBAD/google/wikipedia 某天體的性質、找某類天體
- 影像 Images 庫 --- Digital Sky Survey (DSS)、PS1
  - ✓觀看影像（FITS; Flexible Image Transport System）：ds9
- 數據 Data 庫 --- Vizier https://vizier.u-strasbg.fr/
  - ✓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


google.com/search?q=simbad+ngc726&rlz=1C1CAFC_enTW890TW890&oq=simbad+ngc726&aqs=chrome
simbad ngc726
全部
圖片
地圖
影片
新聞
更多
工具
約有 1,650 項結果 (搜尋時間：0.36 秒)
http://simbad.u-strasbg.fr › sim-basic
翻譯這個網頁
NGC 726 - SIMBAD Astronomical Database - Université de Strasbourg
The SIMBAD astronomical database provides basic data, cross-identifications, bibliography and measurements for astronomical objects ... Query : NGC 726 ...
https://simbad.u-strasbg.fr › sim-id
翻譯這個網頁
ngc7226 - SIMBAD Astronomical Database
The SIMBAD astronomical database provides basic data, cross-identifications, bibliography and

NGC 726

不安全 | simbad.u-strasbg.fr/simbad/sim-basic?Ident=NGC+726

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

NGC 726

other query modes : Identifier query | Coordinate query | Criteria query | Reference query | Basic query | Script submission | TAP | Output options | Help

Query : NGC 726

Basic data :

NGC 726 -- Galaxy

SIMBAD Query around within 2

Other object types:	G (6dFGS,KUG,...)
ICRS coord. *(ep=J2000) :*	01 55 31.873 -10 47 59.19 (Infrared) [ ] C 2006AJ....131.1163S
FK5 coord. *(ep=J2000 eq=2000) :*	01 55 31.874 -10 47 59.19 [ ]
FK4 coord. *(ep=B1950 eq=1950) :*	01 53 04.288 -11 02 39.46 [ ]
Gal coord. *(ep=J2000) :*	168.724275 -67.774378 [ ]
Radial velocity / Redshift / cz :	V(km/s) 5346 [11] / z(~) 0.017994 [0.000037] / cz 5394.53 [11.00] D 2005A&A...430..373T
Morphological type:	Sp D ~
Angular size *(arcmin)*:	0.363 0.283 100 (NIR) C 2006AJ....131.1163S
Fluxes (4) :	B 14.27 [~] E ~
	J 13.471 [0.080] C 2006AJ....131.1163S
	H 12.735 [0.098] C 2006AJ....131.1163S
	K 12.109 [0.107] D 2006AJ....131.1163S

2MASS DSS SDSS

Google

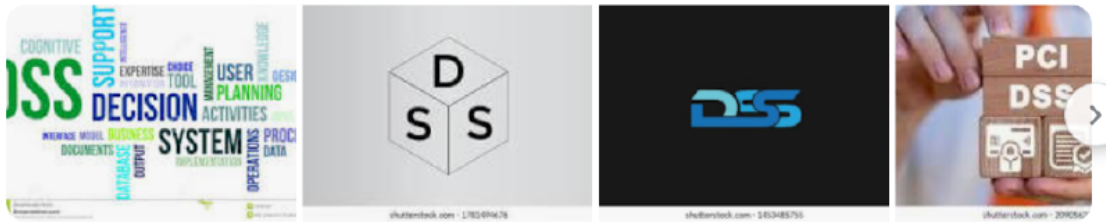
dss images

全部 圖片 新聞 影片 地圖 更多 工具

約有 50,200,000 項結果 (搜尋時間：0.60 秒)

「dss images」的圖片搜尋結果

band diagram dss imagetech space telescope



意見回饋

全部顯示

https://irsa.ipac.caltech.edu › data › DSS ▾ 翻譯這個網頁

DSS Data Collection Atlas - IRSA/IPAC

Digitized Sky Survey (DSS) Data Access ... clicking on any area in red on the above image, or by typing a coordinate below. ... Images must cover coordinate ...

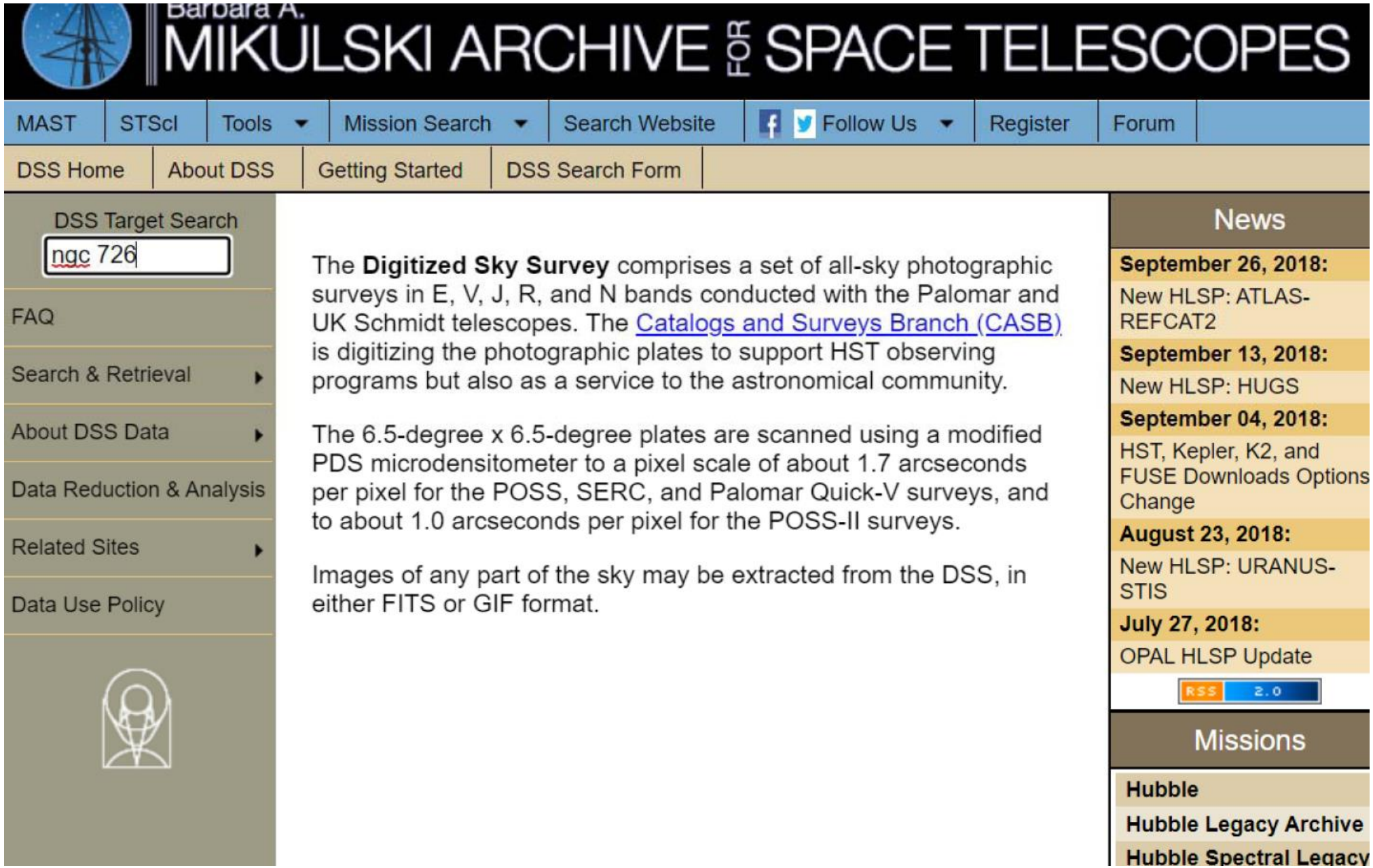
https://archive.eso.org › dss › dss ▾ 翻譯這個網頁

ESO Online Digitized Sky Survey - ESO Archive

2016年8月29日 — The images of these surveys are based on photographic data obtained ... A client to access the DSS-1 and DSS-2 at ESO directly from your ...

https://www.eso.org › public › images ▾ 翻譯這個網頁

DSS image | ESO - Eso.org


Barbara A. MIKULSKI ARCHIVE FOR SPACE TELESCOPES
MAST
STScI
Tools
Mission Search
Search Website
Follow Us
Register
Forum
DSS Home
About DSS
Getting Started
DSS Search Form
DSS Target Search
ngc 726
FAQ
Search & Retrieval
About DSS Data
Data Reduction & Analysis
Related Sites
Data Use Policy
The Digitized Sky Survey comprises a set of all-sky photographic surveys in E, V, J, R, and N bands conducted with the Palomar and UK Schmidt telescopes. The Catalogs and Surveys Branch (CASB) is digitizing the photographic plates to support HST observing programs but also as a service to the astronomical community.
The 6.5-degree x 6.5-degree plates are scanned using a modified PDS microdensitometer to a pixel scale of about 1.7 arcseconds per pixel for the POSS, SERC, and Palomar Quick-V surveys, and to about 1.0 arcseconds per pixel for the POSS-II surveys.
Images of any part of the sky may be extracted from the DSS, in either FITS or GIF format.
News
September 26, 2018:
New HLSP: ATLAS-REFCAT2
September 13, 2018:
New HLSP: HUGS
September 04, 2018:
HST, Kepler, K2, and FUSE Downloads Options Change
August 23, 2018:
New HLSP: URANUS-STIS
July 27, 2018:
OPAL HLSP Update
RSS 2.0
Missions
Hubble
Hubble Legacy Archive
Hubble Spectral Legacy

https://stdatu.stsci.edu/cgi-bin/dss_form

The STScI Digitized Sky Survey

NOTE: To obtain target coordinates for **HST Phase 2 proposals**, select the HST Phase 2 (GSC2) survey option.

[*New!* | Help | FAQ | © | Acknowledging DSS | Other DSS Sites | Archive | STScI]

Get an Object's Coordinates

Object name [ ] GET COORDINATES Clear

Get coordinates from (•) SIMBAD ( ) NED

Retrieve an Image

`Target: NGC 0726 (G)  Resolved by: SIMBAD`

Retrieve from

- POSS2/UKSTU Red
- POSS2/UKSTU Blue
- POSS2/UKSTU IR
- POSS1 Red
- POSS1 Blue
- Quick-V
- HST Phase 2 (GSC2)

(detailed information about the Surveys)

RA 01 55 31.87 Dec -10 47 59.3 J2000

Height 15.0 (max: 60.0) Width 15.0 (max: 60.0) **arcminutes**

File format FITS Compression **(FITS only)** None

[ ] **Save file to disk (instead of displaying)**

HST Field of View Overlay (1st generation GIF only): NONE

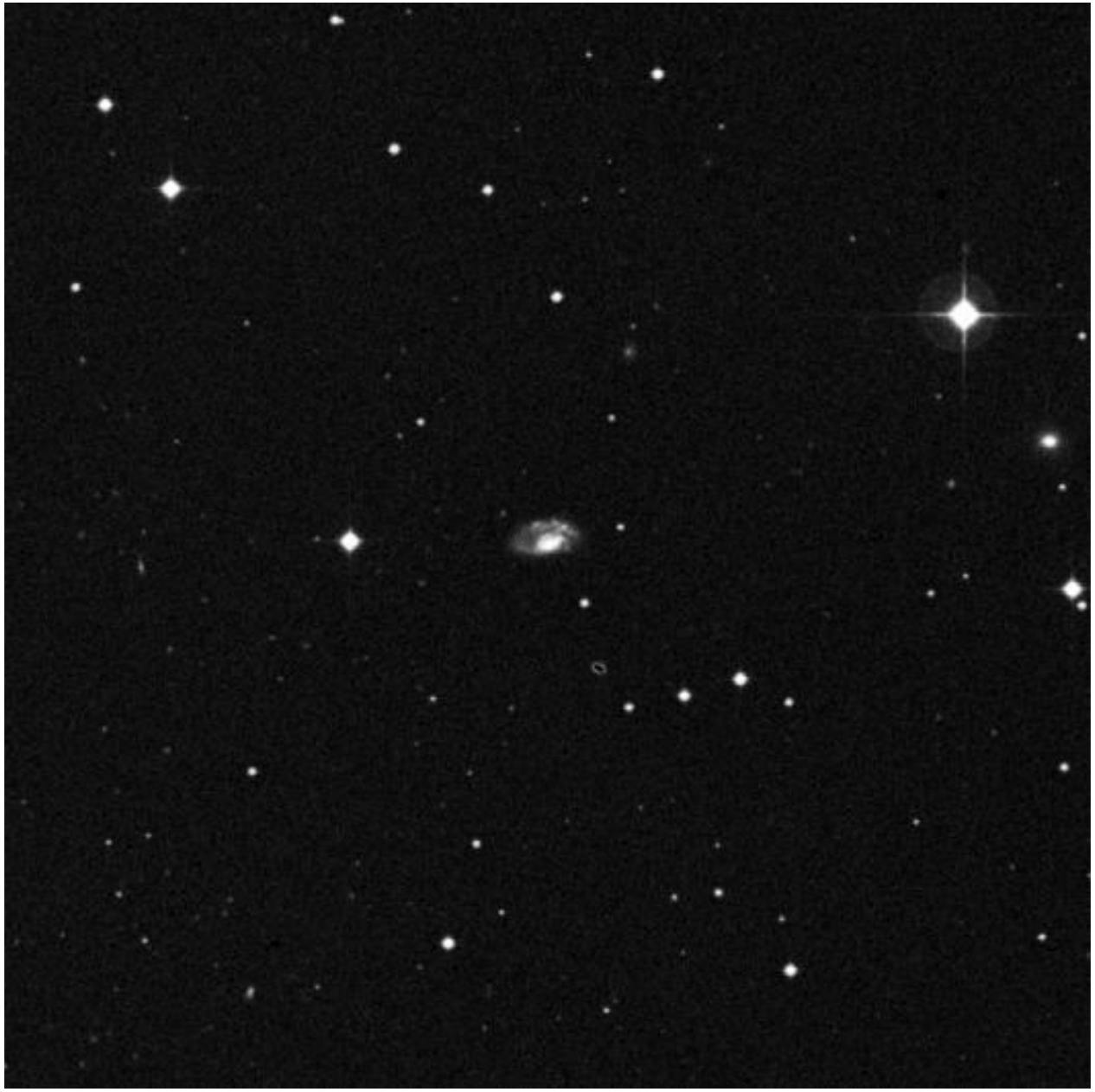
Roll angle (V3): [ ]

RETRIEVE IMAGE Reset values to defaults

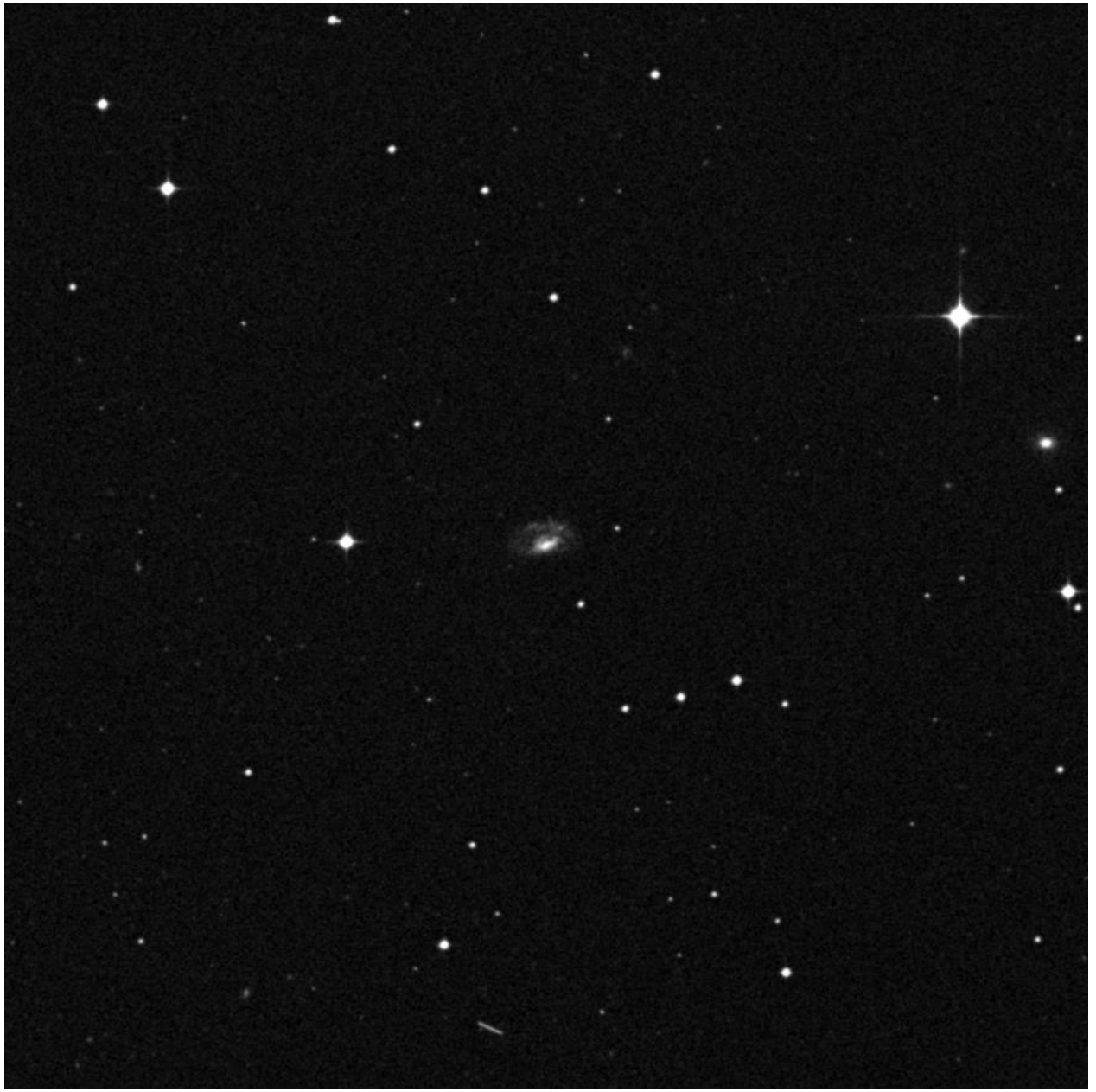
Image	Band	Approximate wavelength range
DSS1B	B_j	3950 - 5400 Å
DSS1R	R	6125 - 6475 Å
DSS2B	B_j	3950 - 5400 Å
DSS2R	R	6300 - 6900 Å
DSS2IR	I	6950 - 9000 Å

包括了氫元素的訊號 H_α λ656.3 nm

https://irsa.ipac.caltech.edu/applications/FinderChart/docs/coverage.html



NGC 726 blue



NGC 726 red

SAOImageDS9

SAOImageDS9

sites.google.com/cfa.harvard.edu/saoimageds9/

SAOImageDS9

Home About Download Documentation Gallery

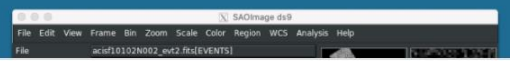
SAOImageDS9

An image display and visualization tool for astronomical data

DOWNLOAD

New Features of SAOImageDS9 version 8.2

Themes



SAOImageDS9 8.....exe

在這裡輸入文字來搜尋

下午 04:11
2021/1/13

SAOImage ds9

File Edit View Frame Bin Zoom Scale Color Region WCS Analysis Help

File D:\CourseTex\Text\NCU\InstAst\Personnel\VickyBowen\ngc726Red.fits
Object data
Value
WCS
Physical x y
Image x y
Frame 1 x 1 0

file edit view frame bin zoom scale color region wcs analysis help

open save header page setup print exit

5379 7164 8966 10751 12554 14339 16124 17926 19711

toolsStarClusters.pptx - PowerPoint

告訴我您想要執行的動作...

文字方向 對齊文字 轉換成 SmartArt 段落

排列 快速樣式 圖案填滿 圖案外框 圖案效果 繪圖

尋找 取代 選取 編輯

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8

17.黃惟娟-20220425T0
29.薛宇森-20220425T0
poster2mT 20220727.pptx 2022/7/26 下午 08:02 Microsoft Power...

