

Finder Charts for the Northern High Mass X-Ray Binary Photometry Project

Gordon E. Sarty, e-mail: gordon.sarty@usask.ca

June 22, 2005

Finder charts for 15 northern objects taken from Liu *et al.* [1] are given in the following pages. These objects were chosen because they are northern hemisphere high mass X-ray binaries (HMXB) with unknown orbital periods. The information as given by Liu *et al.* appear in Table 1. The HMXBs are given LPH numbers after the authors of [1]. The catalogue is available electronically at:

<http://vizier.u-strasbg.fr/cgi-bin/qcat?J/A+AS/147/25>

Note that LPH130 has a known period. This star could be monitored as a check on period finding algorithms.

Each chart consists of a DSS image (or for brighter objects, an AAVSO chart) for the identification of the high mass x-ray binary object in a CCD image plus reference star data taken from the SIMBAD database. *Note that the reference stars are not necessarily good comparison stars.* Indeed some are known variables. The reference stars simply represent the available SIMBAD information about the fields given. The identification of each reference star was confirmed by plotting a DSS image centered on the coordinates given by SIMBAD. The determination of a good set of comparison stars is yet to be done.

On the reverse of each finder chart (these charts are meant to be printed double sided) is a visual finder chart produced using the `starchart` software. The visual chart is produced for reference only for broader orientation.

object number	name	other name	RA	DEC	V	B-V	U-B
LPH012	0053+604	γ Cas	00 53 40.3	60 26 47	1.6 - 3.0	-0.15	-1.08
LPH029	J0146.9+6121	LS I+61°235	01 43 32.6	61 06 26	11.33	0.82	-0.39
LPH032	0352+309	X Per	03 52 15.1	30 54 01	6.0 - 6.6	0.29	-0.82
LPH033	J0421+560	CI Cam	04 19 46.0	55 59 24	9.25	1	-0.04
LPH034	J0440.9+4431	BSD 24 - 491	04 40 59.9	44 31 51	10.78	0.61	-0.36
LPH040	0521+373	HD 34921	05 19 10.7	37 37 44	7.51	0.14	-0.86
LPH057	0556+286	HD 249179	05 52 44.3	28 46 41	9.2		
LPH058	J0635+0533		06 35 17.4	05 33 20.9	12.83	+0.98	
LPH115	1936+541	DM+532262	19 31 42.6	53 46 12	9.8		
LPH117	1947+300		19 47 36.3	30 04 54	14.2	0.9	-0.3
LPH123	J2030.5+4751	SAO 49725	20 30 30.6	47 51 46	9.27	0.38	-0.65
LPH127	2202+501	SAO 51568	21 59 44.1	49 55 35	8.8		
LPH128	2206+543		22 06 07.4	54 16 23	9.9	0.2	-0.6
LPH129	2214+589	GG3 71	22 24 47.8	60 58 59	11		
LPH130	J2239.3+6116		22 39 20.90	61 16 26.8	15.4	1.4	

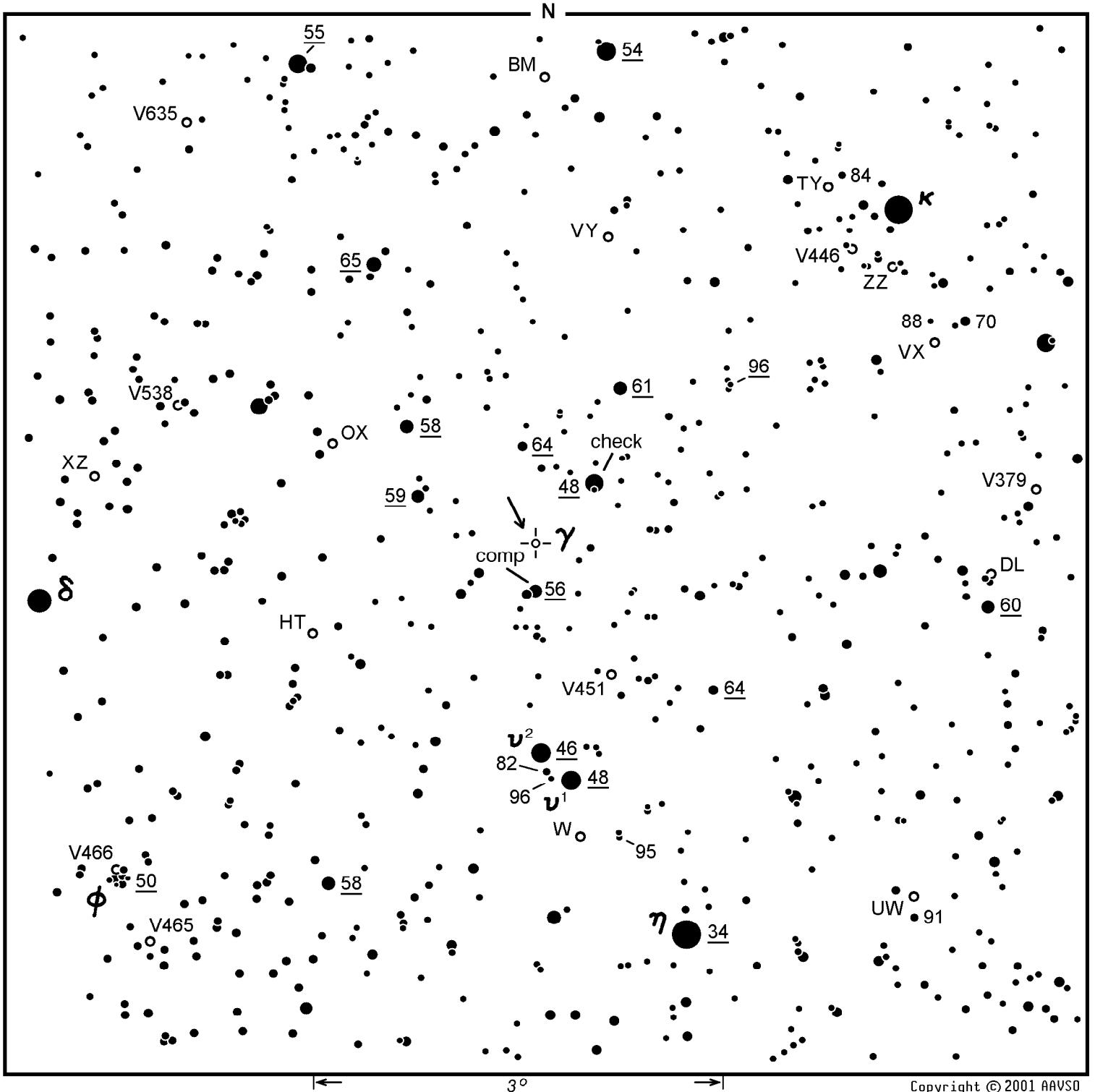
Table 1: List of high mass x-ray binaries taken from Liu *et al.* [1].