投影片 9/ 43 中文 (台灣)

1955.0 1956.0 1957.0

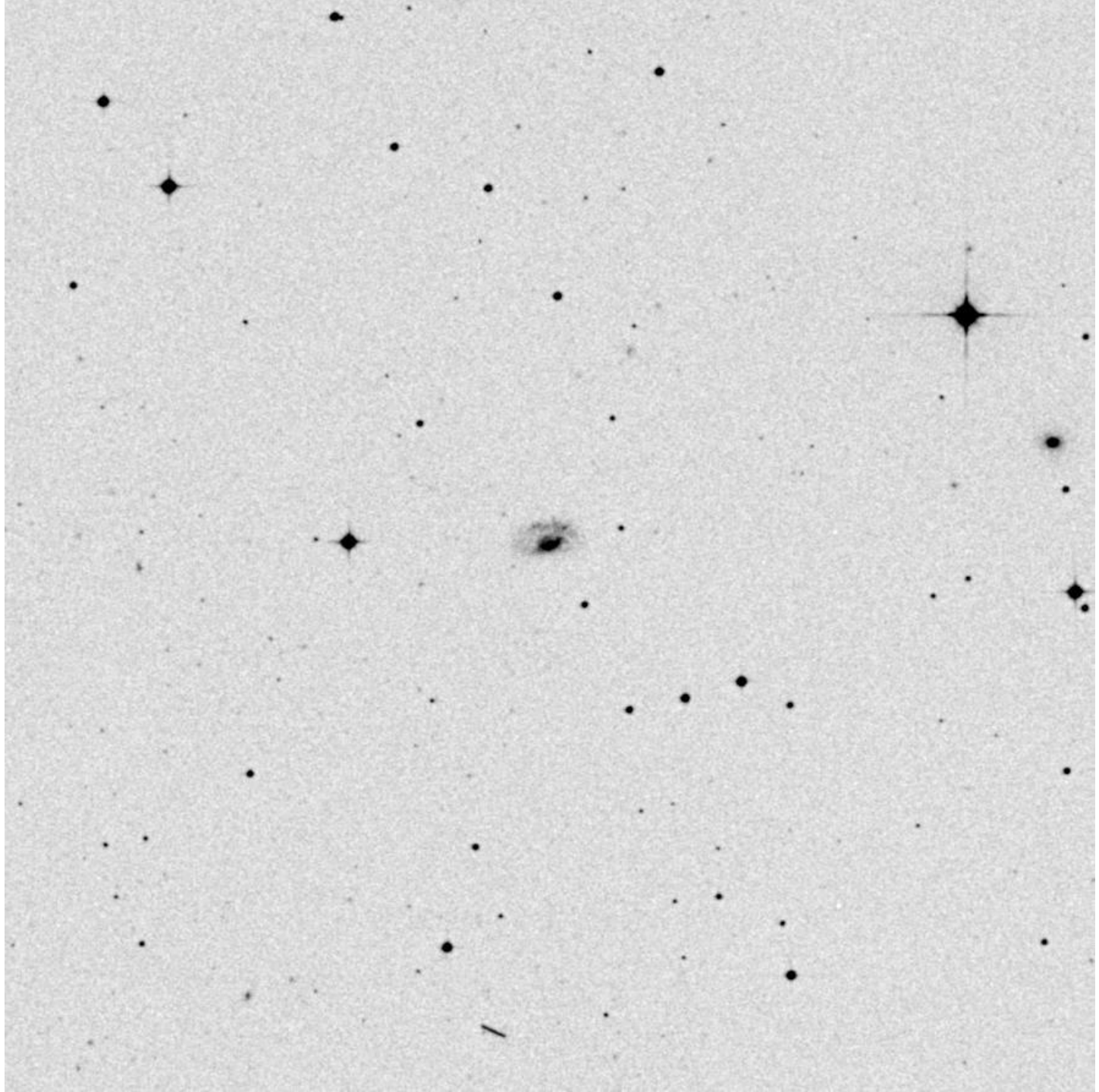
在這裡輸入文字來搜尋

雨停 英 下午 01:47 2022/8/2

ds9

Color inverted

Export to jpeg



Try

- ✓ M51
- ✓ M67
- ✓ NGC 6823

Messier catalog

https://en.wikipedia.org/wiki/Messier_object

Catalog of Nebulae and Star Clusters (110)

Check out M1, M31, M42, M51, M82

New General Catalog (NGC)

(of Nebulae and Clusters of Stars

7840 galaxies, star clusters, emission nebulae
Arranged in RA order

Rough coordinates of NGC 726?

Index Catalog (IC)

+5386 entries

Latest version 2019, a total of ~14,000 objects

習題

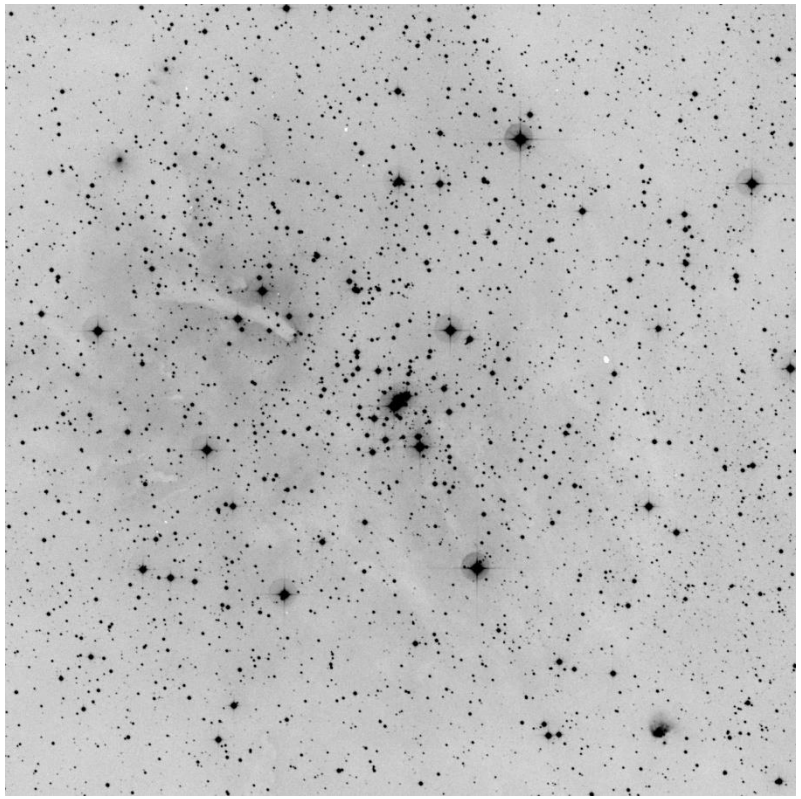
- 某位家人的生日，例如今天 07/26
  找出 NGC 726 是什麼天體？有哪些已知的性質？

  下載 NGC 726 的影像 (gif, FITS)，
  　短波（藍色）、長波（紅色）

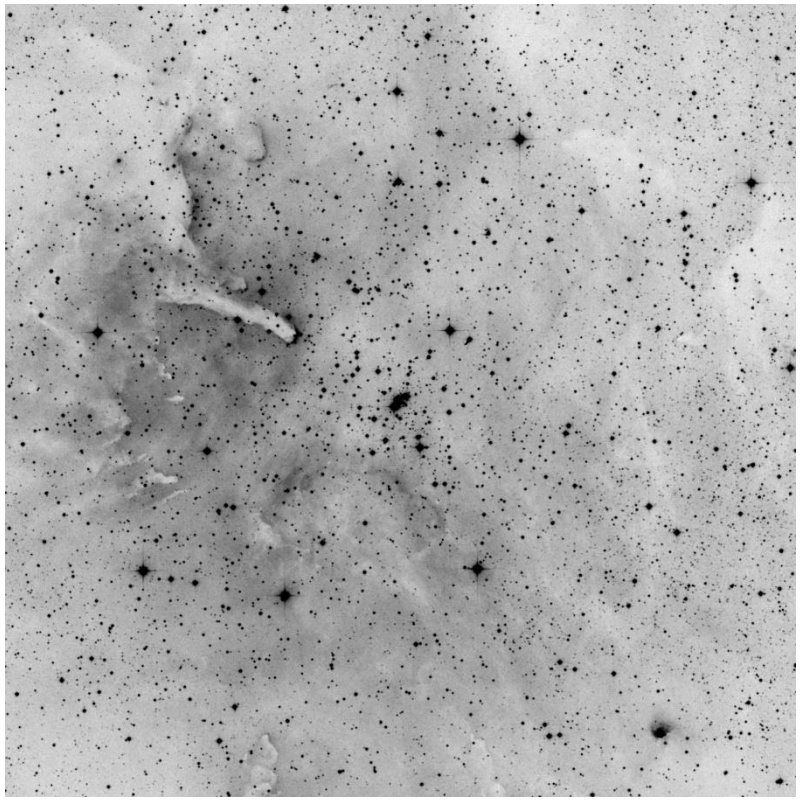
  檢視這些影像，試試下載不同範圍 (5', 30') 的影像
- 然後試 NGC 6823，這是什麼天體？距離、年齡？
  （怎麼知道？）

ds9
--- display, adjust brightness/contrast/color (inverted)/window size,
--- export jpeg

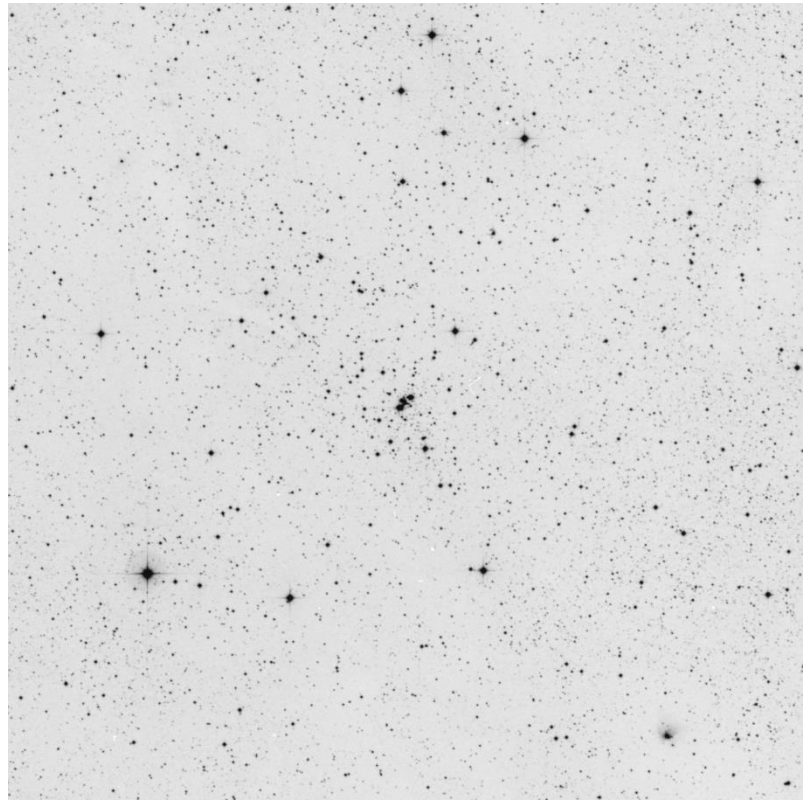
DSS filter responses https://irsa.ipac.caltech.edu/applications/FinderChart/docs/coverage.html



blue



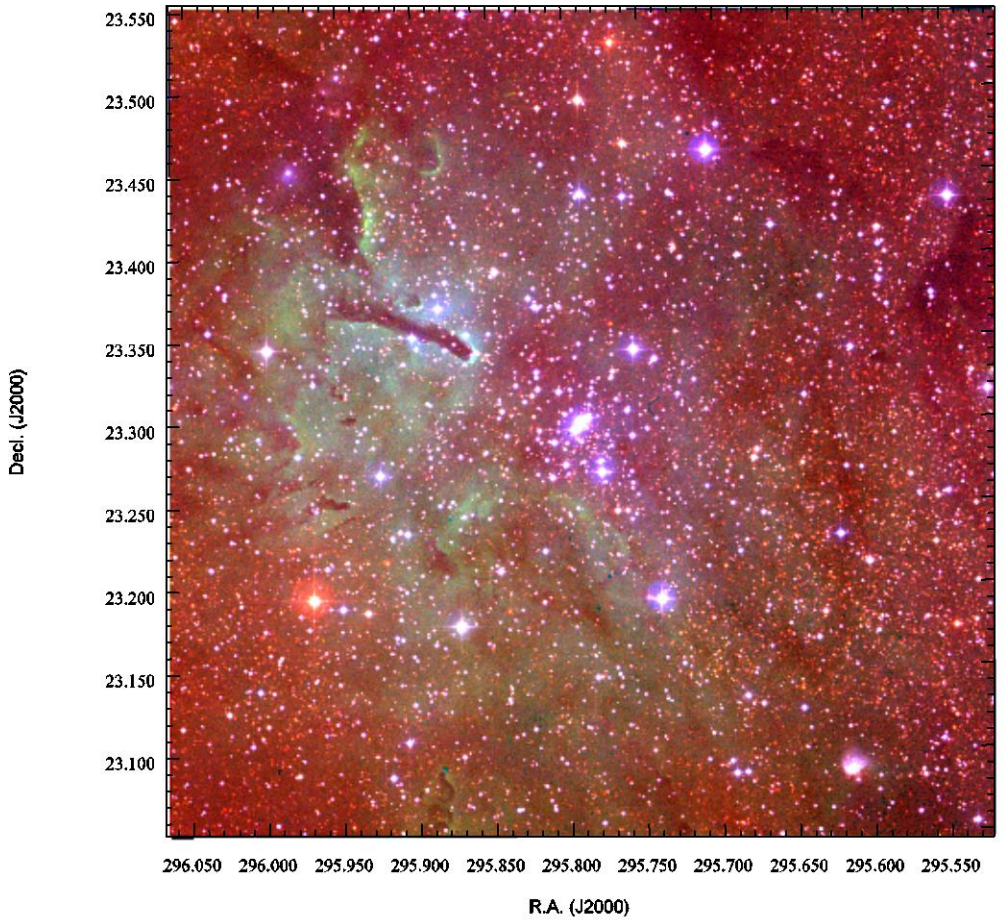
red

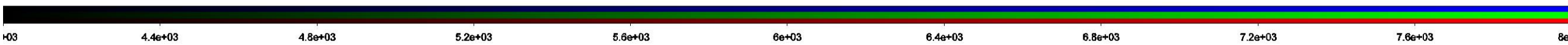


infrared

Tri-color composite

ds9
--- Frame, New Frame RGB
--- Select Current View, one of the b, g, and r images
--- RGB
--- Open

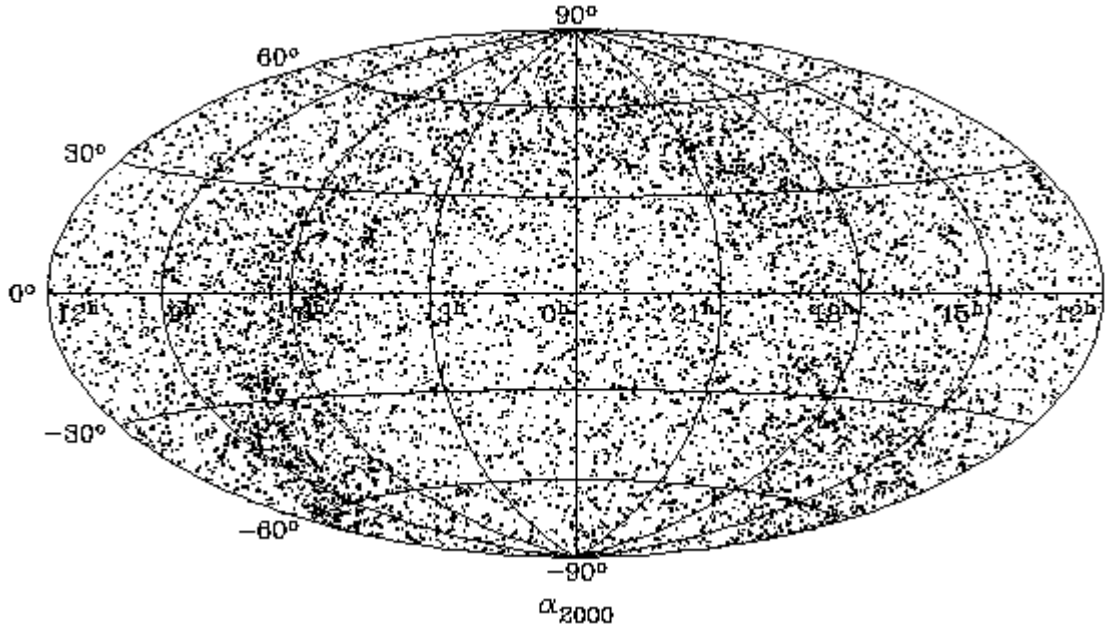

23.550
23.500
23.450
23.400
23.350
23.300
23.250
23.200
23.150
23.100
Decl. (J2000)
296.050
296.000
295.950
295.900
295.850
295.800
295.750
295.700
295.650
295.600
295.550
R.A. (J2000)


+03
4.4e+03
4.8e+03
5.2e+03
5.6e+03
6e+03
6.4e+03
6.8e+03
7.2e+03
7.6e+03
8e

https://www.cloudynights.com/topic/584227-ngc-6823-hasho/

Yale Bright Star Catalog BSC5

http://tdc-www.harvard.edu/catalogs/bsc5.html



習題

1. 下載BSC5，並繪製全天亮星位置
2. 只繪出亮於二等的亮星。試試以較大的符號表示較亮的星

Full	RAJ2000 “h:m:s”	DEJ2000 “d:m:s”	GLON deg	GLAT deg	Vmag mag	SpType
1	00 05 09.9	+45 13 45	114.44	-16.88	6.70	A1Vn
2	00 05 03.8	-00 30 11	98.33	-61.14	6.29	gG9
3	00 05 20.1	-05 42 27	93.75	-65.93	4.61	K0IIIbCN-0.5
4	00 05 42.0	+13 23 46	106.19	-47.98	5.51	G5III
5	00 06 16.0	+58 26 12	117.03	-3.92	5.96	G5V
6	00 06 19.0	-49 04 30	321.61	-66.38	5.70	G1IV
7	00 06 26.5	+64 11 46	118.06	1.75	5.59	B9III
8	00 06 36.8	+29 01 17	111.26	-32.83	6.13	K0V
9	00 06 50.1	-23 06 27	52.21	-79.14	6.18	A7V
10	00 07 18.2	-17 23 11	74.36	-75.90	6.19	A6Vn
11	00 07 44.1	-02 32 56	98.02	-63.29	6.43	B8IIIpSi
12	00 07 46.8	-22 30 32	55.56	-79.07	5.94	A2Vp:
13	00 08 03.5	-33 31 46	355.91	-78.67	5.68	K1III
14	00 08 12.1	-02 26 52	98.34	-63.24	6.07	K2III+F
15	00 08 23.3	+29 05 26	111.73	-32.84	2.06	B8IVpMnHg
16	00 08 17.4	-08 49 26	91.79	-69.04	5.99	gG8
17	00 08 41.0	+36 37 36	113.45	-25.45	6.19	F8IV
18	00 08 33.4	-17 34 39	74.69	-76.25	6.06	M0III
19	00 08 52.2	+25 27 46	110.97	-36.42	6.23	K0III
20	00 09 20.2	+79 42 53	120.98	17.00	6.01	A7IV
21	00 09 10.7	+59 08 59	117.52	-3.27	2.27	F2III-IV
22	00 09 02.4	+18 12 43	108.99	-43.51	5.53	G9III
23	00 09 02.4	-54 00 07	316.25	-62.02	6.33	G4IV

自己問：

1. 星表中一共有多少顆星？全天空為何分布不均勻？
2. 最亮的星是哪顆？有多亮？
3. 星表中最暗的星是哪顆？視星等為多少？
4. 按照亮度的分布如何？小於0等、0～1等、1～2等 …

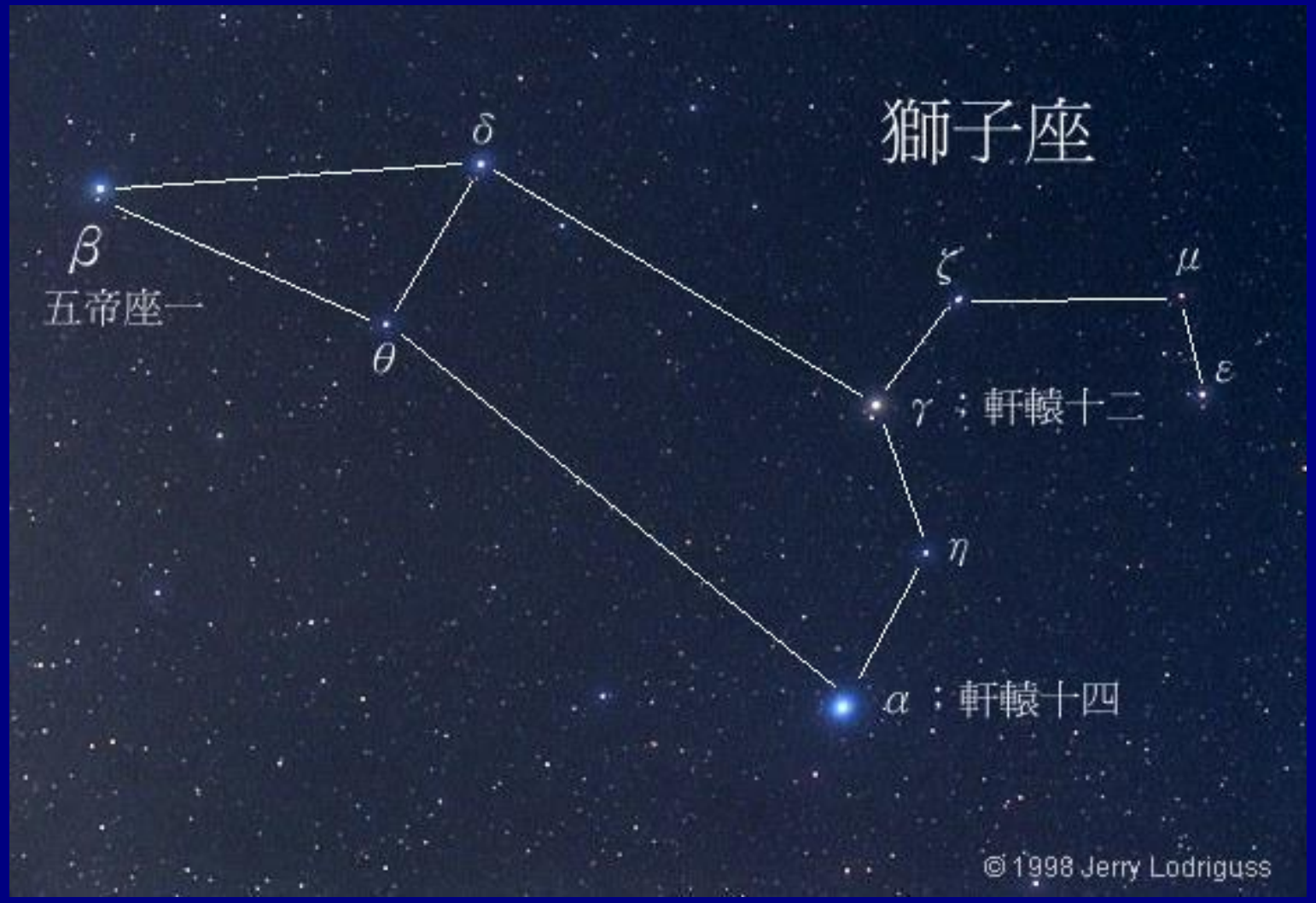
✓ASCII (alpha-numericals 拉丁字母、數字、標點符號)

✓Binary (code), Unicode（統一碼，14萬個字元）、UTF-8, Big-5 code（一字兩碼）…

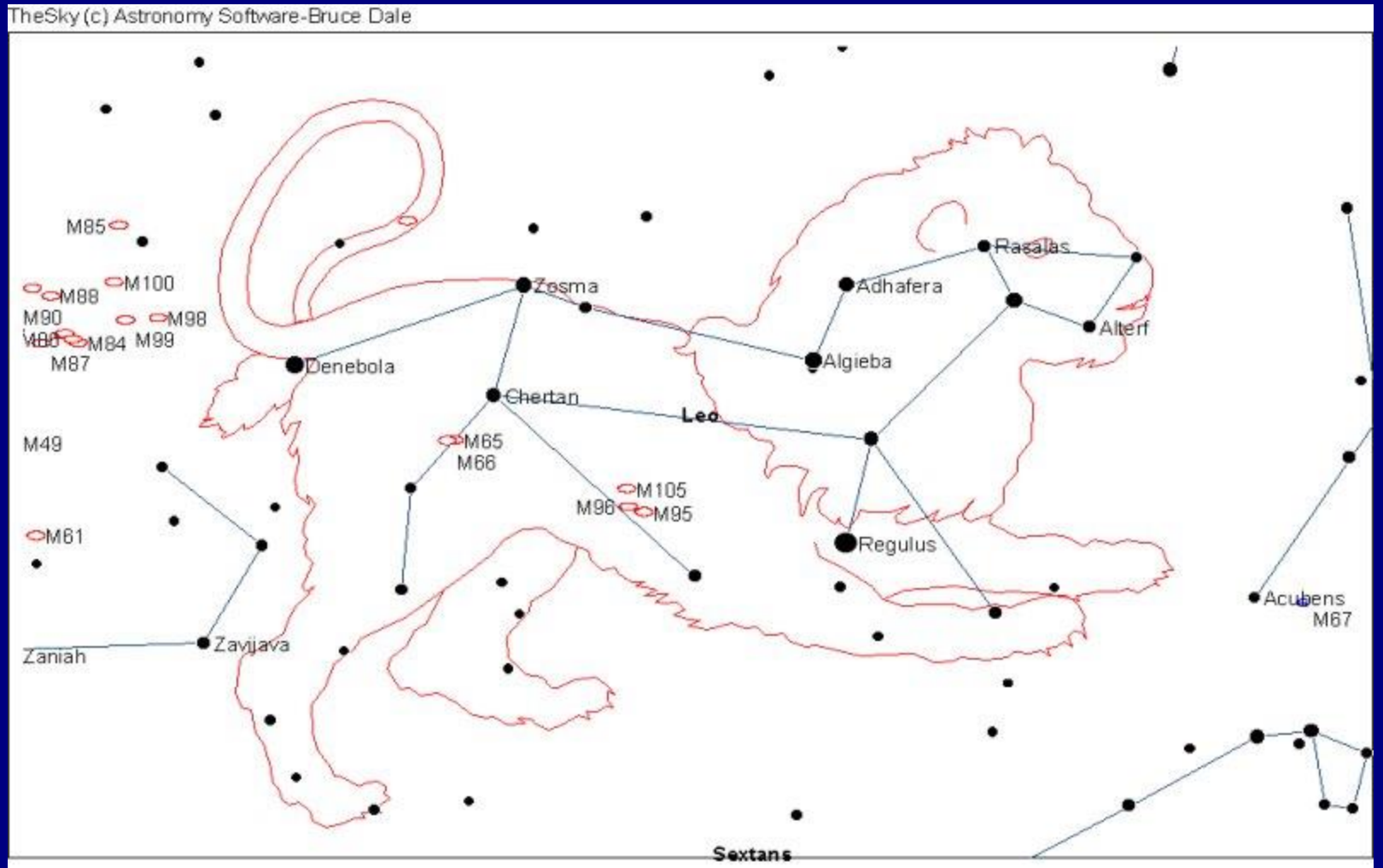
✓It’s messy.

✓**It’ s messy.**（用中文編碼編輯英文的結果）

星座 (constellations) --- 星球「看起來」形成的圖樣，其實彼此可能遠近不同而毫無關連



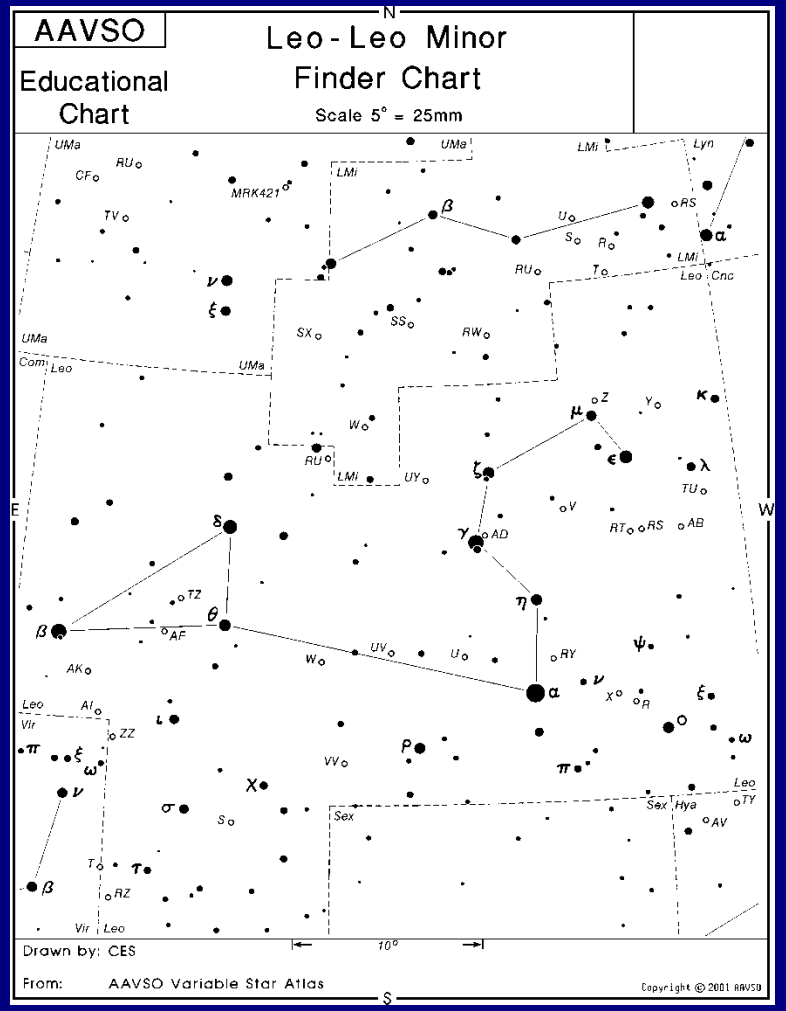
亮星「看起來」構成特殊圖樣，此處所示為春季夜空的「**獅子**」(Leo)

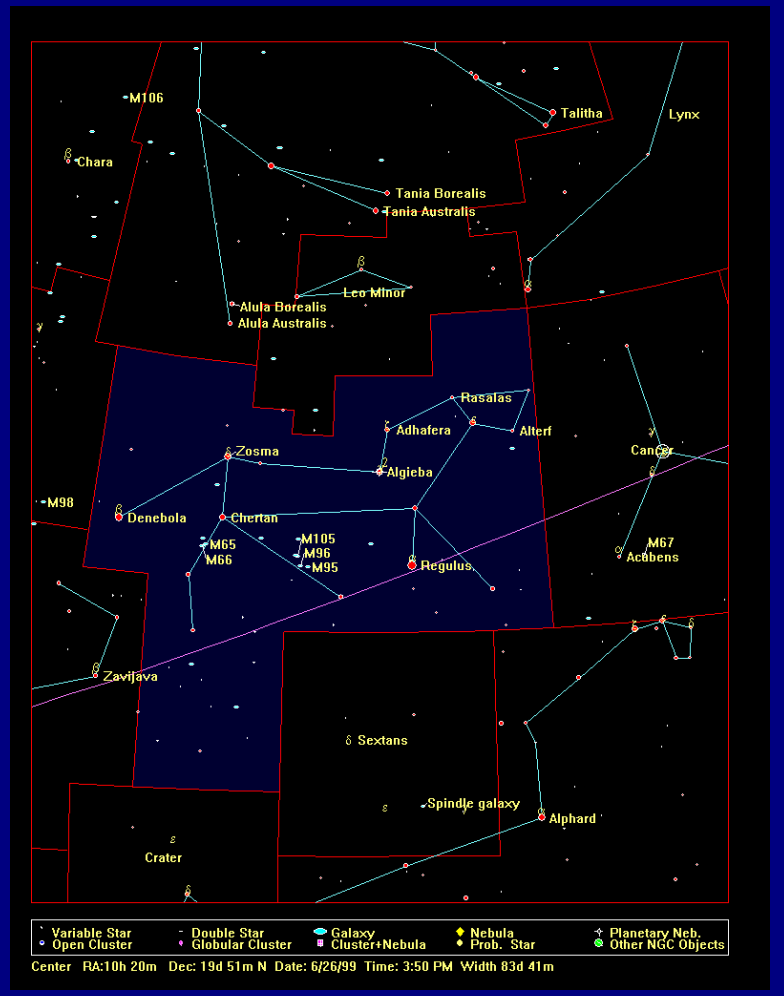


Leo

Abbreviation: Leo
Genitive Form: Leonis
Description: The Lion

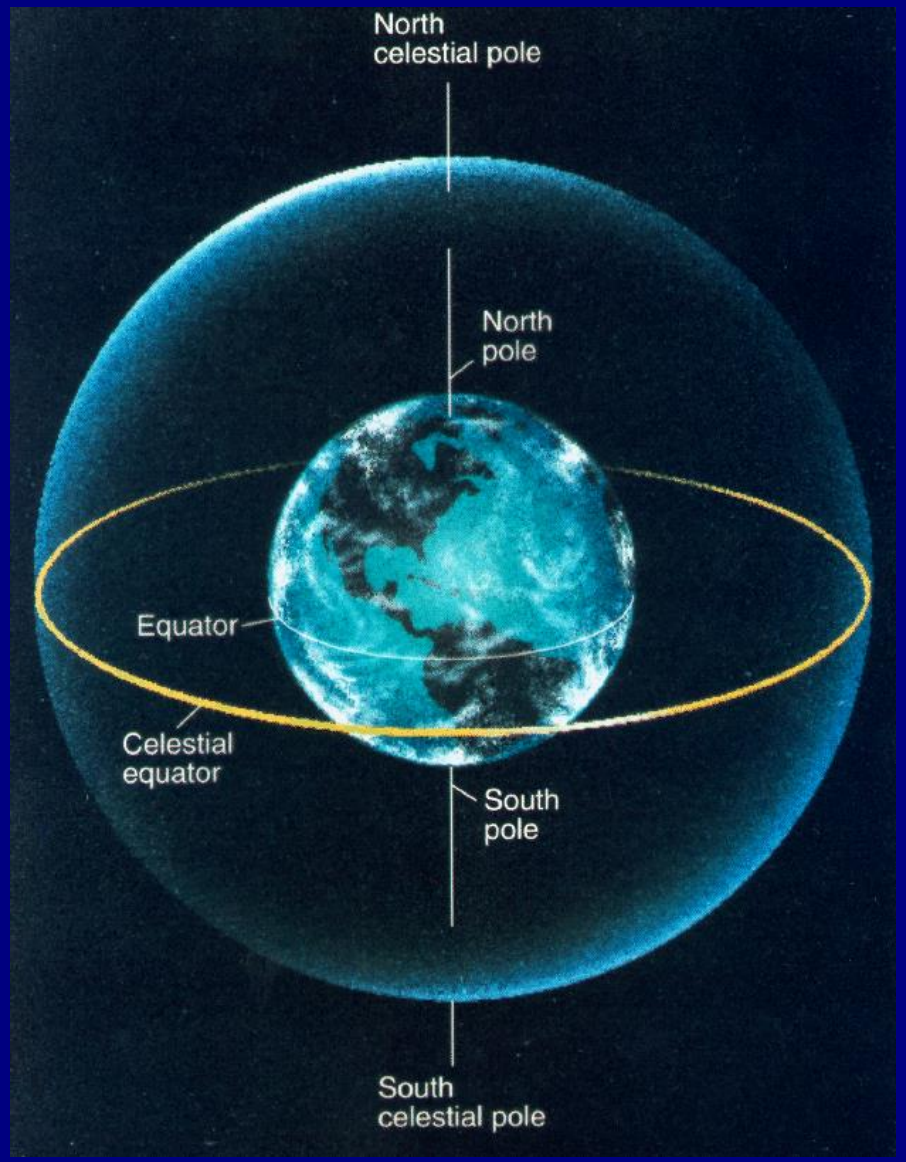
Pronunciation: LEE' oh
Genitive Pronunciation: lee OH' nis
Sky Database: Constellation Labels





天空共有 88 個天區，以星座命名。星座不只是個圖騰，或某幾顆星，而是個「天區」。此處所示為獅子座附近的**星圖**

天球北極



（地球）北極

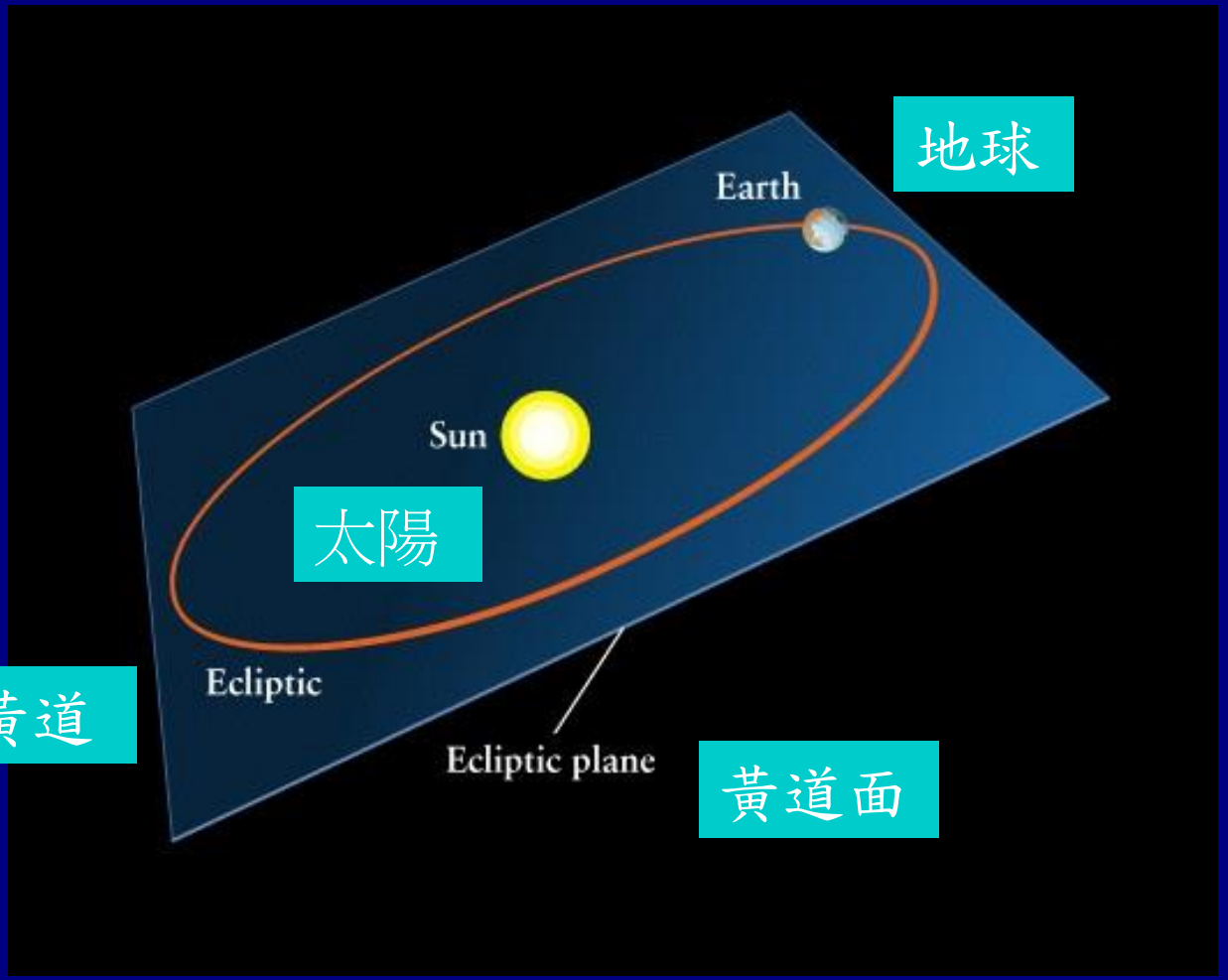
（地球）赤道

天球赤道

（地球）南極

天球南極

Earth's Revolution 地球公轉



地球繞著太陽公轉，軌跡稱為「黃道」(ecliptic)，
所在的平面稱為「**黃道面**」(ecliptic plane)