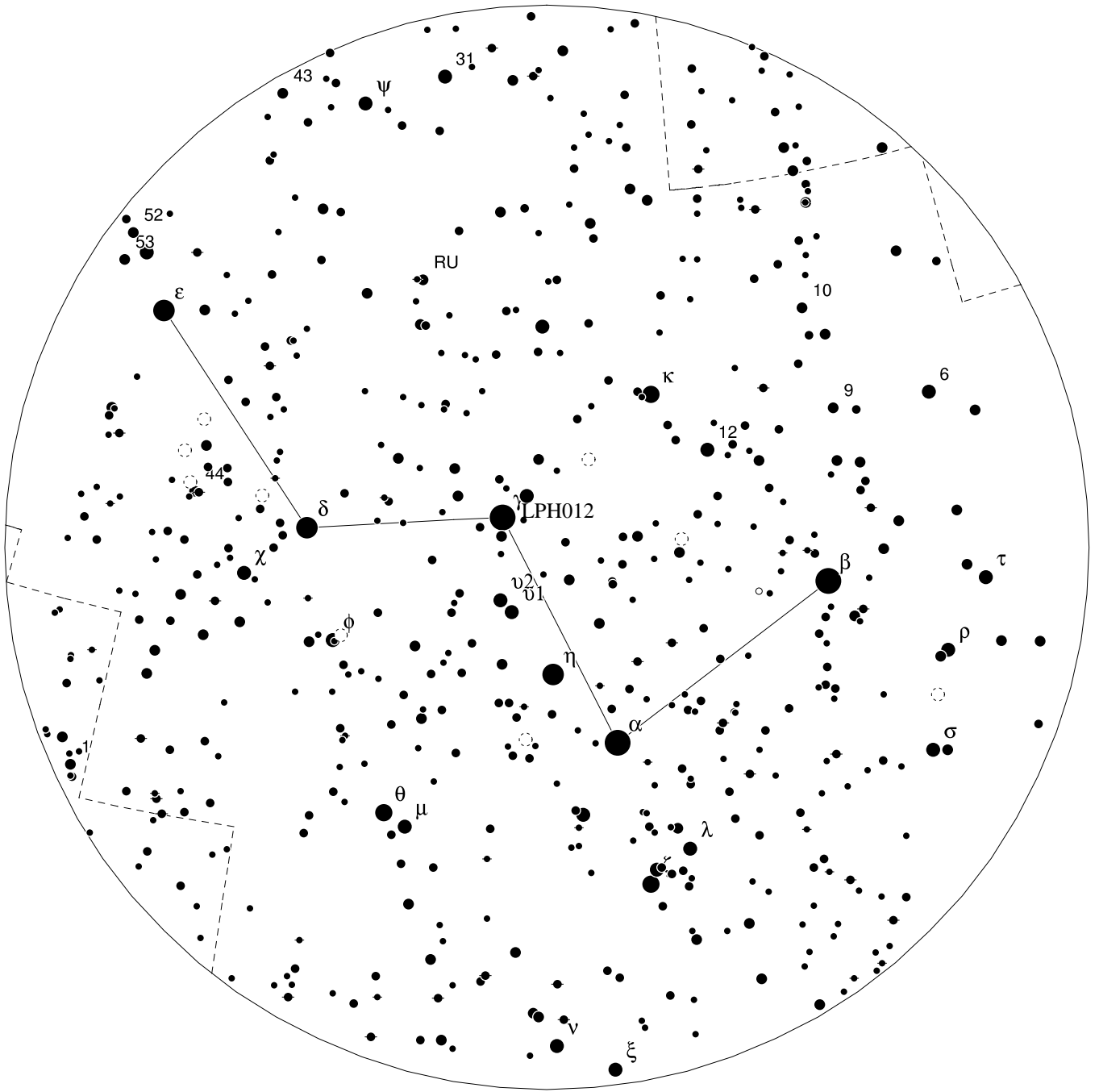
References

- [1] Liu QZ, van Paradijs, van den Heuvel. *Astron. Astrophys. Suppl. Ser.* 147:25-49 (2000)

AAVSO Photoelectric Photometry Chart

STAR	COORDINATES	TYPE	MAX - MIN	SPECTRUM	S.A.O. #
gamma Cas	(1900) 00 ^h 50 ^m 40 ^s +60° 10'5"	GCas	1.6 - 3.0(V)	B0.5 IVPE	011482
0050+60	(2000) 00 56 43 +60 43.0				
Comparison	(2000) 00 56 47 +60 21.8		5.55(V)	B9IV	011484
Check	(2000) 00 53 04 +61 07.4		4.82(V)	F8V	011444

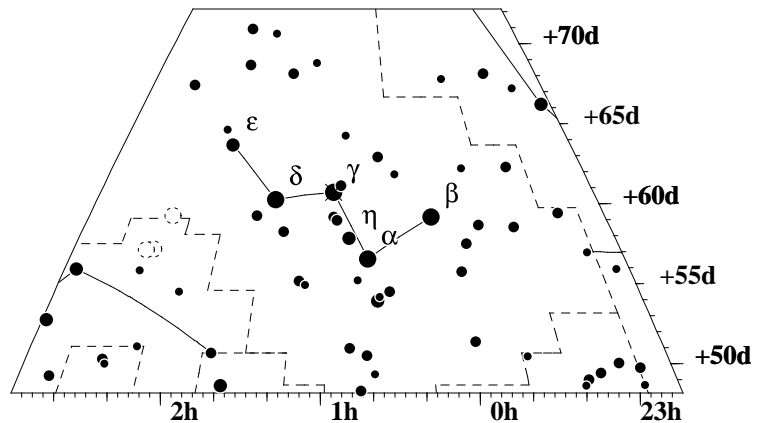




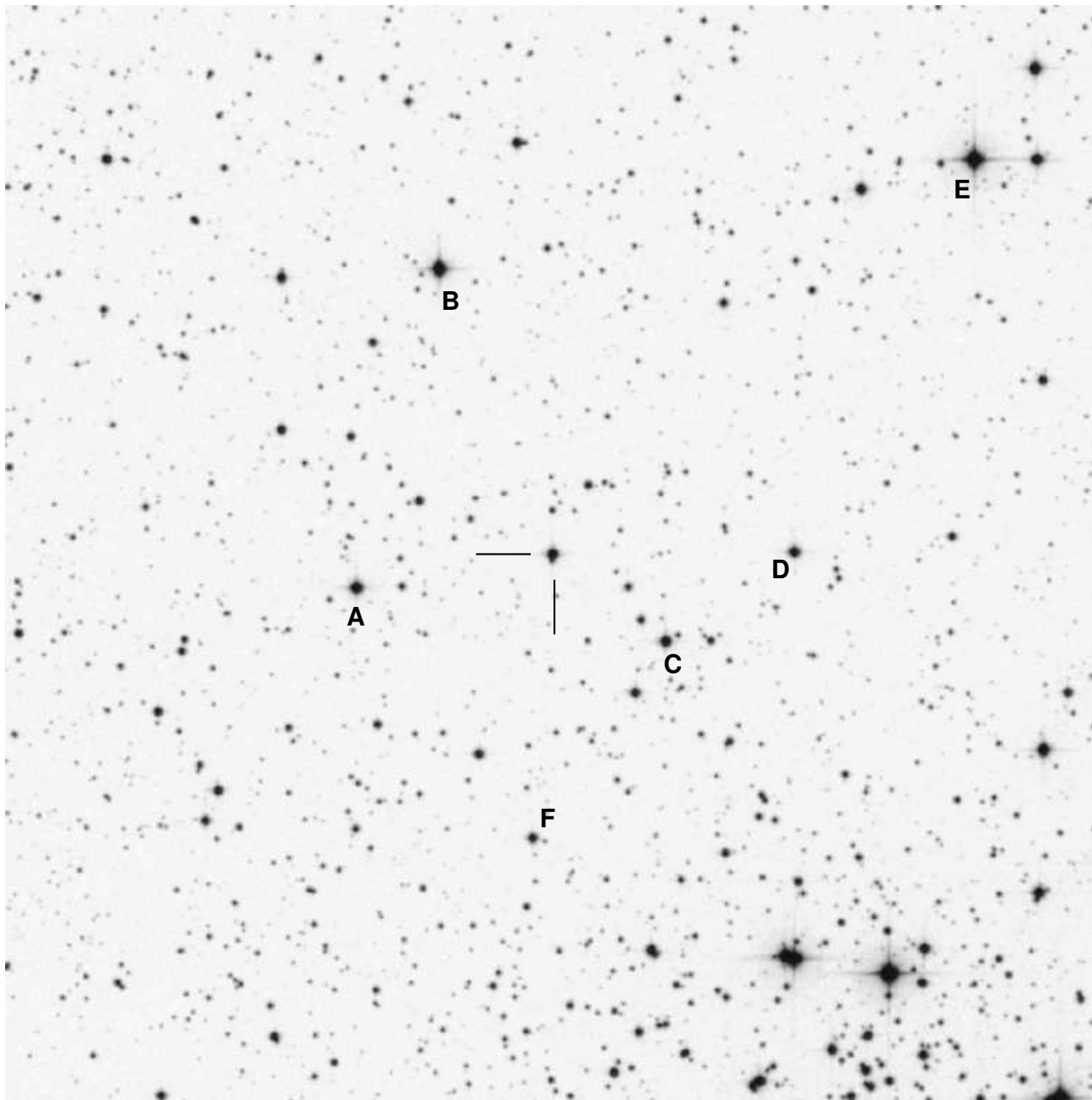
0053+604 (gamma Cas) (LPH012)

(0h50m,+60d10m lim: 8.0)

- | | | |
|-----|-----|-----|
| ● 1 | ● 2 | ● 3 |
| ● 4 | ● 5 | ● 6 |
| ● 7 | ● 8 | |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ● double | ○ variable |
| ⊖ Cluster | × Asteroid | ☾ Comet |
| ◇ Nebula | ⊙ Globular | ○ Open |
| ◆ Galaxy | ♁ Planetary | ◇ Diffuse |
| ? | ● Elliptical | ⊙ Spiral |
| | ⊗ Other | ★ Quasar |