黃道面：太陽在天空走過的面（實際上是地球公轉面），與天球赤道成 23.4度

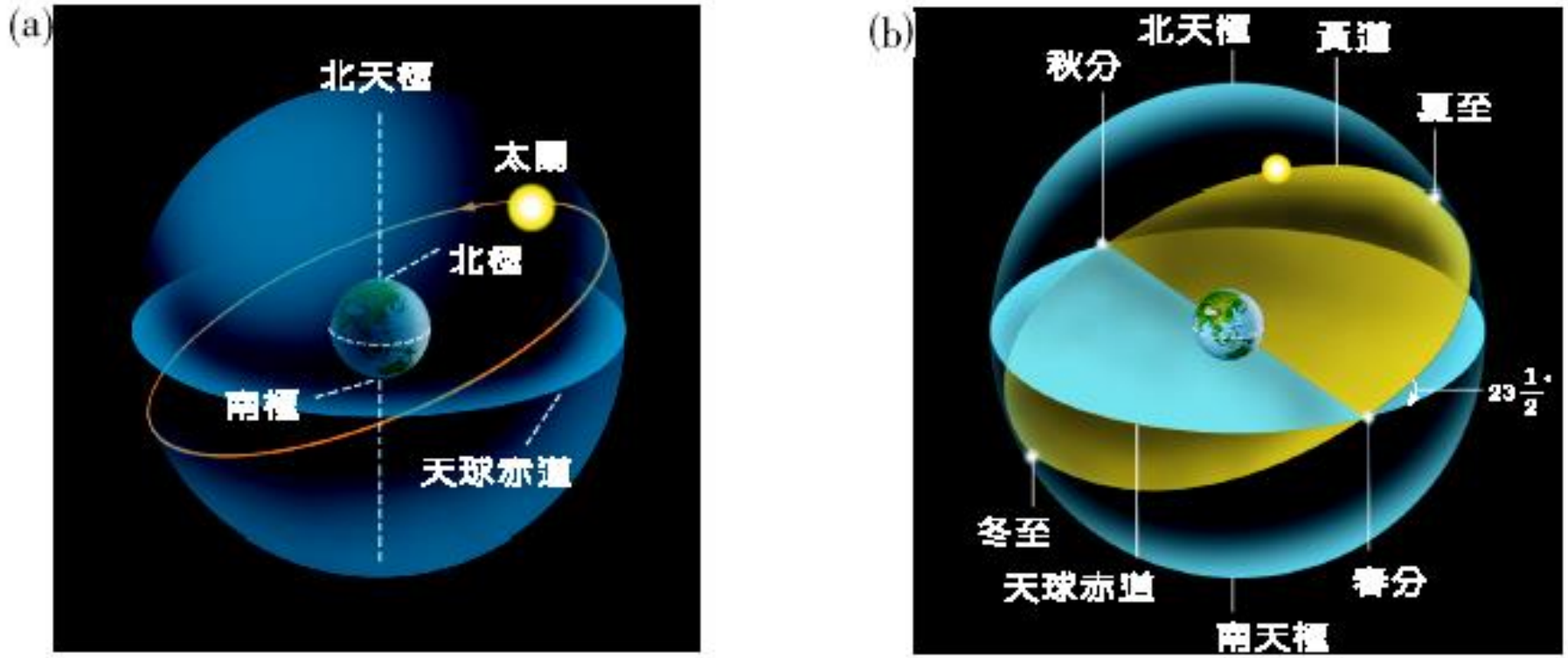
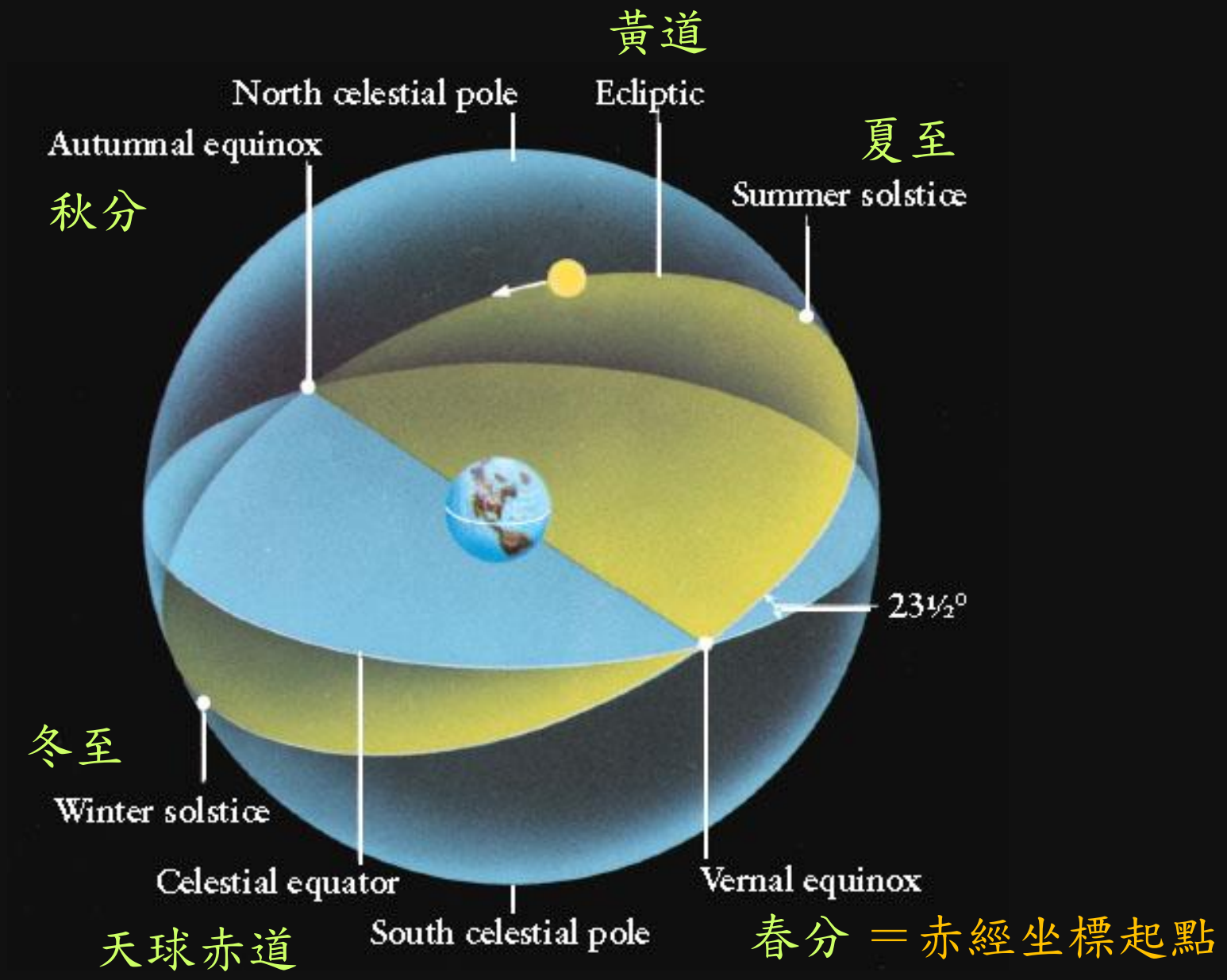
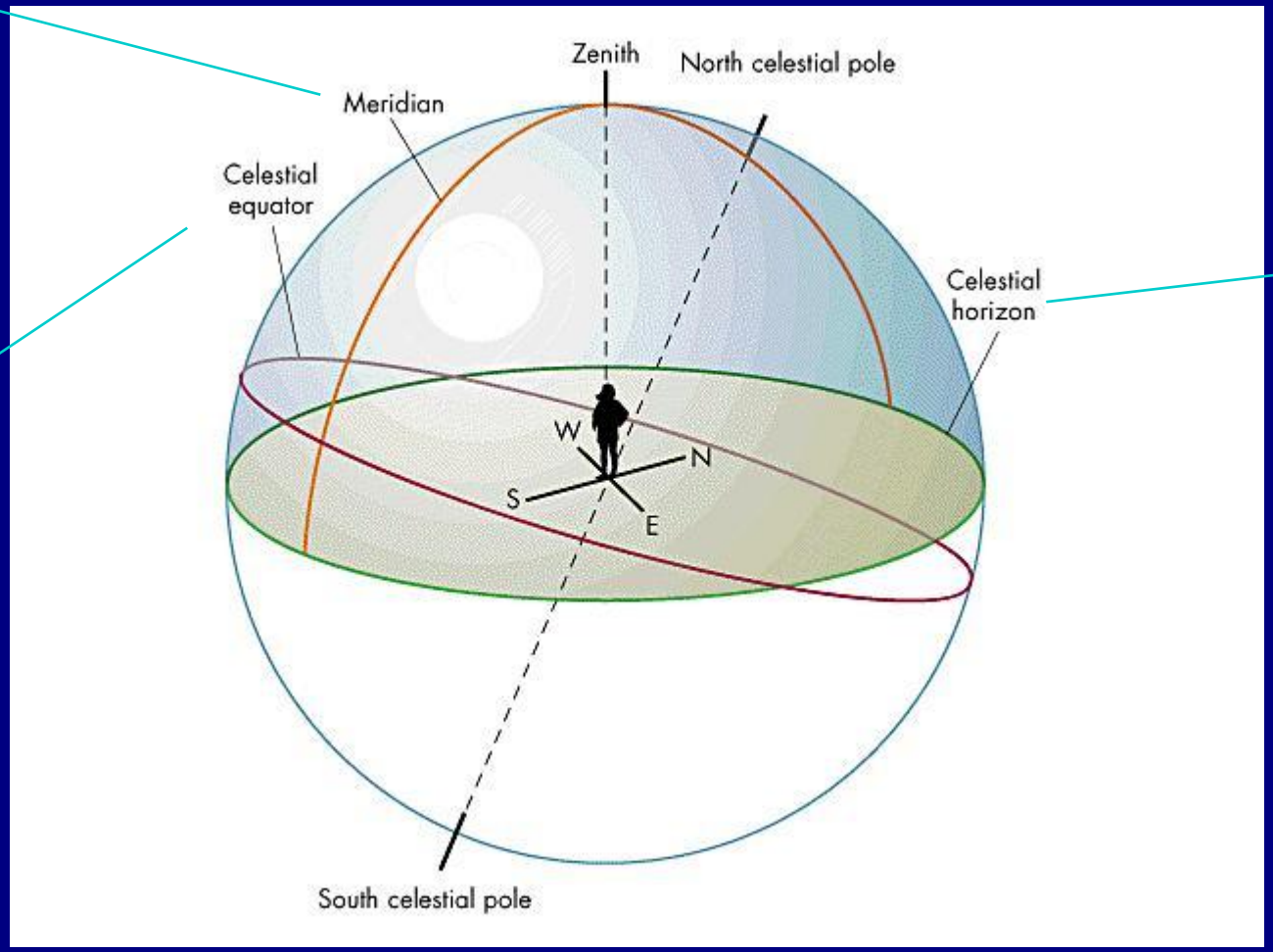


圖 2-12 (a)從地球看太陽一年當中的運動，最北時達到赤緯北方 23.5 度，然後通過天球赤道，繼續南行直到赤緯南方 23.5 度。

(b)黃道面與天球赤道成 23.5 度傾角，兩個面的交點分別稱為春分點及秋分點，黃道面最（上）北方的點稱為夏至，最南方的點則稱為冬至。


黃道
North celestial pole
Ecliptic
Autumnal equinox
秋分
夏至
Summer solstice
23½°
冬至
Winter solstice
Celestial equator
Vernal equinox
South celestial pole
天球赤道
春分 ＝赤經坐標起點

子午線



地平線

天球赤道

把地球的「經度」、「緯度」投影到天球

➔「**赤經**」(right ascension)、

「**赤緯**」(declination)

地表經度以通過格林威治的經度線為起點

想像牆壁上畫了赤經、赤緯線。隨著地球自轉，經度線（看起來）在轉，但緯度線沒動

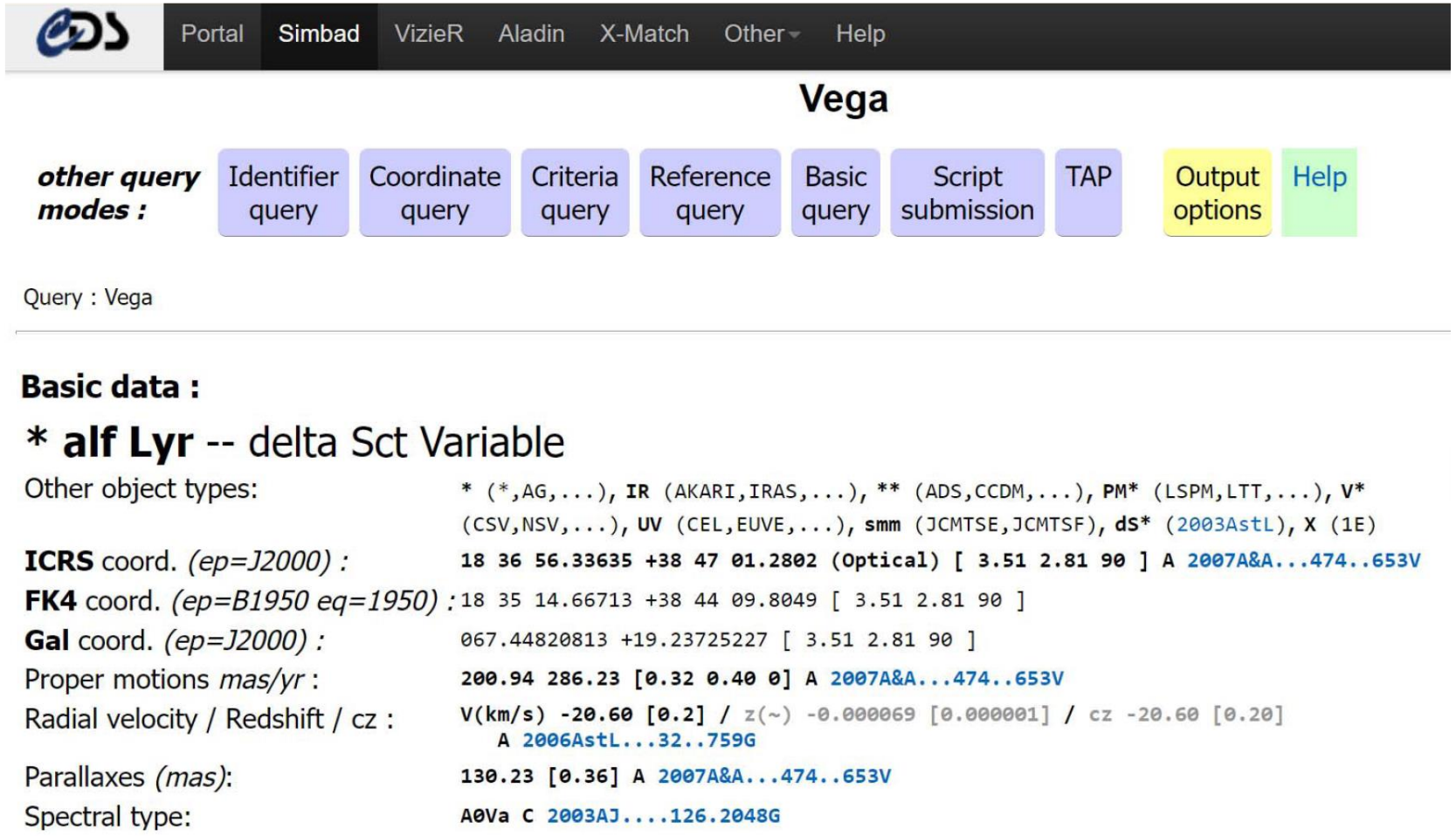
赤經以春分點為起點 $=$ 0^{h}, 向東增加

這樣某顆星就有固定的赤道坐標，對某觀測者來說，例如頭頂的赤經坐標依季節、時刻而變，而赤緯則不變，等於該觀測者所在的地球緯度而定

太陽每年春分時期（大約3月21日）通過春分點，太陽附近的星球看不到，RA 差了12小時的天空（太陽正對面）在半夜則高掛天空，也就是 $\mathrm{RA} \approx 12^{\mathrm{h}}$

一個月後 04/21 太陽會在 $\mathrm{RA} = 2^{\mathrm{h}}$ …
09/21 太陽在 $\mathrm{RA} = 12^{\mathrm{h}}$，半夜面對 $\mathrm{RA} = 24^{\mathrm{h}} = 0^{\mathrm{h}}$

xx/21	Sun	0 am	RAbest	8 pm	4 am	RA range	
3	0	12	180	8	16	120	240
4	2	14	210	10	18	150	270
5	4	16	240	12	20	180	300
6	6	18	270	14	22	210	330
7	8	20	300	16	0	240	0
8	10	22	330	18	2	270	30
9	12	0	0	20	4	300	60
10	14	2	30	22	6	330	90
11	16	4	60	0	8	0	120
12	18	6	90	2	10	30	150
1	20	8	120	4	12	60	180
2	22	10	150	6	14	90	210



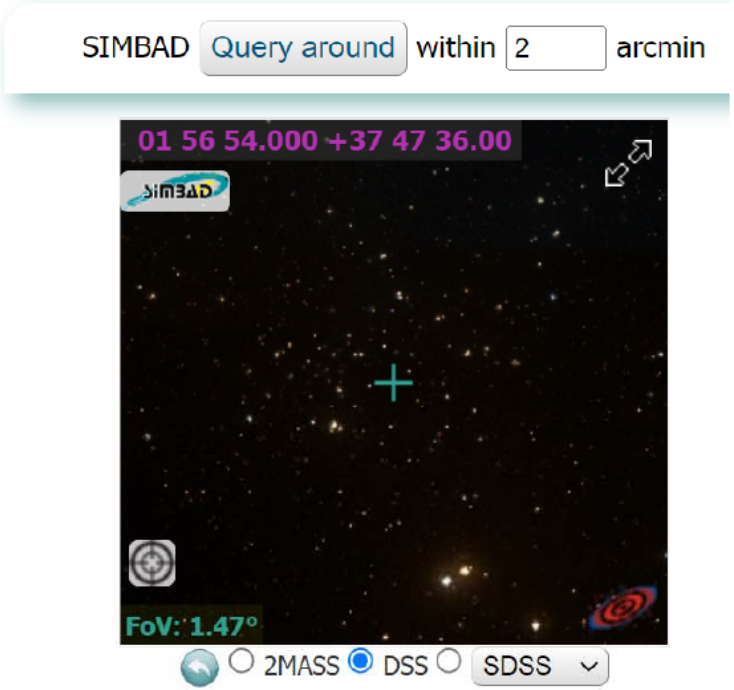
織女星 RA＝18.5時，所以6、7月為最佳觀測季節

台灣北緯大約＋25度，因此赤緯25度的星球會通過天頂，
例如 Pleiades 昴宿星團 RA＝24h, NGC 6823

Basic data :

NGC 752 -- Open Cluster

Other object types:	**Cl*** (2020A&A,C,...), **OpC** (2013A&A,OCl), **As*** (2019AJ,[KC2019])
ICRS coord. *(ep=J2000) :*	**01 56 53.5 +37 47 38 (Optical) [ ] D 2020A&A...633A..99C**
FK4 coord. *(ep=B1950 eq=1950) :*	01 53 54.8 +37 33 01 [ ]
Gal coord. *(ep=J2000) :*	136.9588 -23.2884 [ ]
Proper motions *mas/yr* :	**9.8092 -11.7637 [0.0191 0.0180 90] B 2018A&A...616A..10G**
Radial velocity / Redshift / cz :	**V(km/s) 4.7 [0.1] /** z(spectroscopic) 0.000016 [0.000000] / cz 4.70 [0.10] **(Opt) A 2017A&A...600A.106C**
Parallaxes *(mas)*:	**2.2304 [0.0027] B 2018A&A...616A..10G**
Angular size *(arcmin)*:	**58.2 58.2 0 (Opt) D 2020A&A...633A..99C**



不安全 | simbad.u-strasbg.fr/simbad/sim-id?Ident=Stock+2

Query : Stock 2

Basic data :

Cl Stock 2 -- Open Cluster

Other object types:	Cl* (2020A&A,Cl,...), OpC (2013A&A,OCl), As* (2019AJ,[KC2019])
ICRS coord. *(ep=J2000) :*	02 15 25.4 +59 31 19 (Optical) [ ] D 2020A&A...633A..99C
FK4 coord. *(ep=B1950 eq=1950) :*	02 11 49.4 +59 17 23 [ ]
Gal coord. *(ep=J2000) :*	133.4072 -01.6308 [ ]
Proper motions *mas/yr* :	15.8241 -13.7669 [0.0103 0.0104 90] B 2018A&A...616A..10G
Radial velocity / Redshift / cz :	V(km/s) 7.08 [0.09] / z(spectroscopic) 0.000024 [0.000000] / cz 7.08 [0.09] (NIR) A 2019A&A...623A..80C
Parallaxes *(mas)*:	2.6367 [0.0009] B 2018A&A...616A..10G
Angular size *(arcmin)*:	123.6 123.6 0 (Opt) D 2020A&A...633A..99C

SIMBAD Query around within 2 arcmin

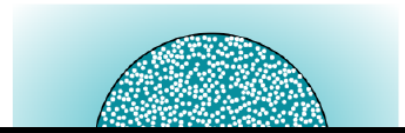
2MASS DSS SDSS

All (CDSPortal)

Send to Aladin

Photometry within 5 arcsec

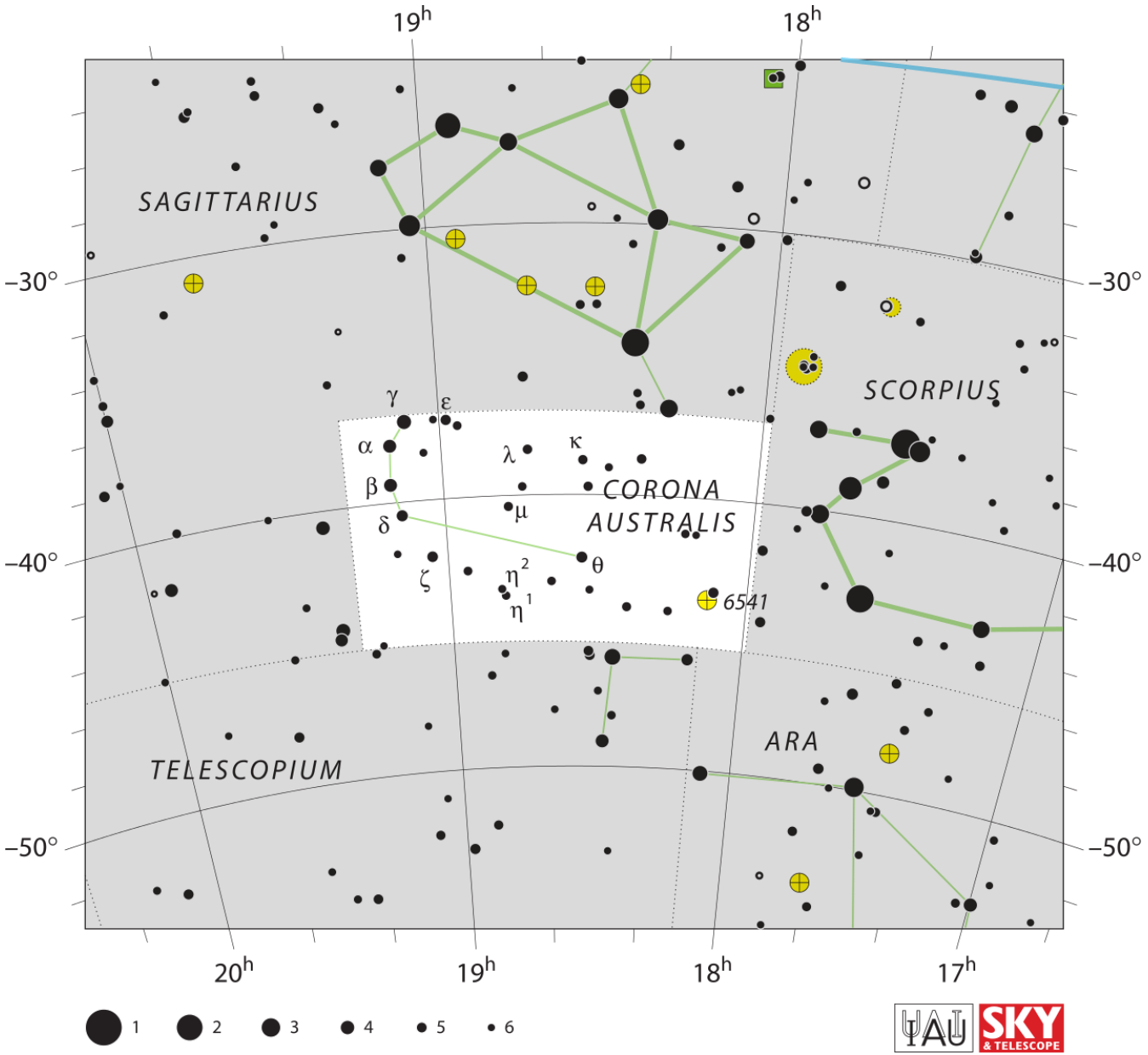
Hierarchy : number of linked objects
whatever the membership probability is (see description here) :