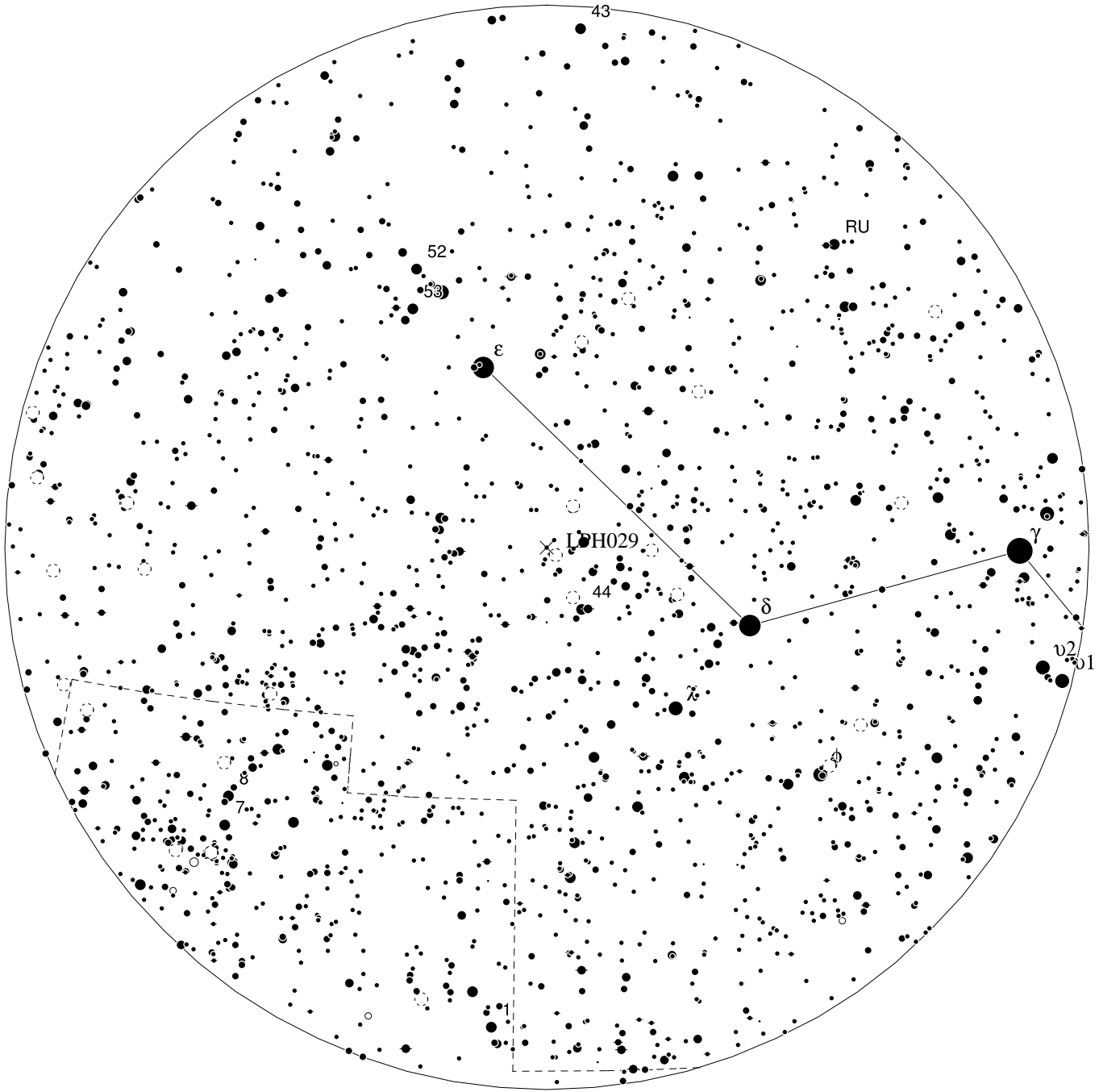
J0146.9+6121 (LS I+61°235, V831 Cas) (LPH029)



J0146.9+6121: $01^h47^m00^s.17 +61^\circ21'23''.7$ (J2000) $V=11.33$, $B-V=0.82$
15m ($1/4^\circ$) sq field — North up. In Cassiopeia (in NGC 663), Uranometria 16.
Position from: SIMBAD

Reference star data from SIMBAD

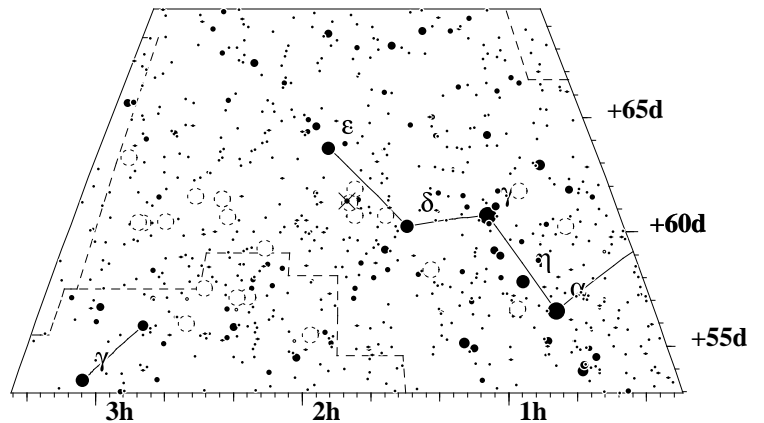
Ref Star	ID	RA	Dec	B	V
A	NGC 663 G 138	01 47 22.69	+61 21 02.5	11.35	10.79
B	BY Cas (Cepheid)	01 47 11.92	+61 25 21.0	11.5	10.41
C	TYC 4032- 1383-1	01 46 47.72	+61 20 08.9	12.26	11.52
D	TYC 4032- 1091-1	01 46 32.63	+61 21 17.9	12.09	11.64
E	SAO 11970	01 46 10.22	+61 26 33.2	9.77	9.11
F	NGC 663 SAN 23	01 47 03.70	+61 17 32.2		12.2



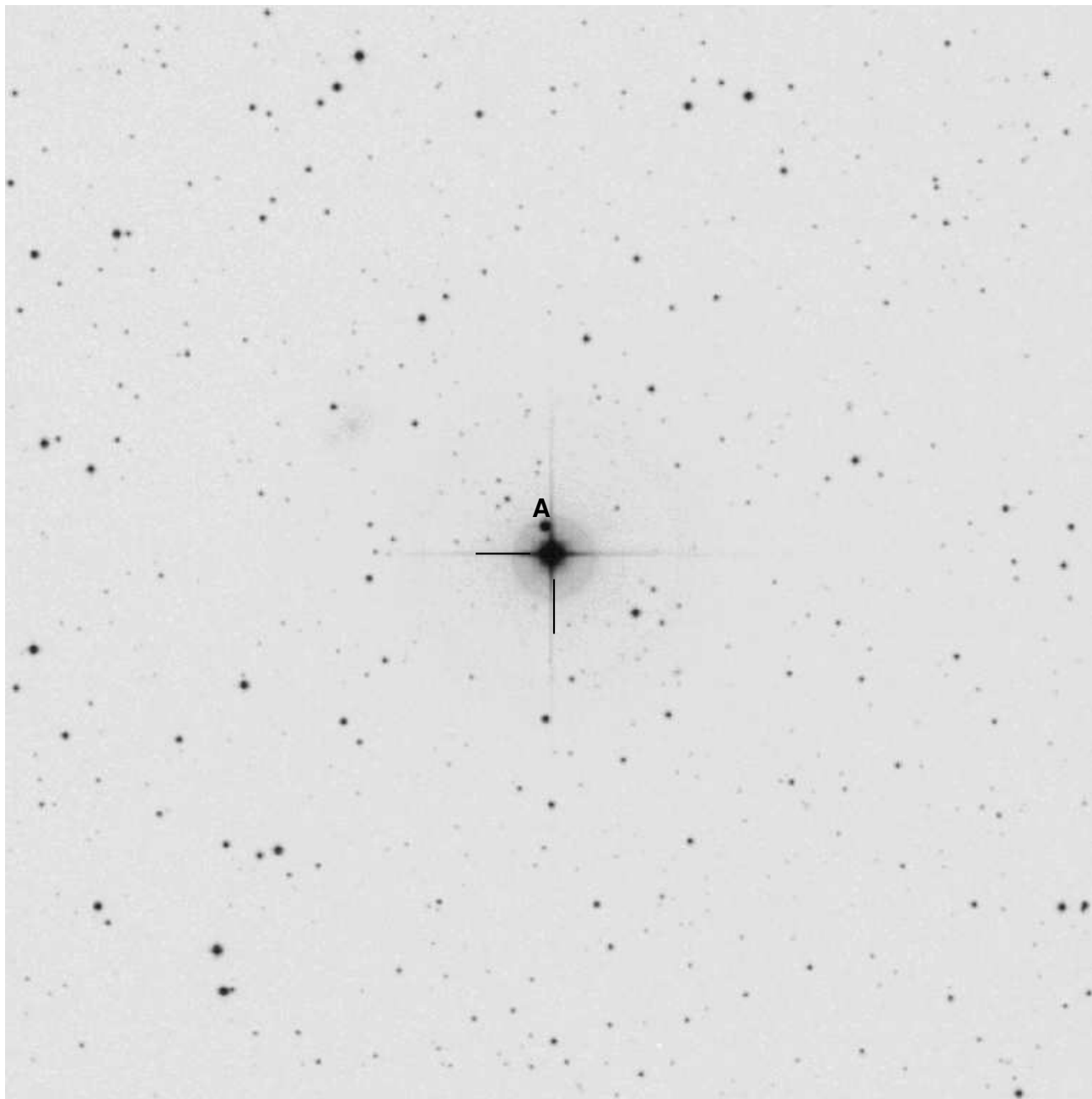
J0146.9+6121 (LPH029)

(1h47m,+61d21m lim: 11.0)

- | | | |
|------|-----|-----|
| ● 1 | ● 2 | ● 3 |
| ● 4 | ● 5 | ● 6 |
| ● 7 | ● 8 | ● 9 |
| ● 10 | | |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | × Asteroid | ○ variable |
| ⊖ Cluster | ⊗ Globular | ⊕ Open |
| ◇ Nebula | ⊕ Planetary | ◇ Diffuse |
| ● Galaxy | ● Elliptical | ● Spiral |
| ⊕ Unknown | ⊗ Other | ★ Quasar |



0352+309 (X Per) (LPH032)



0352+309: $03^h55^m23^s.08$ $+31^\circ02'45''.0$ (J2000) $V=6.0 - 6.6$, $B-V=0.29$

15m ($1/4^\circ$) sq field — North up. In Perseus, Uranometria 95.

Position from: SIMBAD

Orbital Period = 580 days?, 250.3 days?

Reference star data from SIMBAD

Ref Star	ID	RA	Dec	B	V
A	V397 Per	03 55 23.3	+31 03 05	13.03	11.67

0349+30 (aa)

X Per (Persei)

AAVSO

Chart

7/92

Magn. - 6.03 - 7.0V

Period -

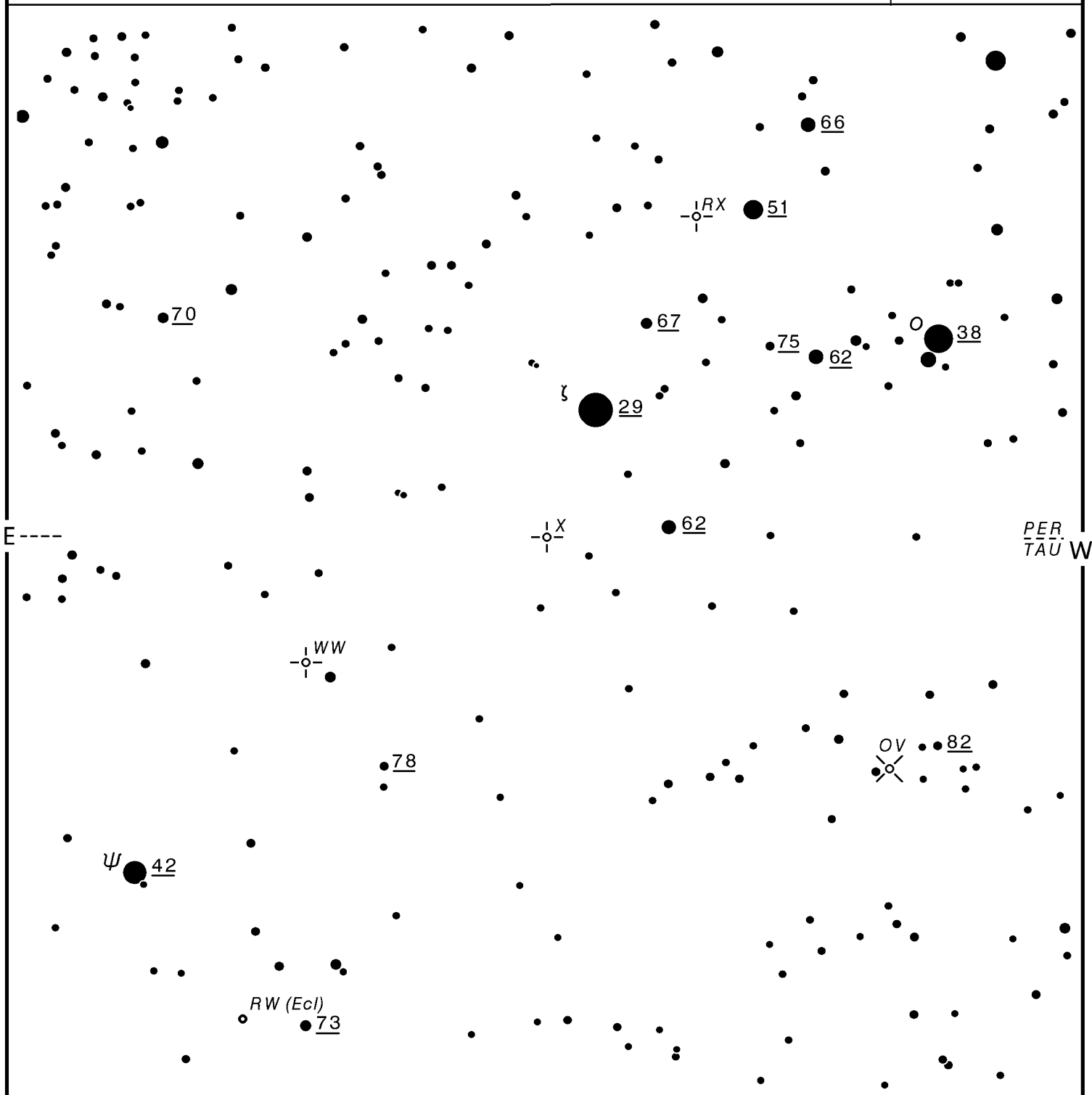
Type - GCas+XP

Spec. - O9.5

(1900) 03^h 49^m 08^s +30° 45'.1

(2000) 03^h 55^m 23^s +31° 02'.7

2.4' = 1mm



Drawn by: CES

From: AAVSO Variable Star Atlas

Sequence: PEP(V), Geneva Obs'y, Grenon et al

S

0411+55

(f) CI CAM (Camelopardalis)

AAVSO
Chart

Magn. - 10.5 - 12.2 (AAVSO)

Period -

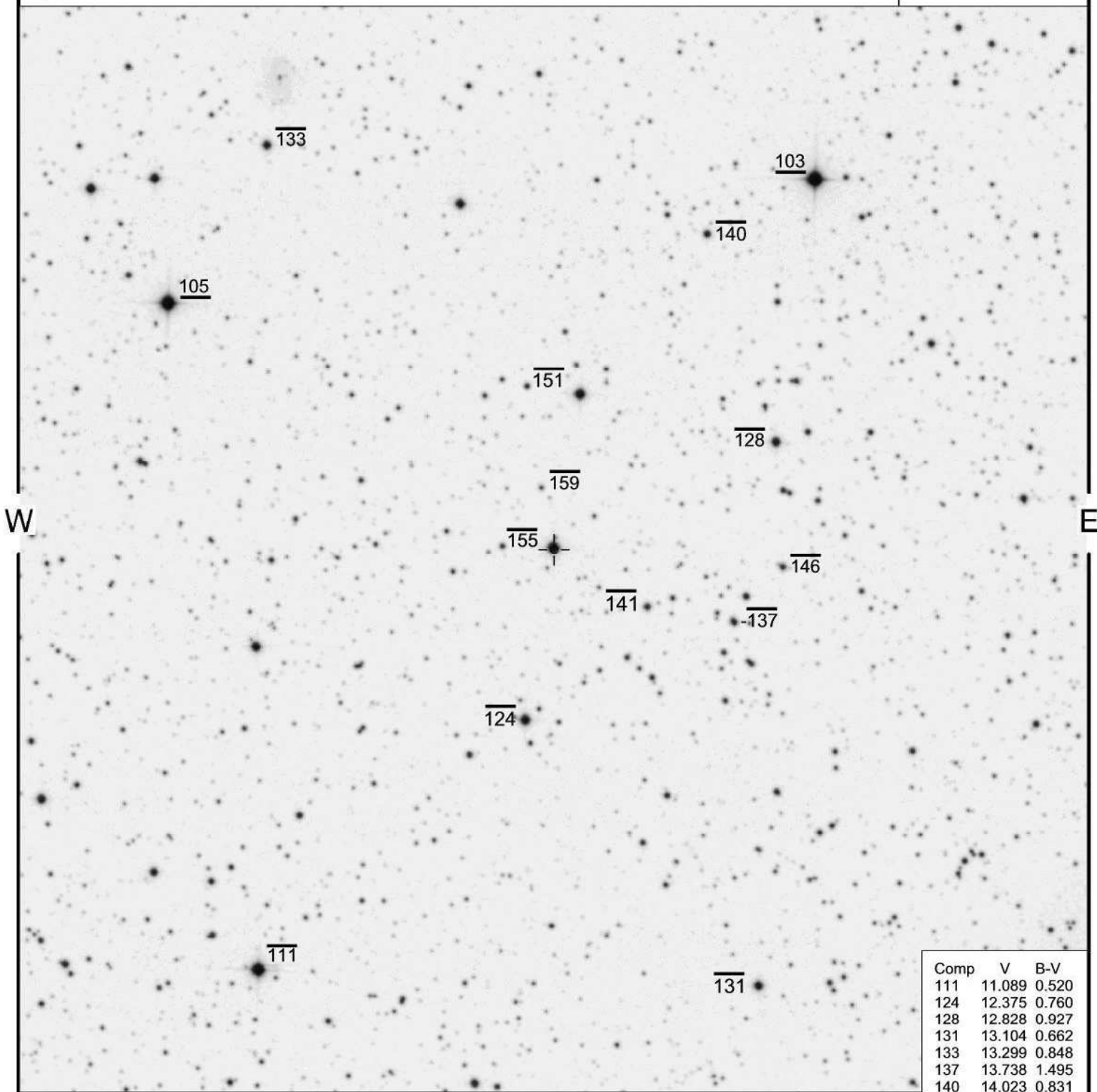
Type -

Spec. - B

(1900) 04^h 11^m 38^s +55° 45.3

(2000) 04^h 19^m 42^s +55° 60.0

020301



Comp	V	B-V
111	11.089	0.520
124	12.375	0.760
128	12.828	0.927
131	13.104	0.662
133	13.299	0.848
137	13.738	1.495
140	14.023	0.831
141	14.141	1.191
146	14.596	1.001
151	15.144	1.194
155	15.477	0.743
159	15.945	1.223