在這裡輸入文字來搜尋

34°C 多雲時晴

https://science.nasa.gov/stars-and-dust-across-corona-australis



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

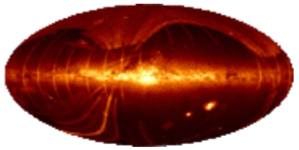
Catalogue collection access

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

News

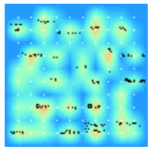
- 2 Jan Catalogs added between 26-Dec-2020 and 02-Jan-2021
- 26 Dec Catalogs added between 19-Dec-2020 and 26-Dec-2020
- 19 Dec Catalogs added between 05-Dec-2020 and 19-Dec-2020
- 5 Dec Catalogs added between 28-Nov-2020 and 05-Dec-2020
- 21 Oct VizieR new version with time capabilities and TAP updates
- 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

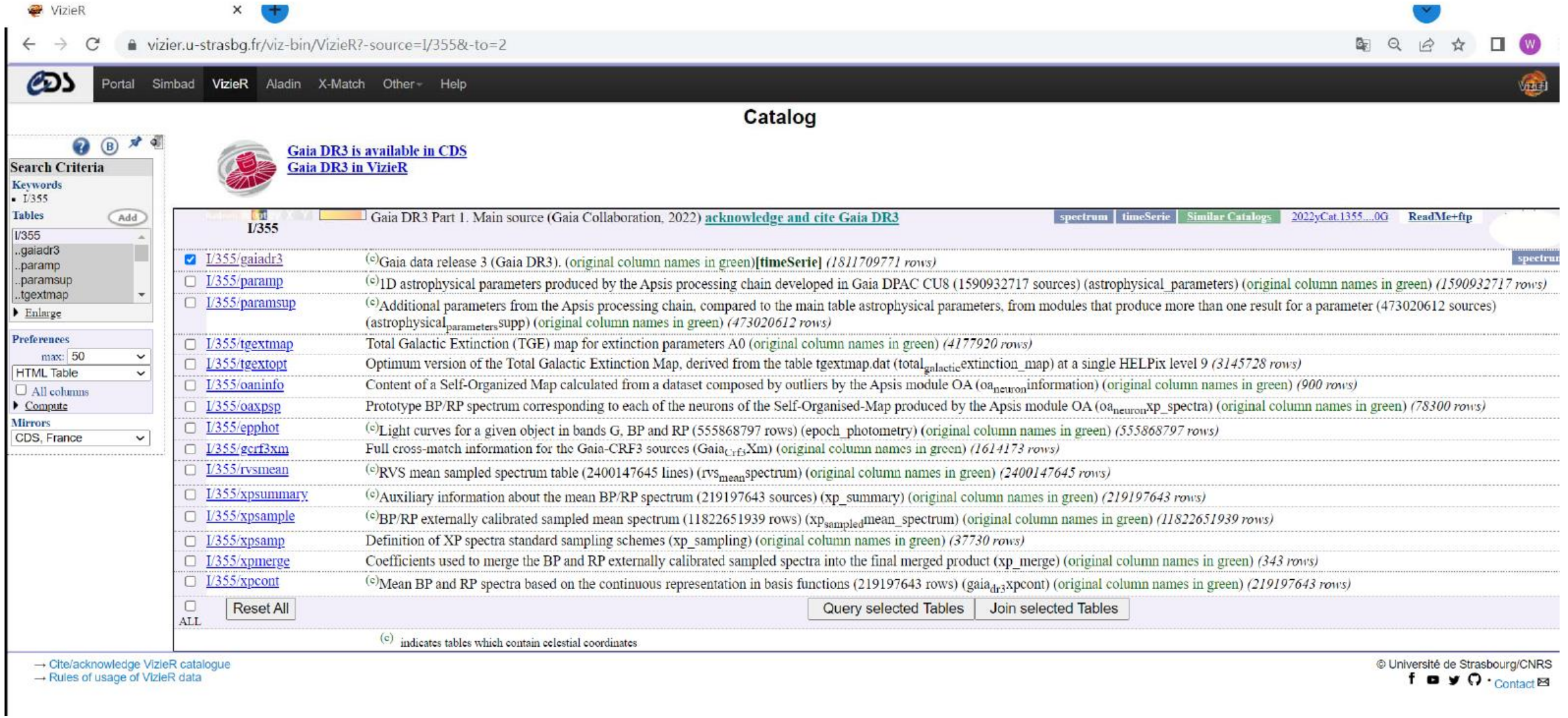


The Kohonen Self-Organizing Map groups on nearby locations of a map catalogues having similar contents.

在這裡輸入文字來搜尋

上午 11:50
2021/1/7

https://vizier.u-strasbg.fr/viz-bin/VizieR?-source=I/355&-to-2



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

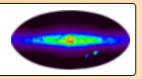
Login Preferences Register

Choose tables to cross-match

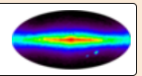
Gaia EDR3 X 2MASS

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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下午 05:23 2021/1/22

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?

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.

習題

- 利用 vizier 下載自己主題天體的蓋婭數據（先試試 2’，然後 20’，然後 2 deg)
- 繪製這些恆星的天球位置
- 繪製這個區域恆星的自行運動（向量圖）

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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下午 04:56
2021/1/13

CMD 3.4 input form

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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

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下午 04:58 2021/1/13

CMD 3.4 input form

不安全 | 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

topcat-full.jar

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下午 04:59
2021/1/13

CMD 3.4 output

不安全 | 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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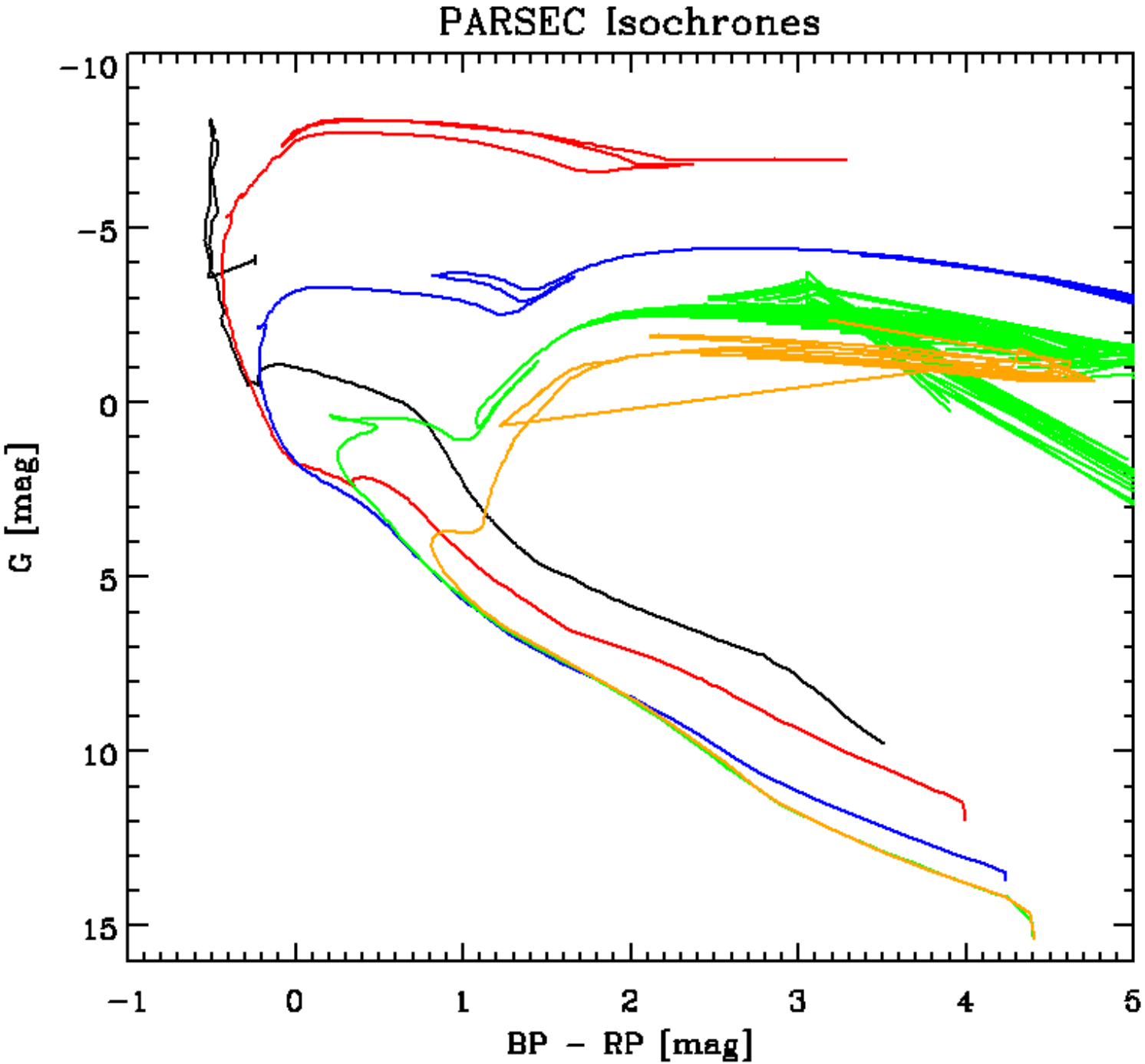
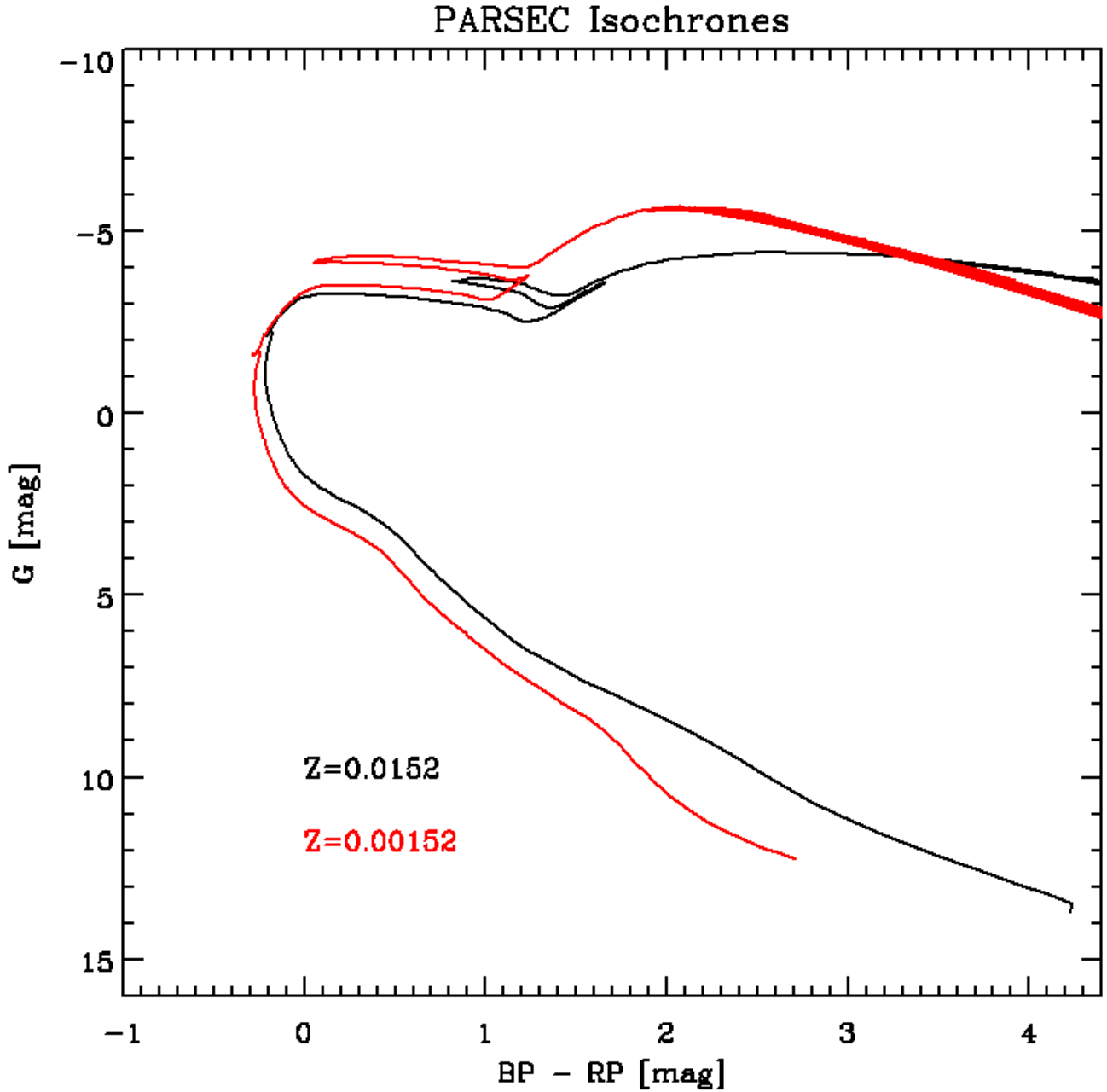
下午 05:00
2021/1/13


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


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

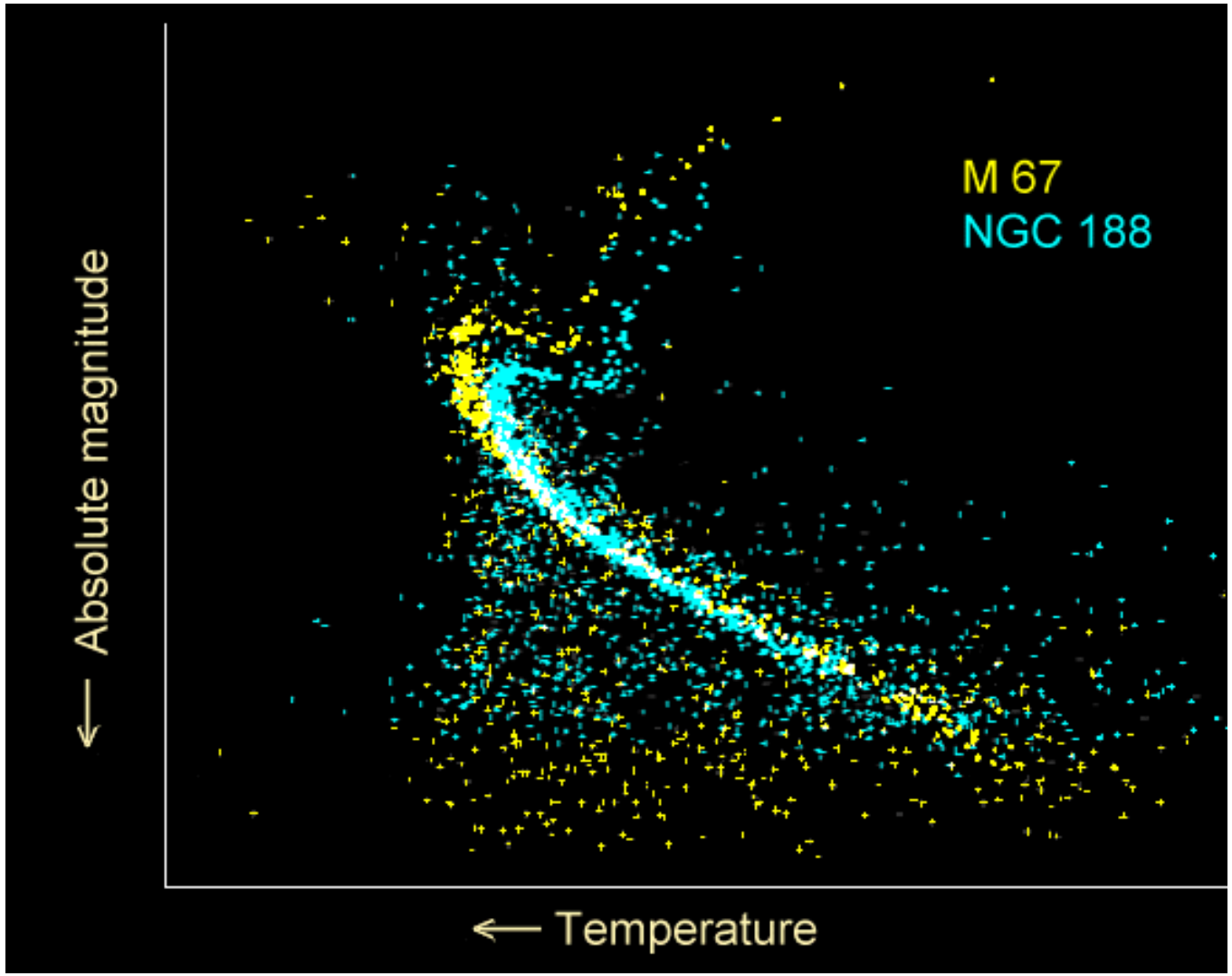
Member stars are grouped in at least 6-dimensional space, 3 in location (position and distance) and 3 in motion (proper motion and radial velocity) (and in metalicity, etc.)

➔ 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 …

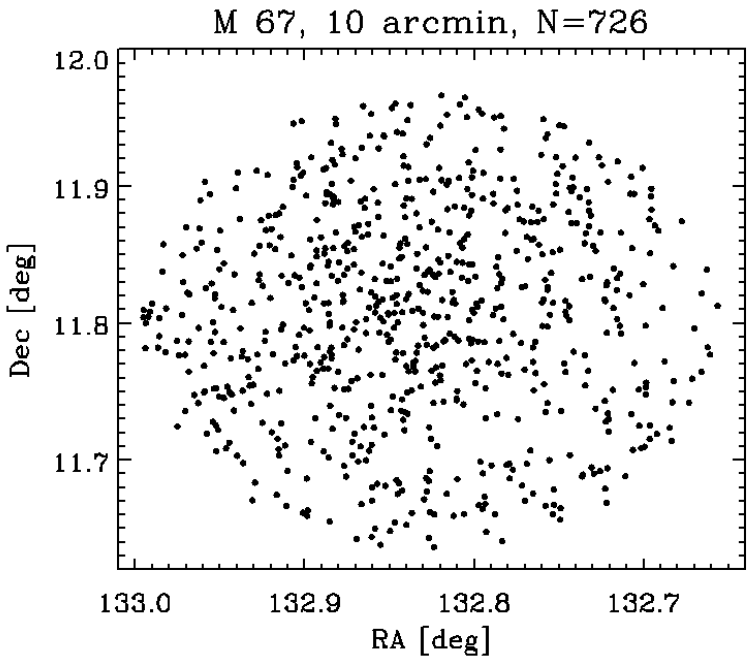
A Case Study M67 an OC ~4 Gyr old (i.e., solar age), [Fe/H] = −0.1, distance 800 to 900 pc, an apparent angular diameter > 30’

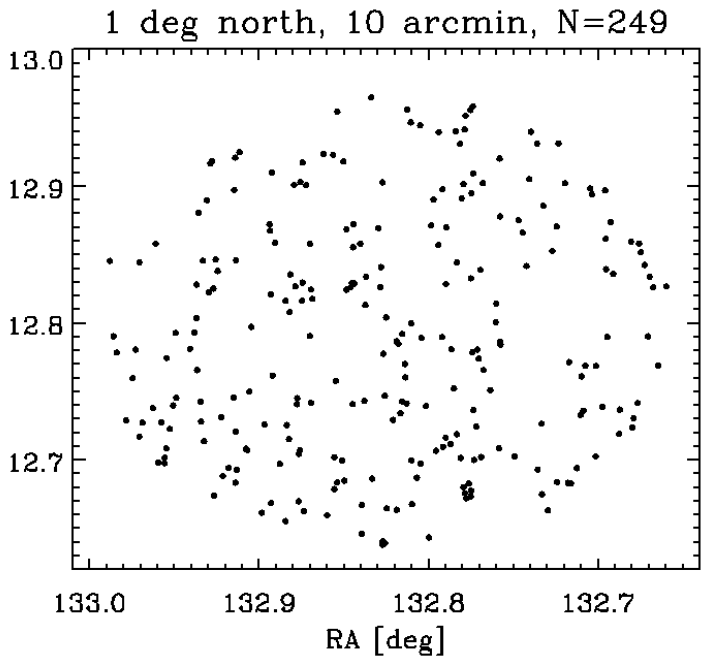


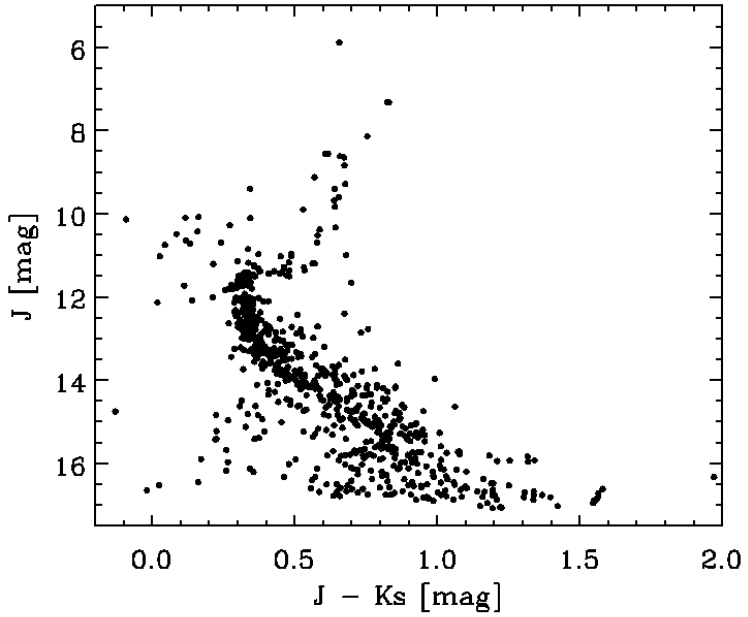
2 old OCs

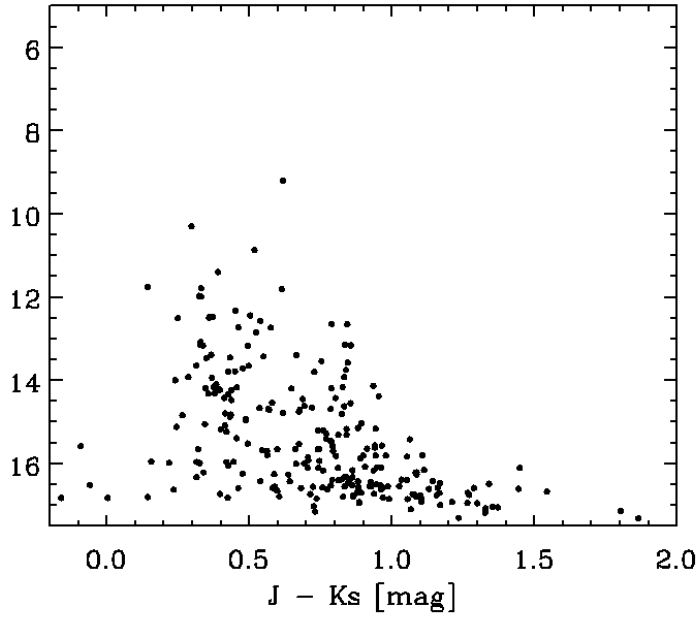
Two Micron All Sky Survey (2MASS) data

M67 field vs a Galactic field



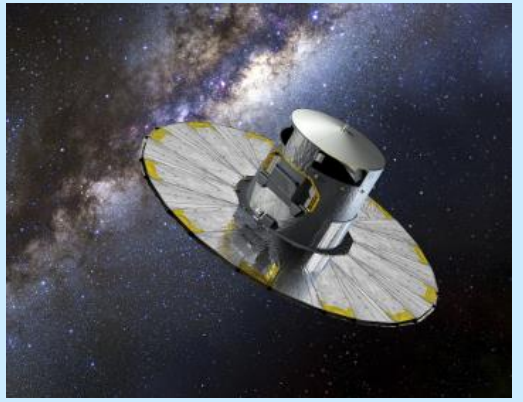


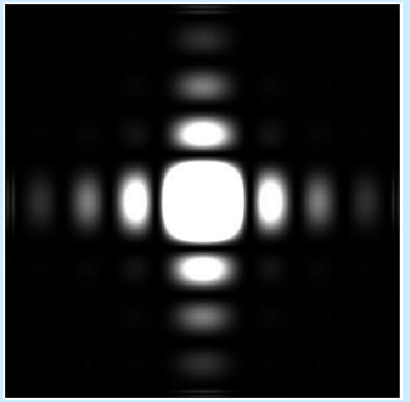




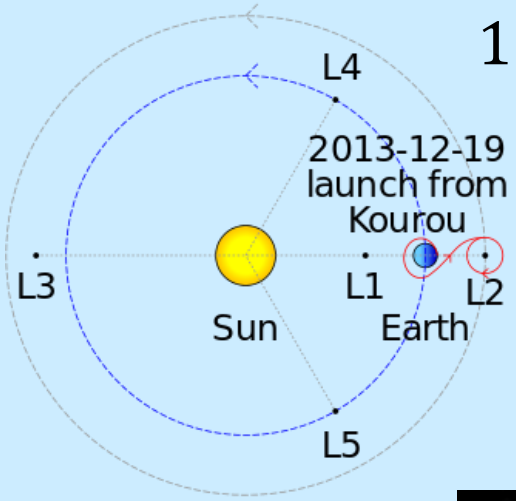
Gaia (Space Telescope)