Drawn by: PAH/SXN

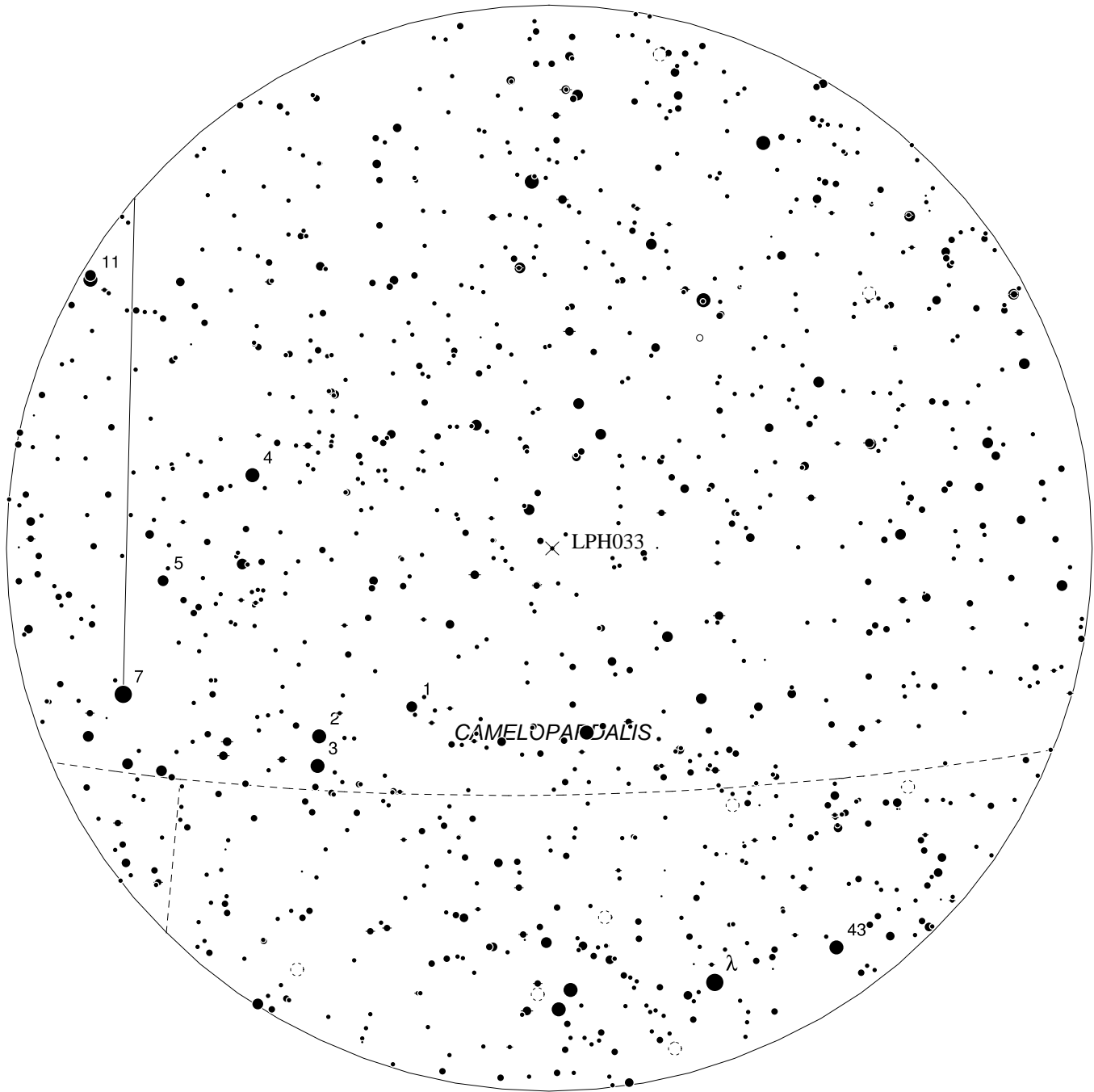
From: DSS

Sequence: CCD(V) A. Henden, USNO & B. Sumner; Tycho-2 Catalogue (V)

<http://charts.aavso.org>; charts@aaavso.org

Typical errors +/- 0.02mag
Visit <http://charts.aavso.org/ccd> for sequence details

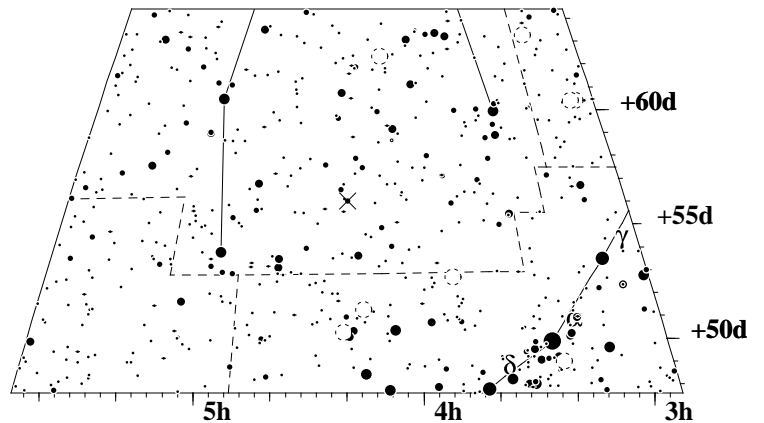
N



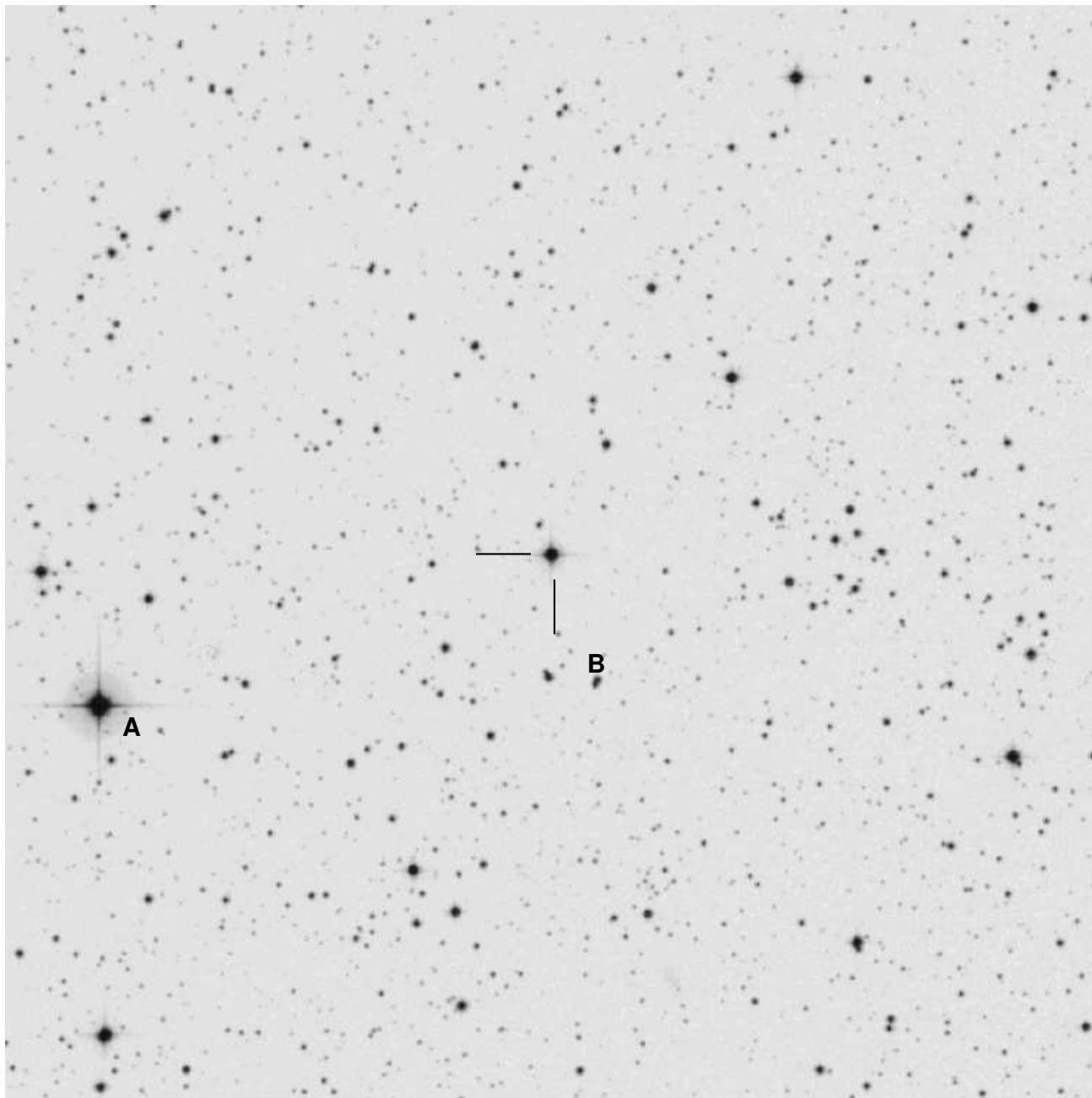
J0421+569, CI Cam (LPH033)

(4h20m,+56d lim: 11.0)

- | | | |
|-----|------|-----|
| ● 3 | ● 4 | ● 5 |
| ● 6 | ● 7 | ● 8 |
| ● 9 | ● 10 | ● 8 |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ● double | ○ variable |
| ⊙ Cluster | × Asteroid | ☄ Comet |
| ◇ Nebula | ⊛ Globular | ○ Open |
| ◆ Galaxy | ♁ Planetary | ◇ Diffuse |
| ⊙ Unknown | ● Elliptical | ◆ Spiral |
| | ⊗ Other | ★ Quasar |



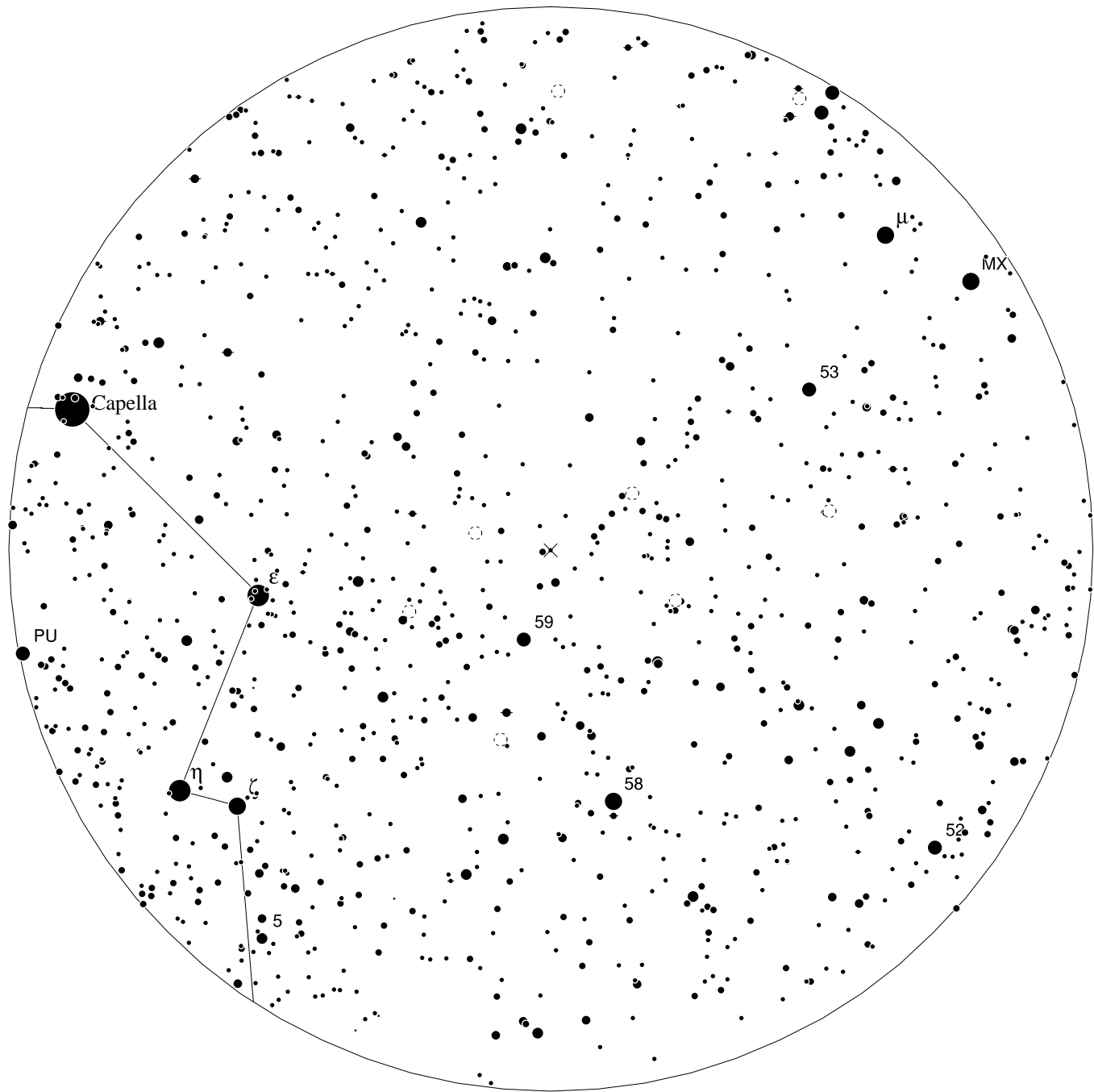
J0440.9+4431 (BSD 24 - 491) (LPH034)



J0440.9+4431: $04^h40^m59^s.32 +44^\circ31'49''.3s$ (J2000) $V=10.78$, $B-V=0.61$
15m ($1/4^\circ$) sq field — North up. In Perseus near Capella, Uranometria 65.
Position from: SIMBAD

Reference star data from SIMBAD

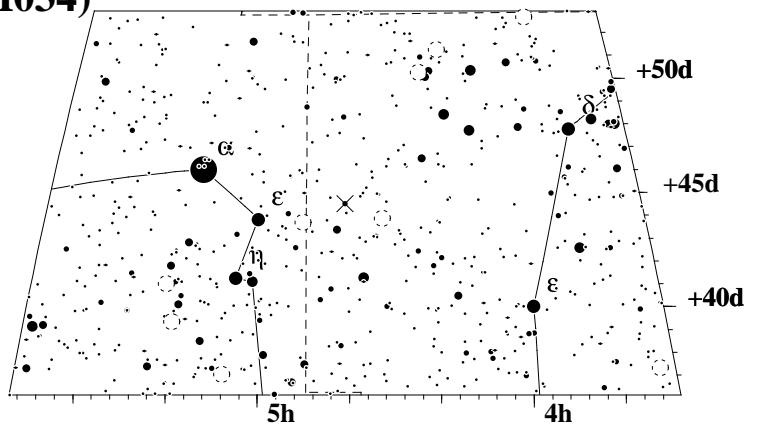
Ref Star	ID	RA	Dec	B	V
A	HD 29580	04 41 34.14	+44 29 47.8	8.80	8.49
B (Var)	OU Per	04 40 55.9	+44 30 06	15.00	



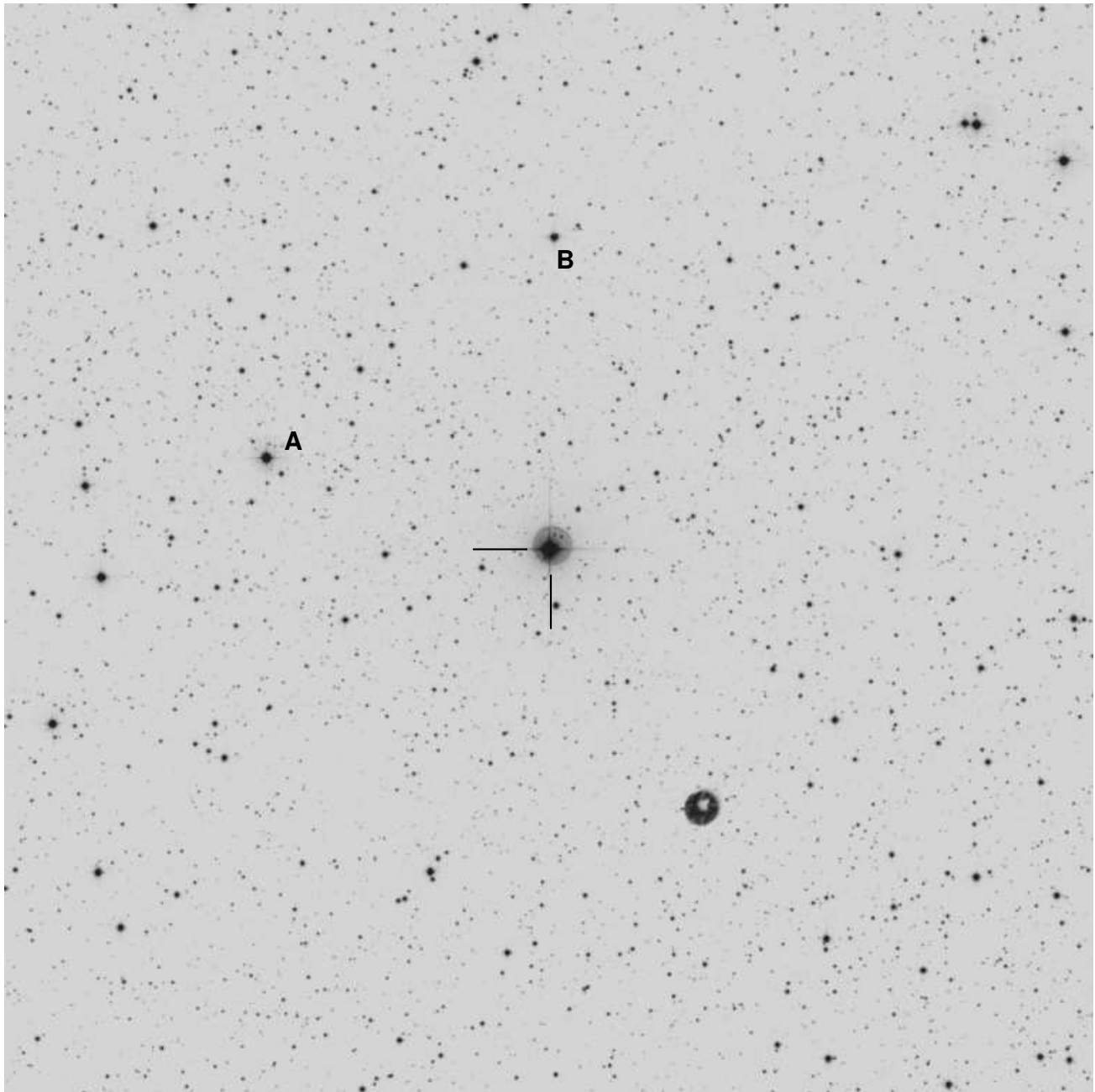
J0440.9+4431 (BSD 24 - 491) (LPH034)