- ✓ 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

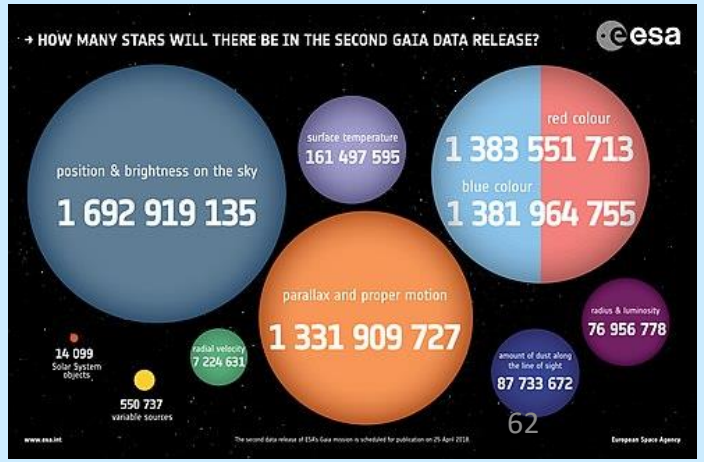




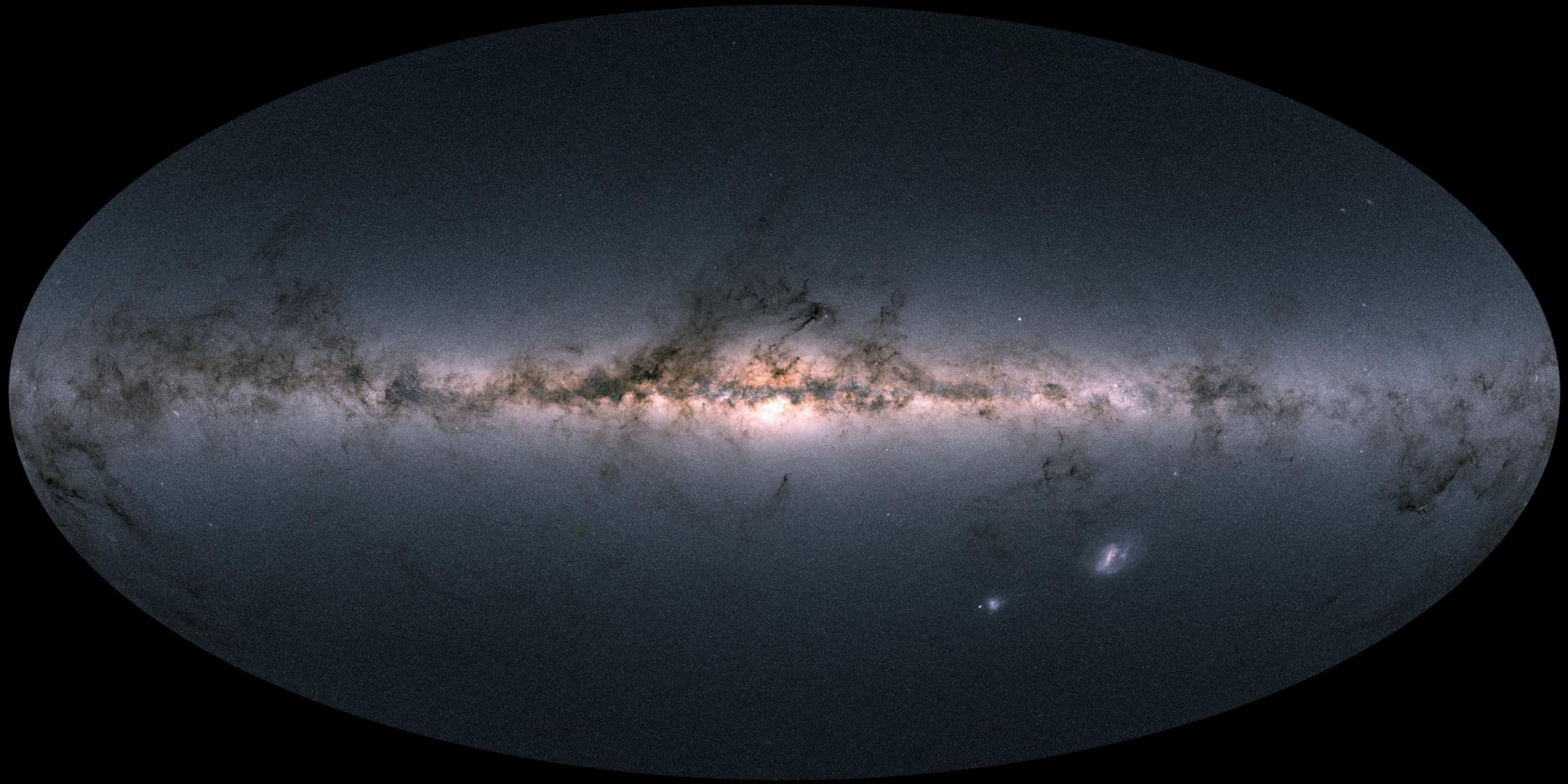
1.45 m × 0.5 m primary



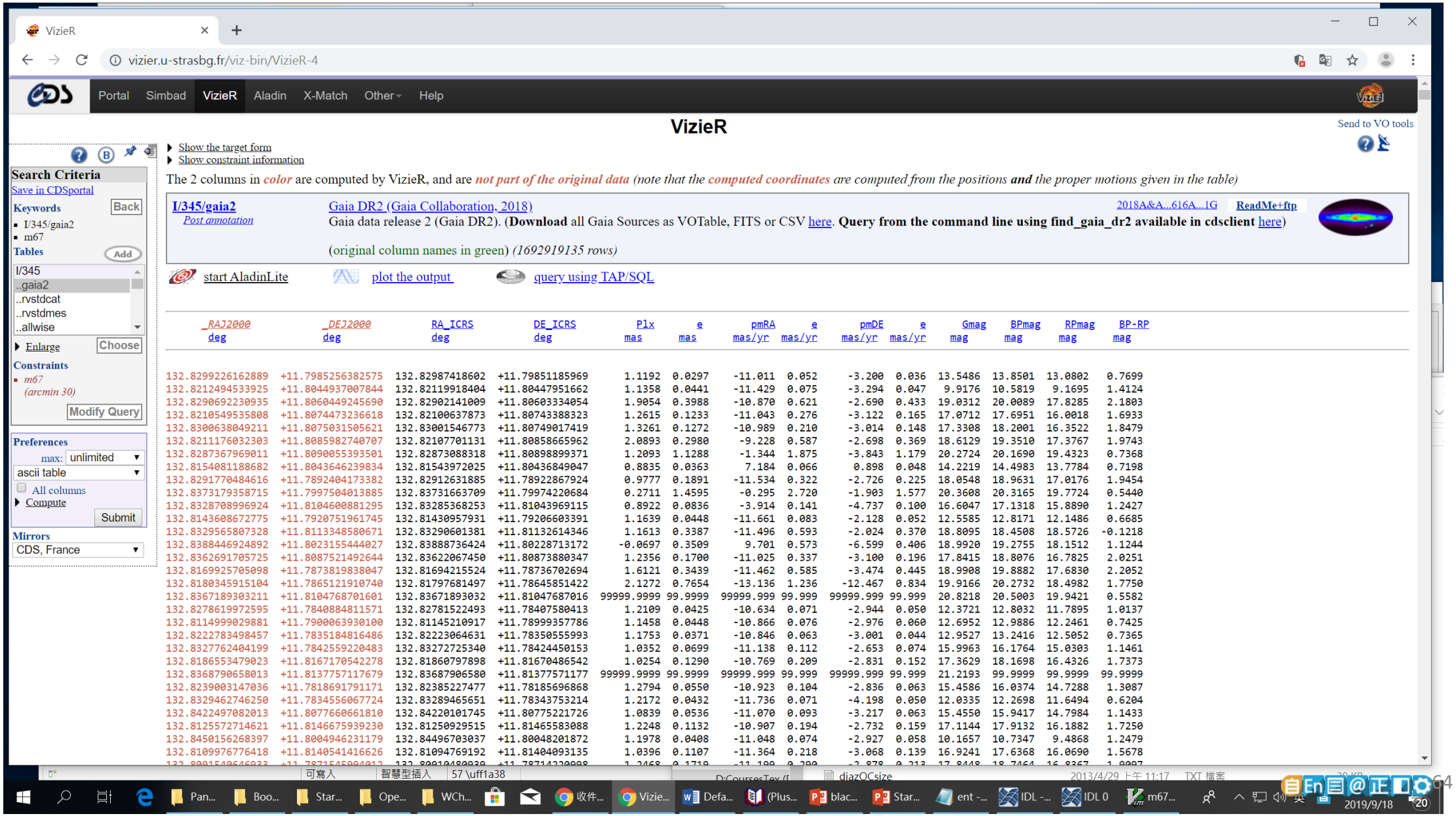
Orbit @Sun-Earth L2



Gaia's Sky in Color



Gaia data vizier and the cross-match tool

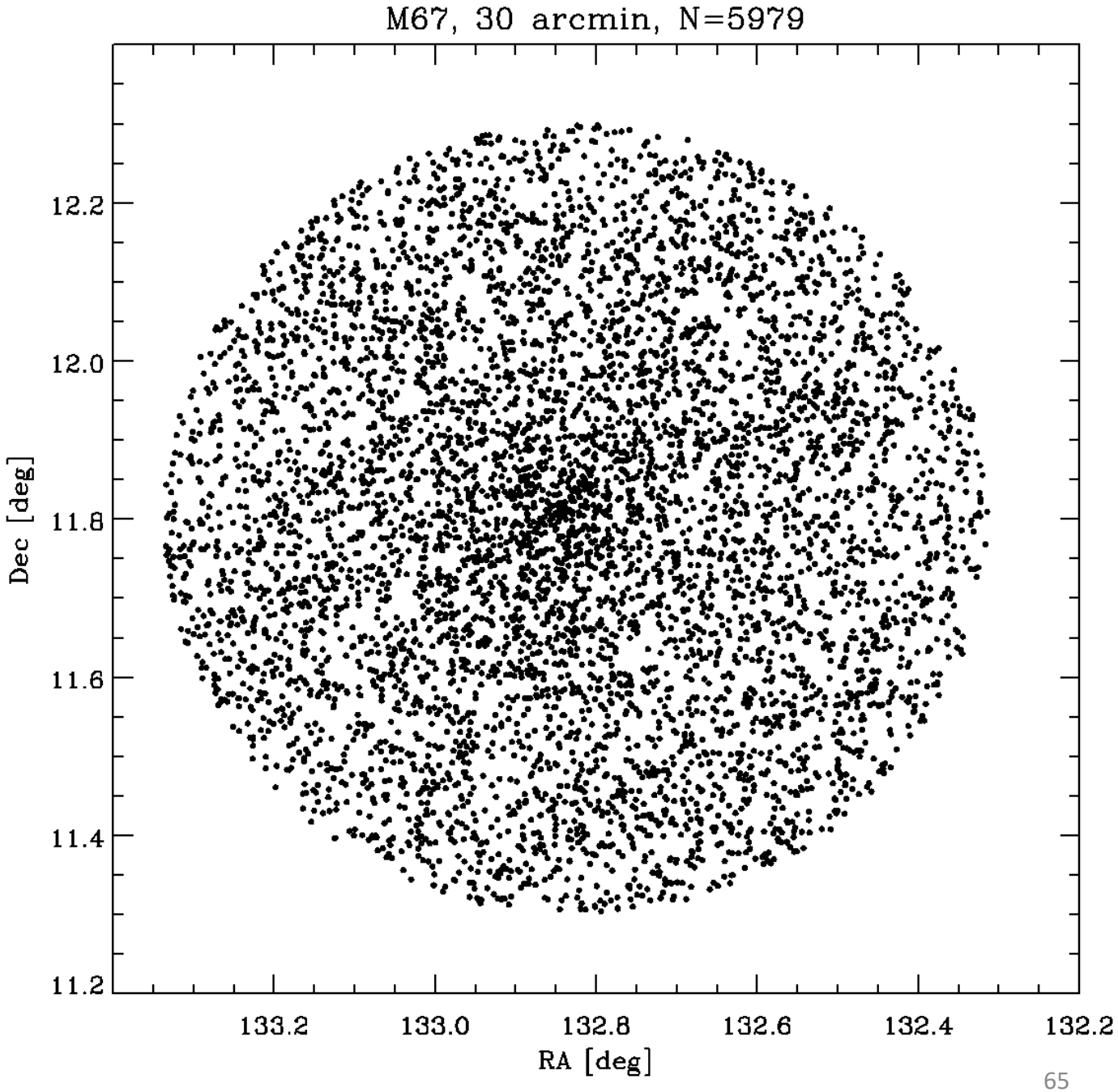


Gaia positions

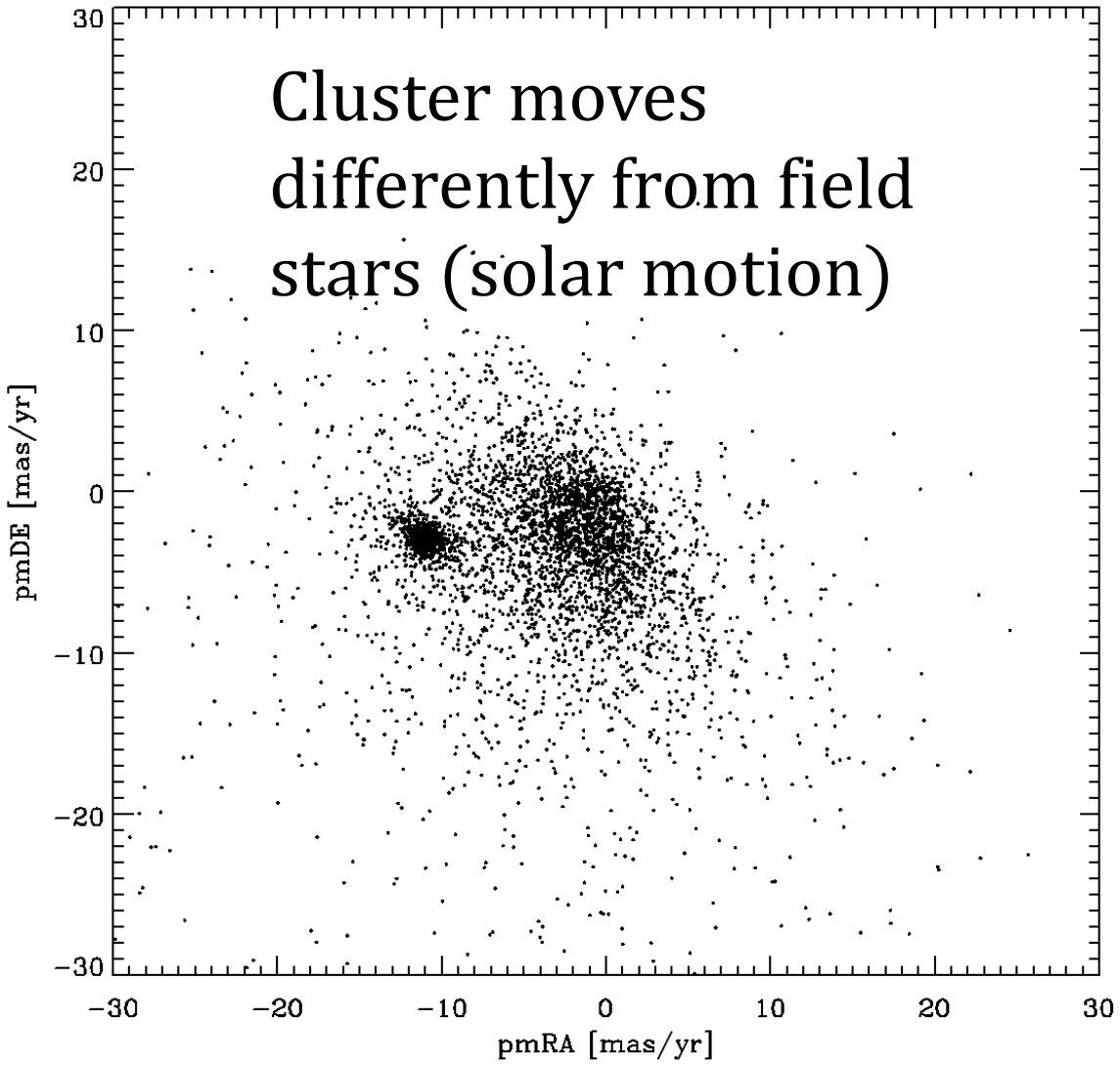
All stars within 1 deg field …

Concentration at center (the cluster) obvious

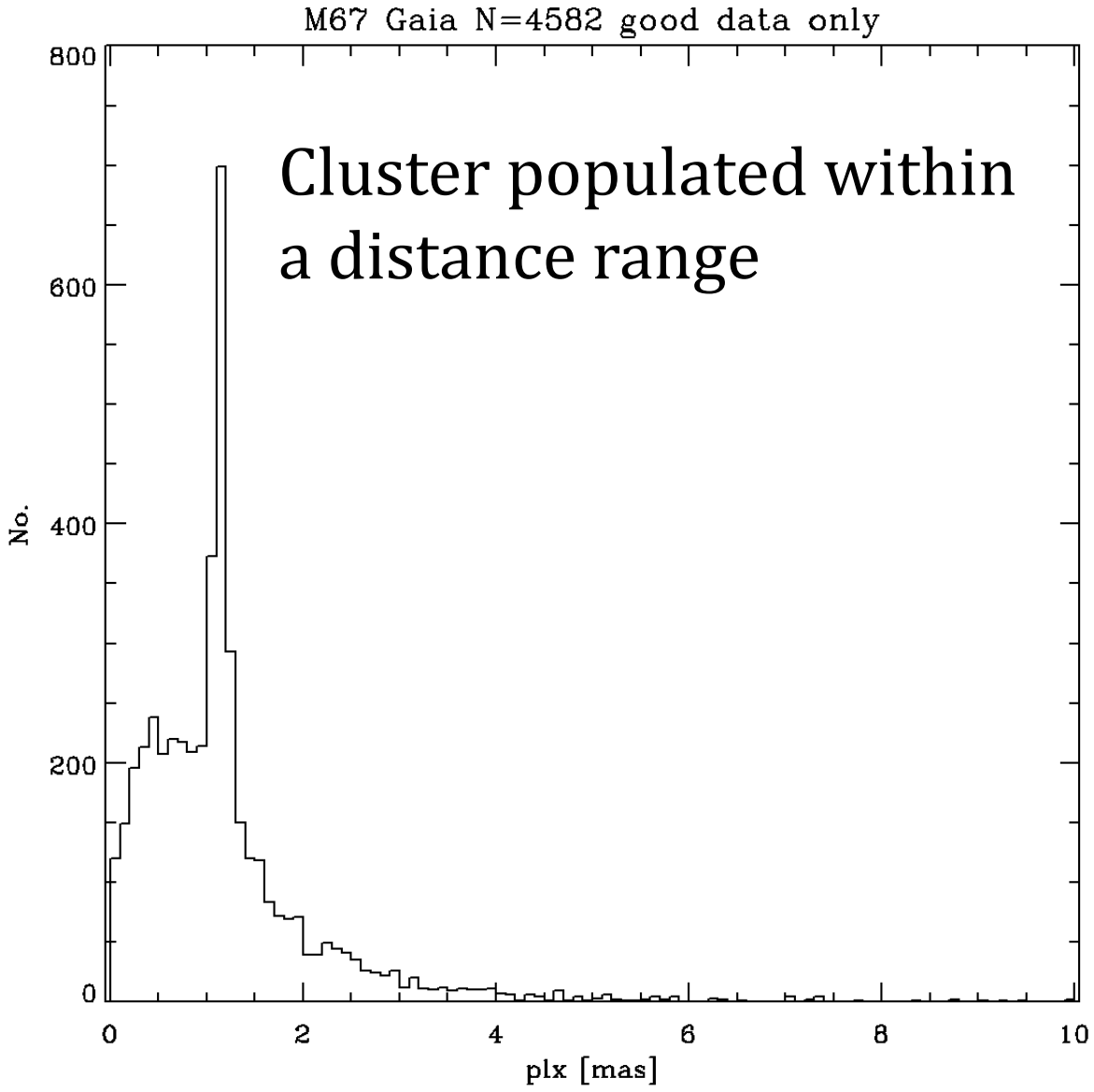
Extended shape?



Gaia proper motions

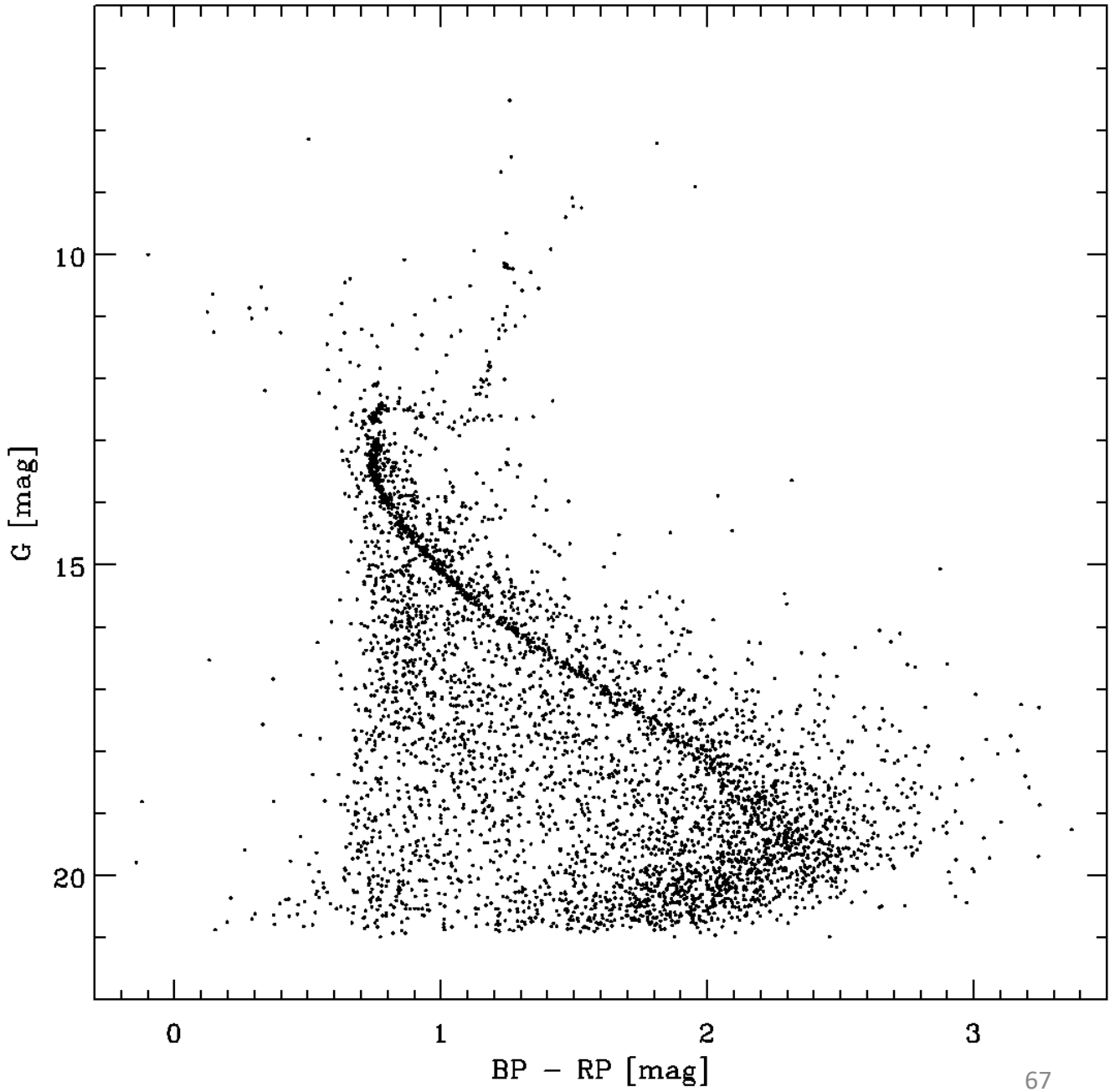


Gaia parallaxes



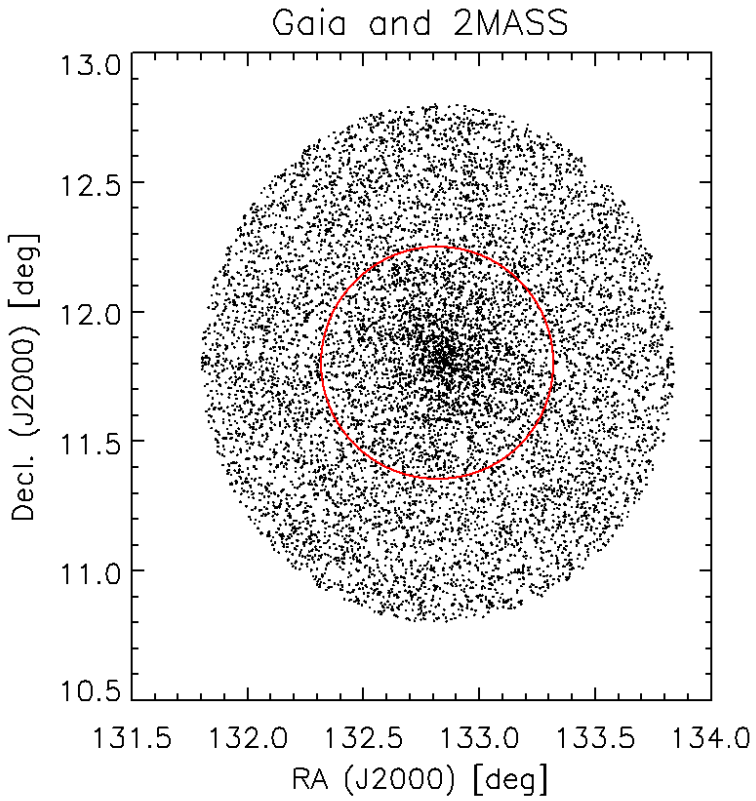
Gaia CMD

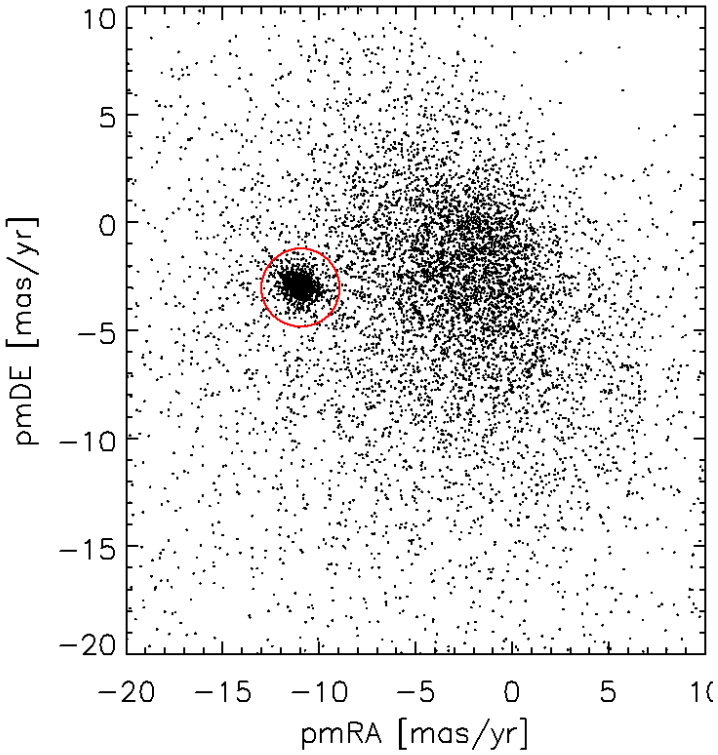
The cluster sequence stands out clearly in the CMD, though there are many contaminations, i.e., non-members.

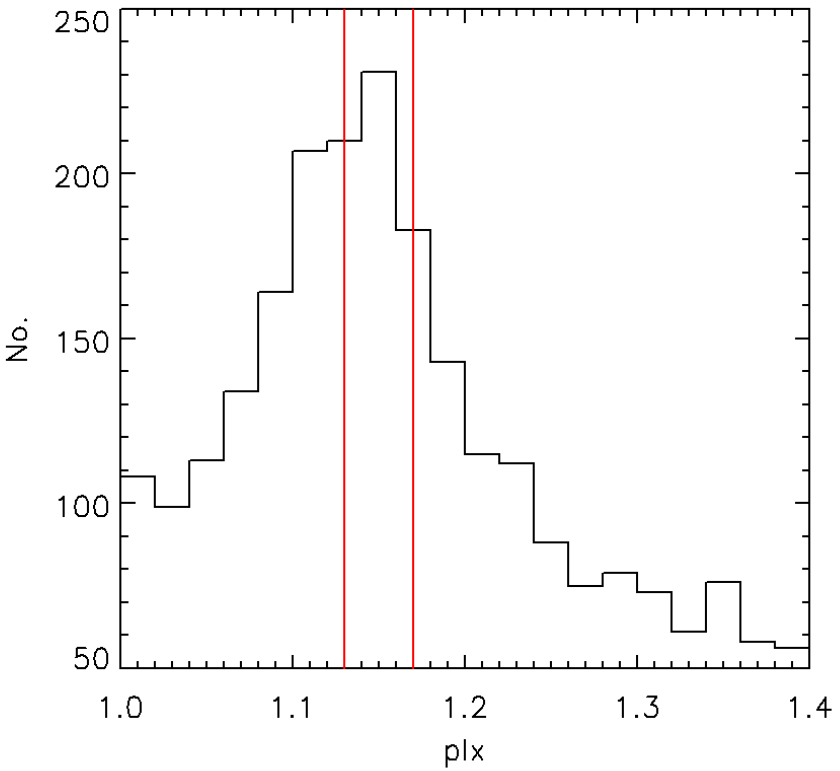


With some preliminary selection criteria in sky coordinates, proper motion, and parallax …

```
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 )
```