(4h41m,+44d31m lim: 11.0)

- | | | |
|-----------|--------------|------------|
| ● 0 | ● 1 | ● 2 |
| ● 3 | ● 4 | ● 5 |
| ● 6 | ● 7 | ● 8 |
| ● 9 | ● 10 | ○ variable |
| ⊕ Planet | × Asteroid | ☄ Comet |
| ⊙ Cluster | ⊙ Globular | ○ Open |
| ◇ Nebula | ⊕ Planetary | ◇ Diffuse |
| ☉ Galaxy | ⊙ Elliptical | ☉ Spiral |
| ? | ⊗ Other | ★ Quasar |

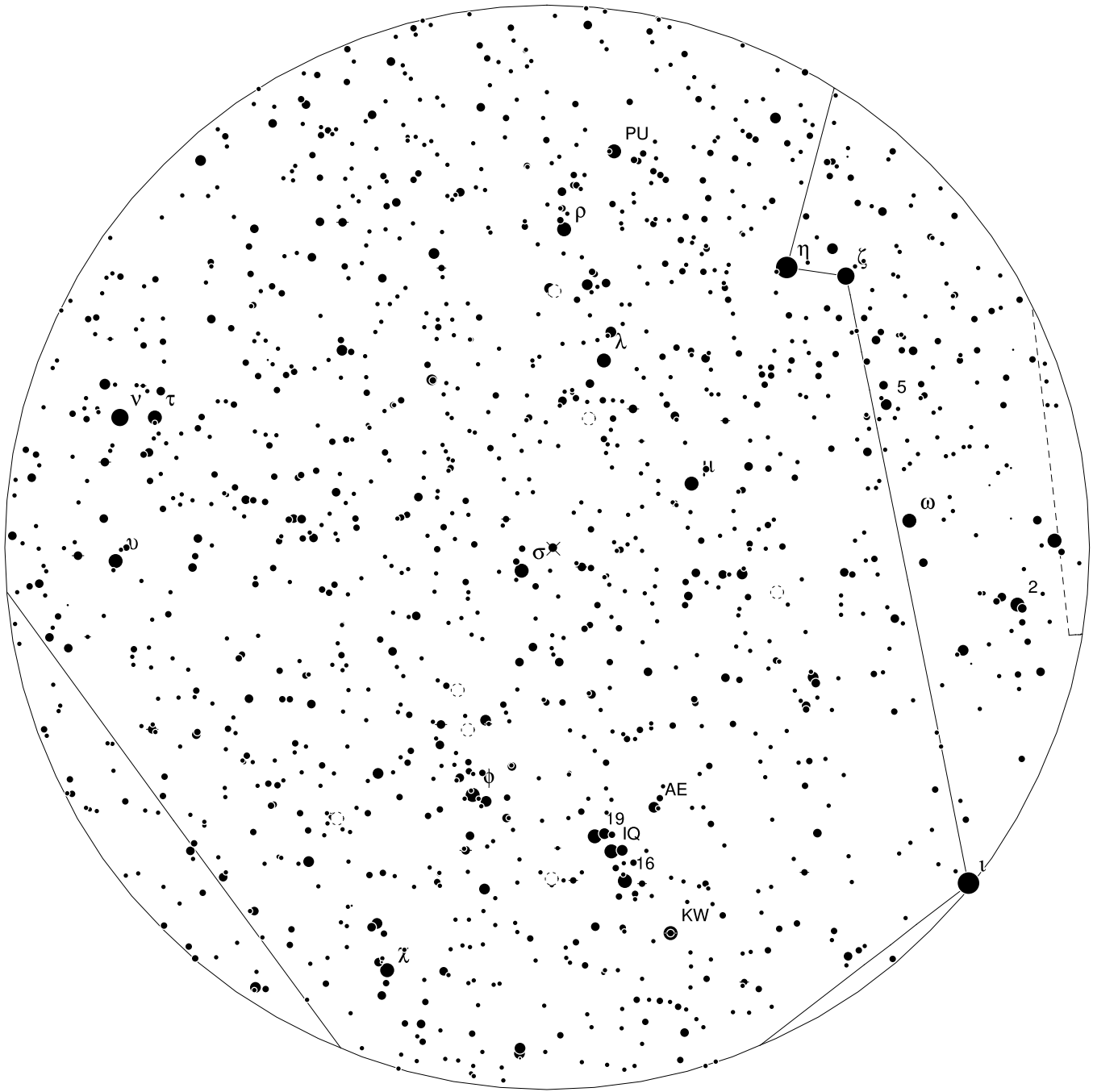


0521+373 (HD 34921, V420 Aur) (LPH040)



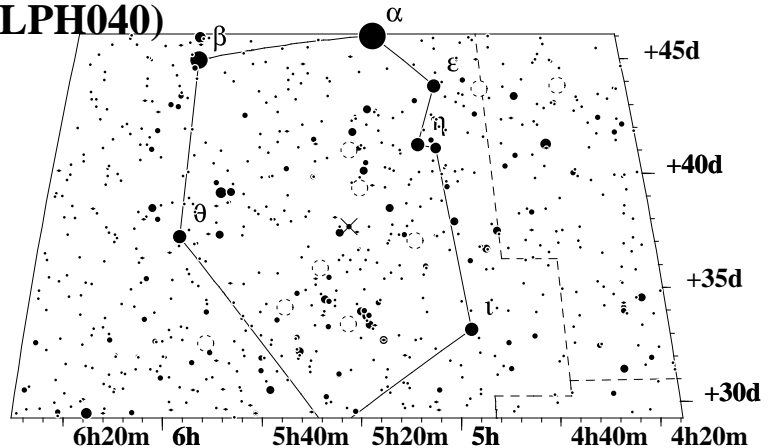
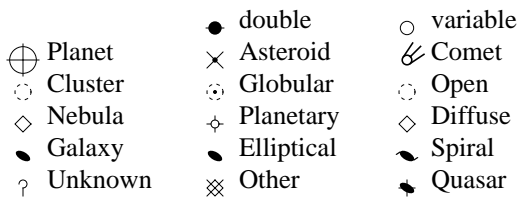
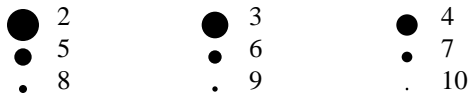
0521+373: $05^h22^m35^s.23$ $+37^\circ40'33''.6$ (J2000) $V=7.51$, $B-V=0.14$
30m ($1/2^\circ$) sq field — North up. In Auriga, Uranometria 97.
Position from: SIMBAD

Reference star data from SIMBAD					
Ref Star	ID	RA	Dec	B	V
A	HD 280999	05 23 14.89	+37 42 53.7	10.06	10.03
B	HD 280863	05 22 35.49	+37 49 07.6	10.	