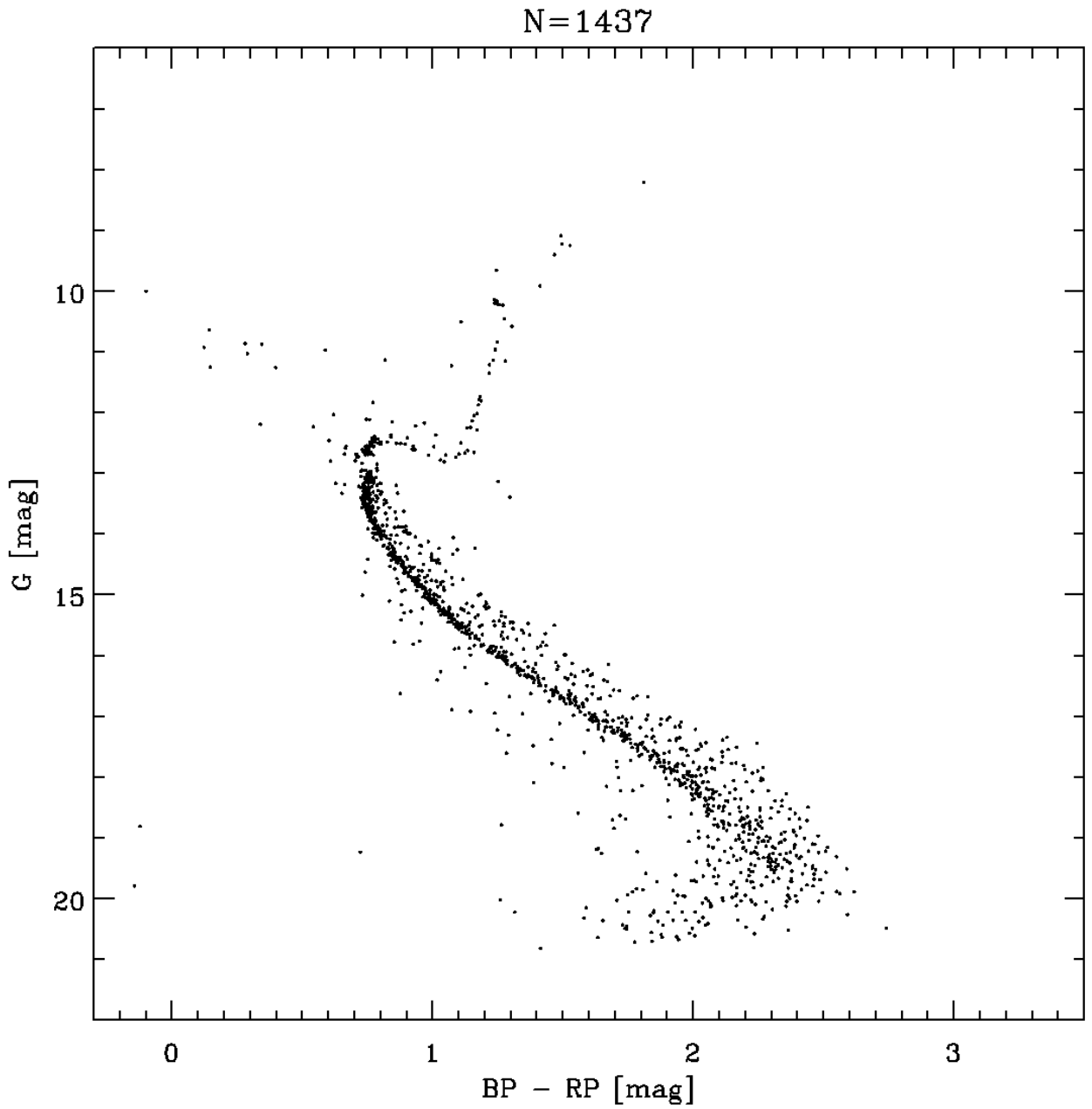


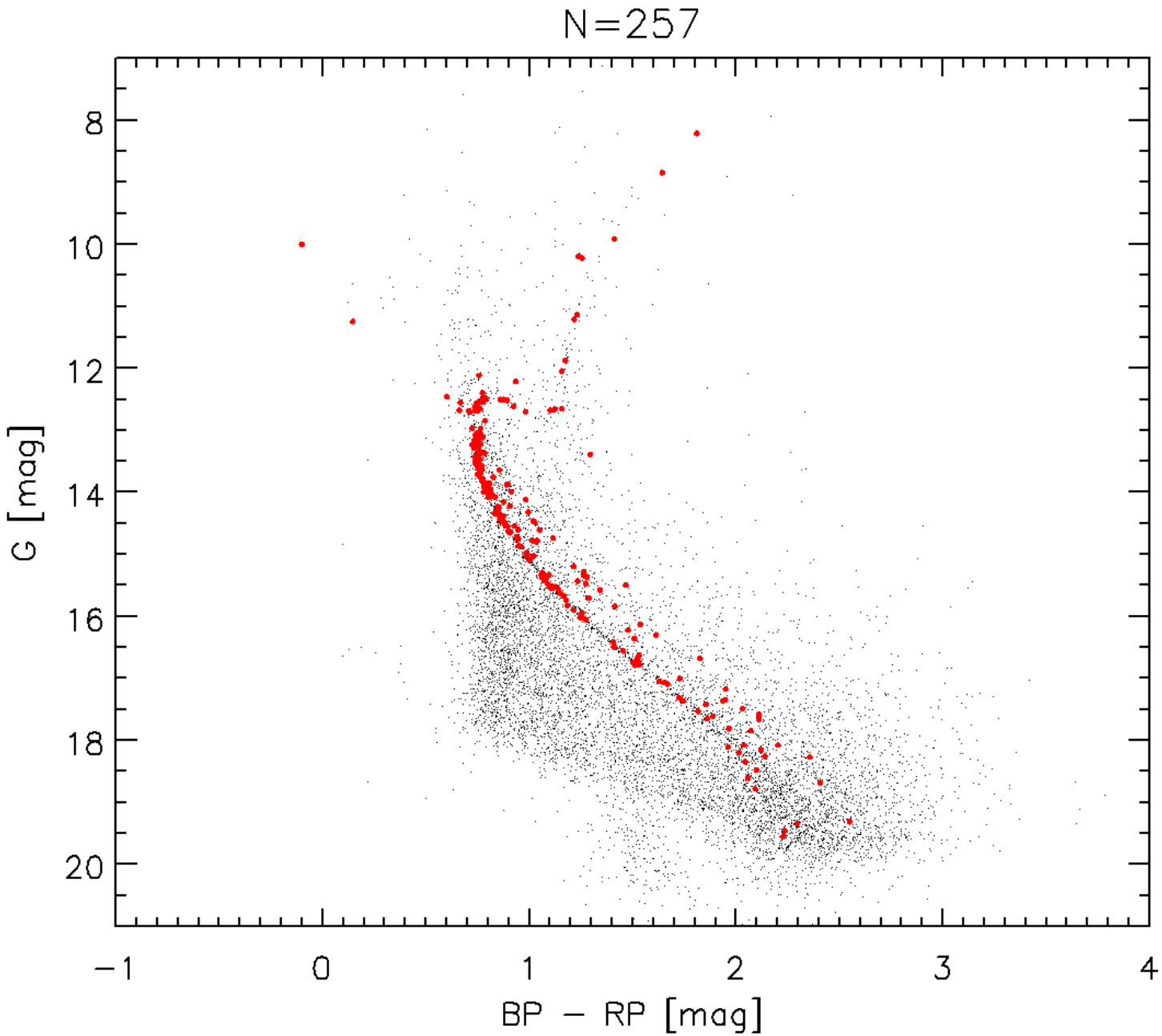


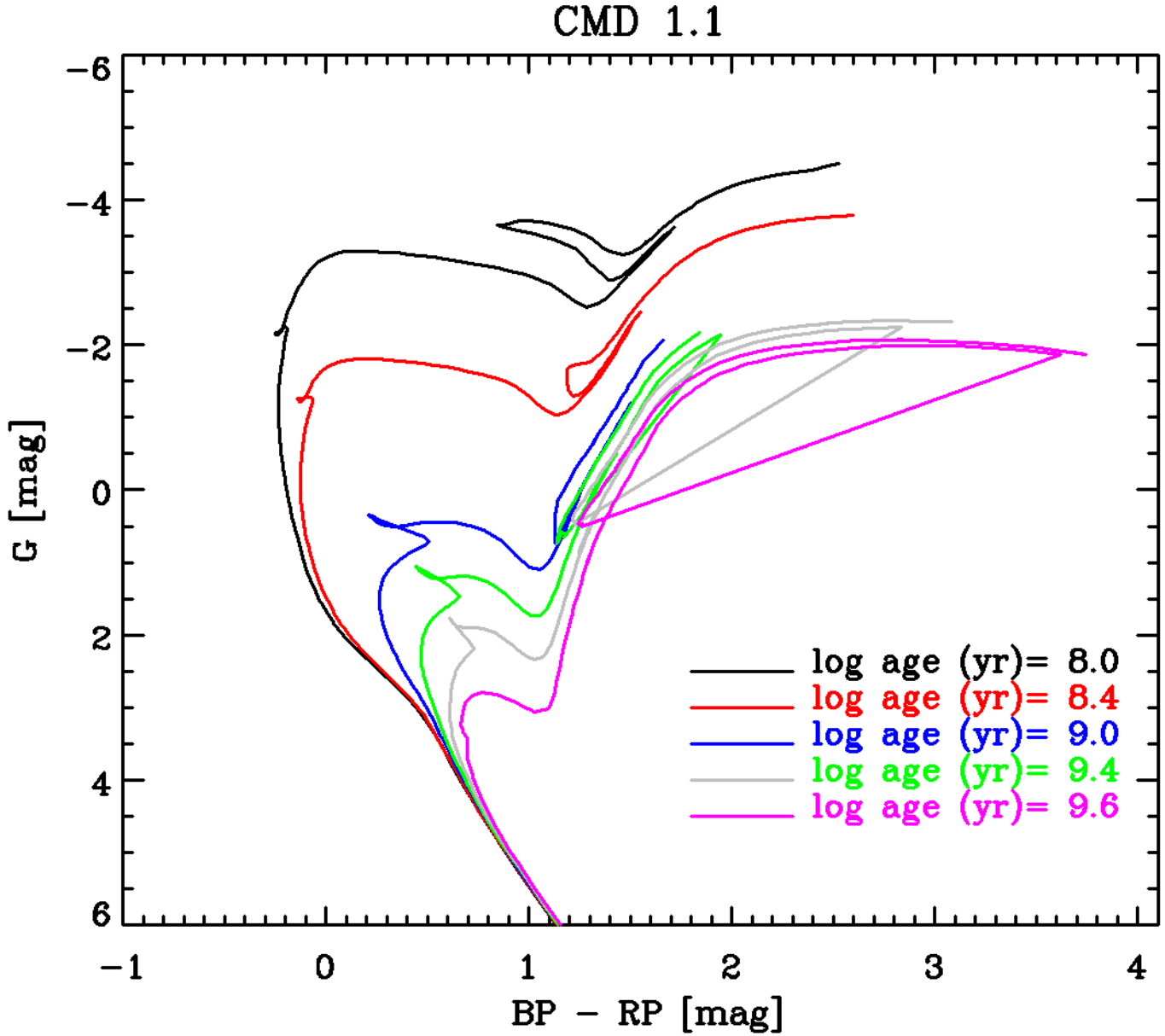
plx(max)=1.15 → d=870pc

Iterative membership selection

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




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


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

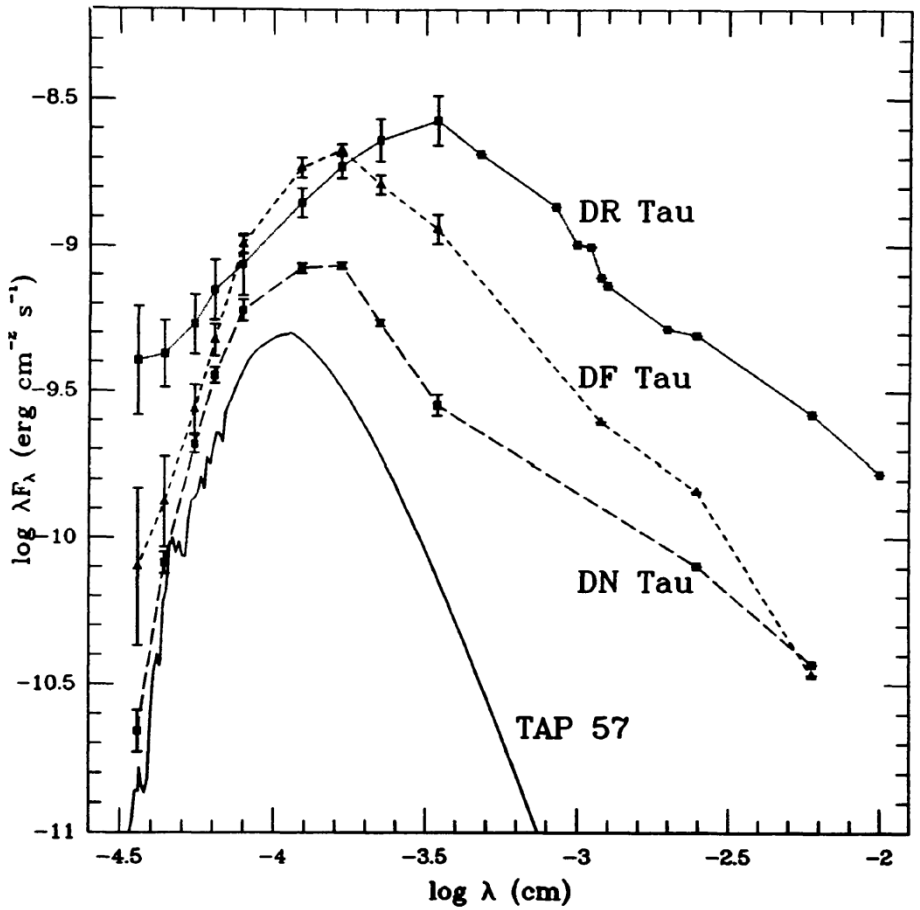


Figure 3 Observed spectral energy distributions from 3600 Å to 100 μm of the stars whose spectra are shown in Figure 2. The energy distribution of the K7V WTTS TAP 57, shown as a solid line, has been displaced downward by 0.3 dex. The filled symbols are simultaneous (for DN Tau and DF Tau) or averaged (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

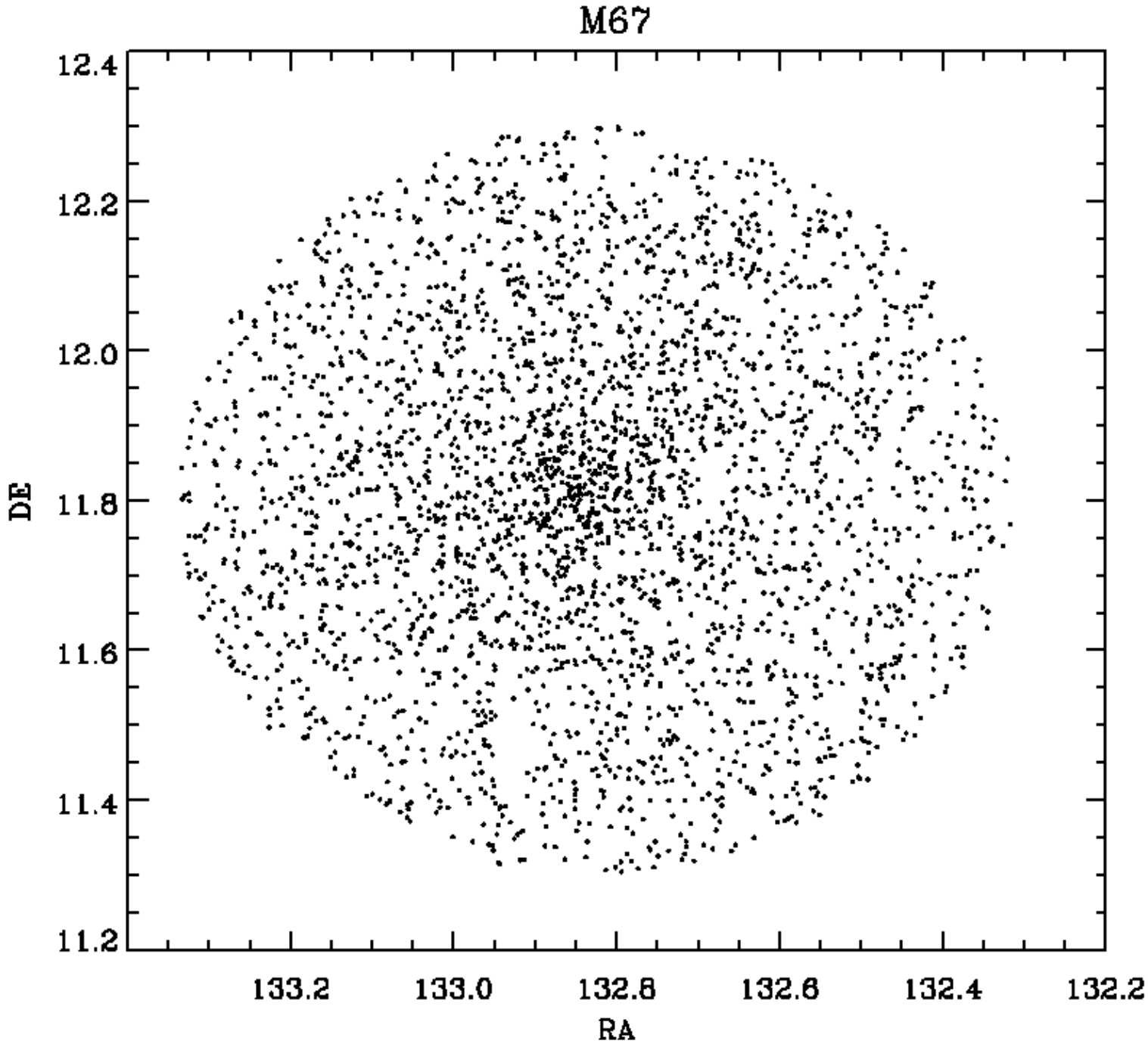
✓Gaia eDR3（選擇下載「需要」的參數）

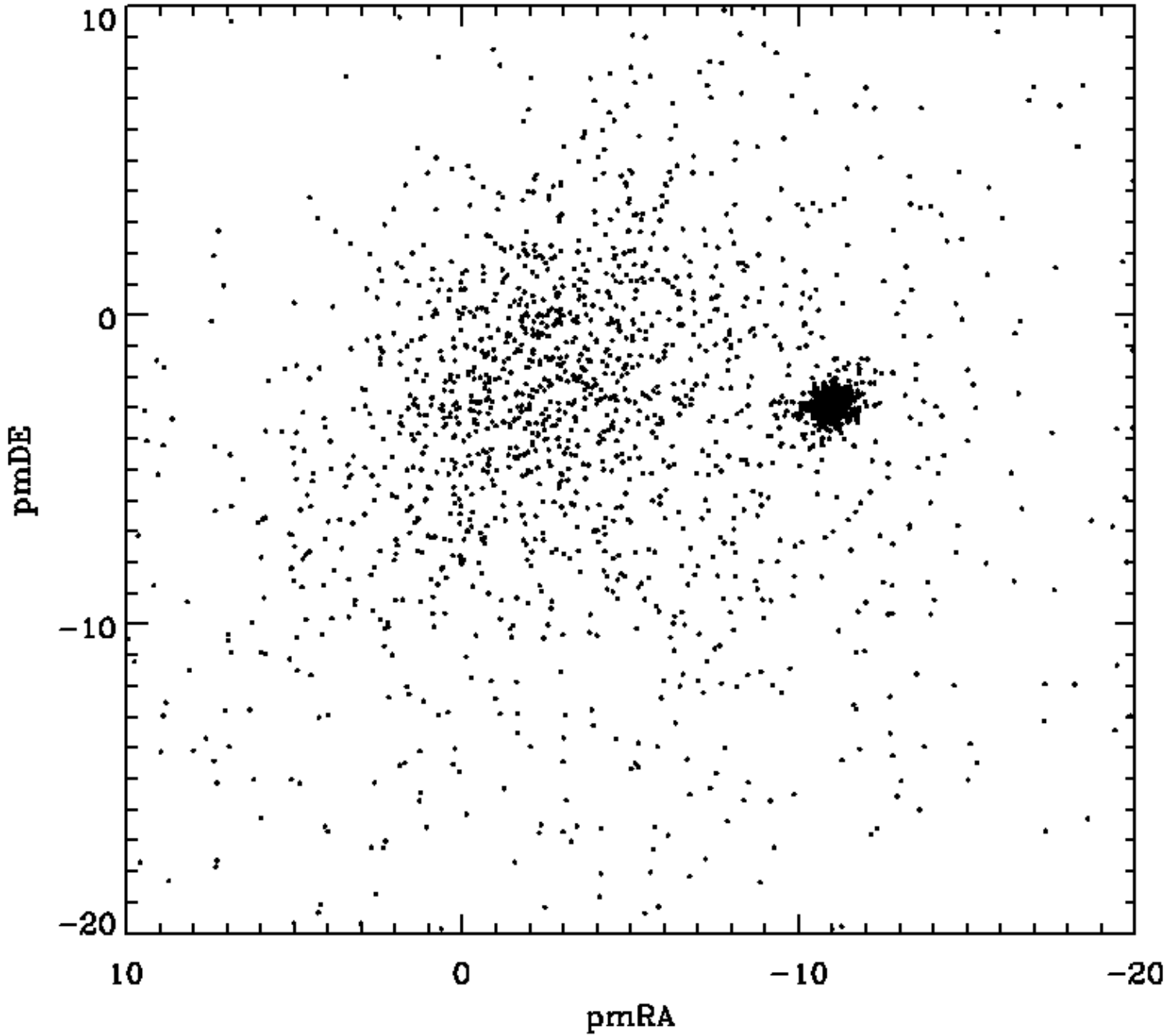
✓ 先少量，然後無限制、999 filled，可以下載道 CDSportal

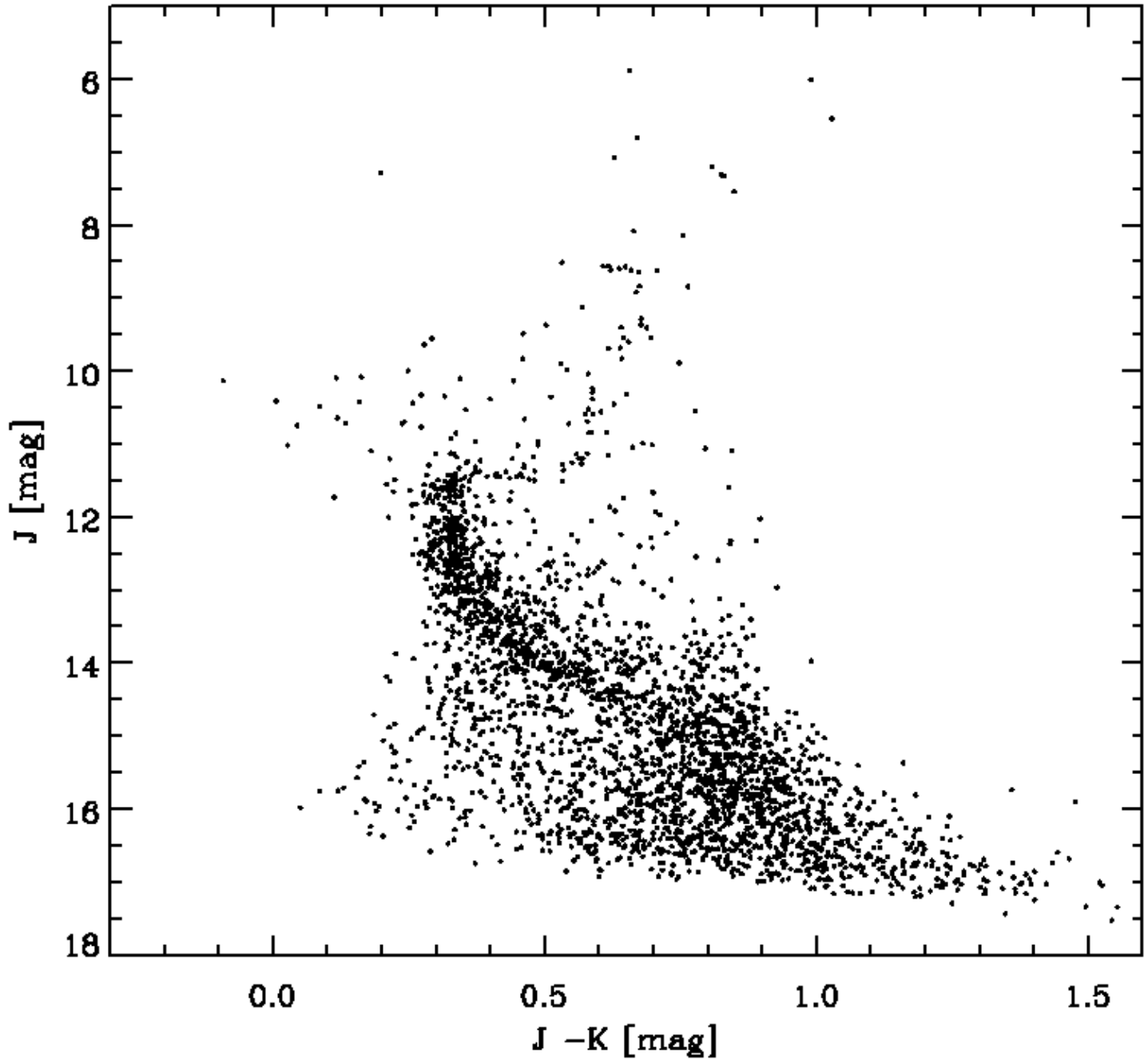
✓2MASS data, 同樣天區

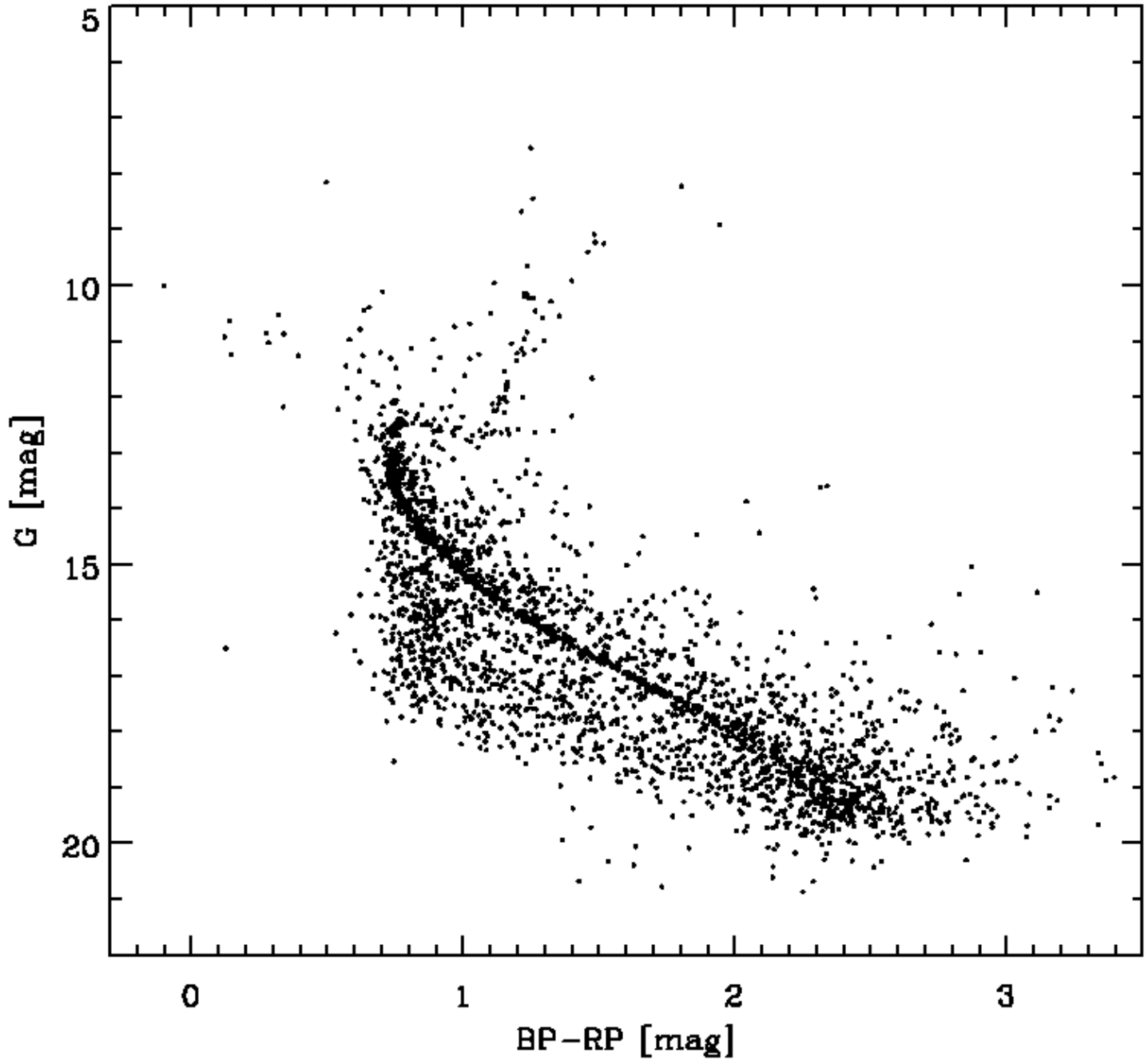
✓Cross-match 結合兩個目錄，也就是同樣一顆星有兩筆數據庫的資料

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


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


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
G [mag]
0
1
2
3
BP−RP [mag]