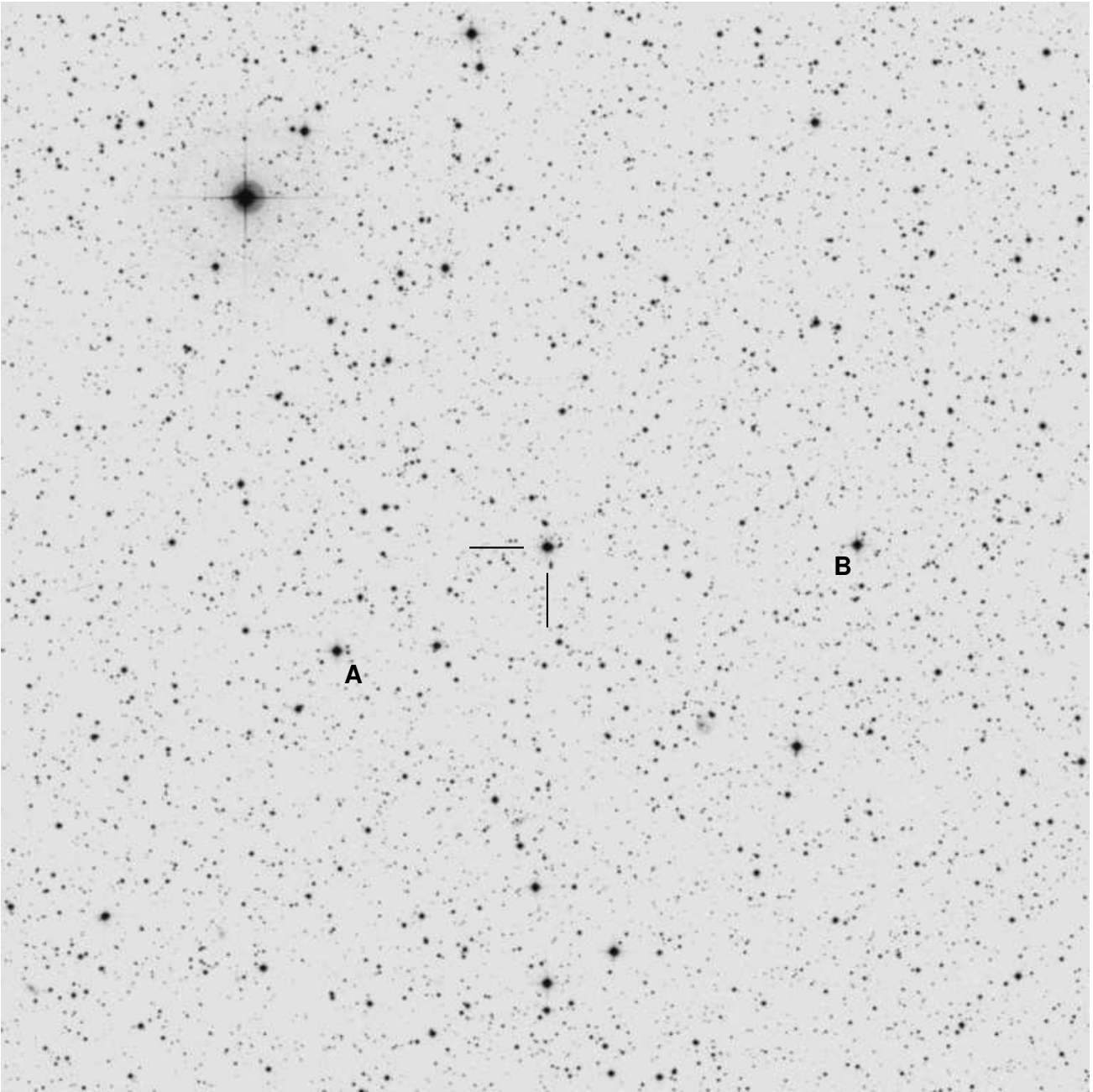


0521+373 (HD 34921, V420 Aur) (LPH040)

(5h23m,+37d40m lim: 11.0)



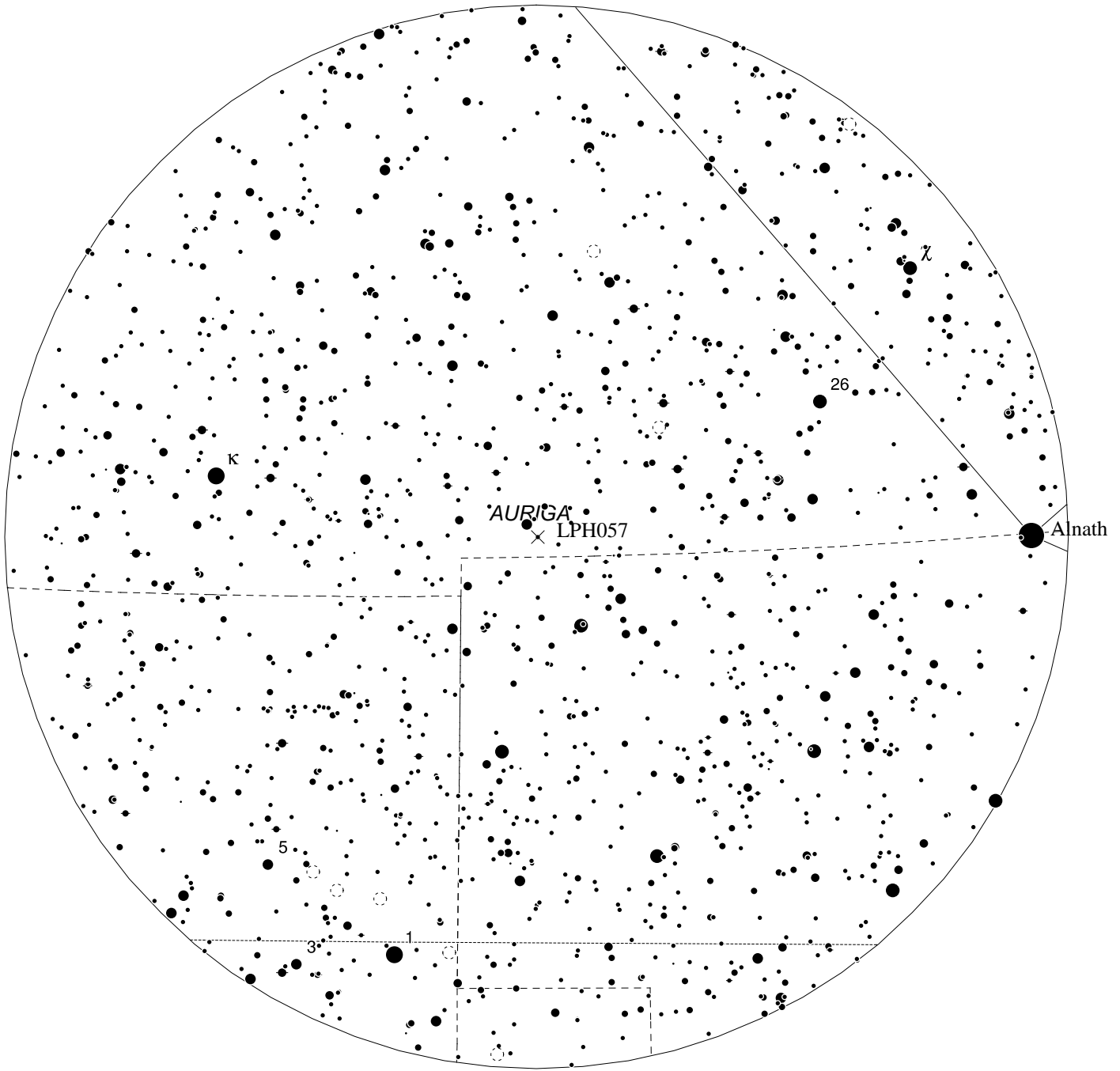
0556+286 (HD 249179) (LPH057)



0556+286: $05^h55^m55^s.05 +28^\circ47'06''.4$ (J2000) $V=9.2$
15m ($1/4^\circ$) sq field — North up. Near Tau, Aur, Gem border, Uranometria 98.
Position from: SIMBAD

Reference star data from SIMBAD

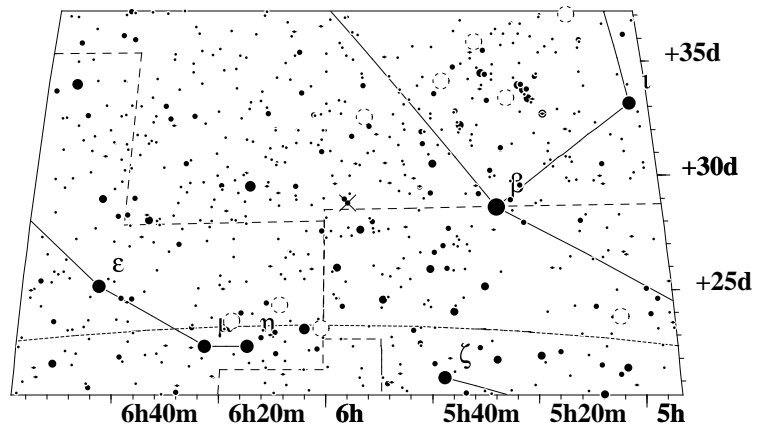
Ref Star	ID	RA	Dec	B	V
A	HD 249279	05 56 21.15	+28 44 08.7	9.94	9.86
B	GSC 01875-01421	05 55 16.05	+28 47 18.8	11.3	10.5



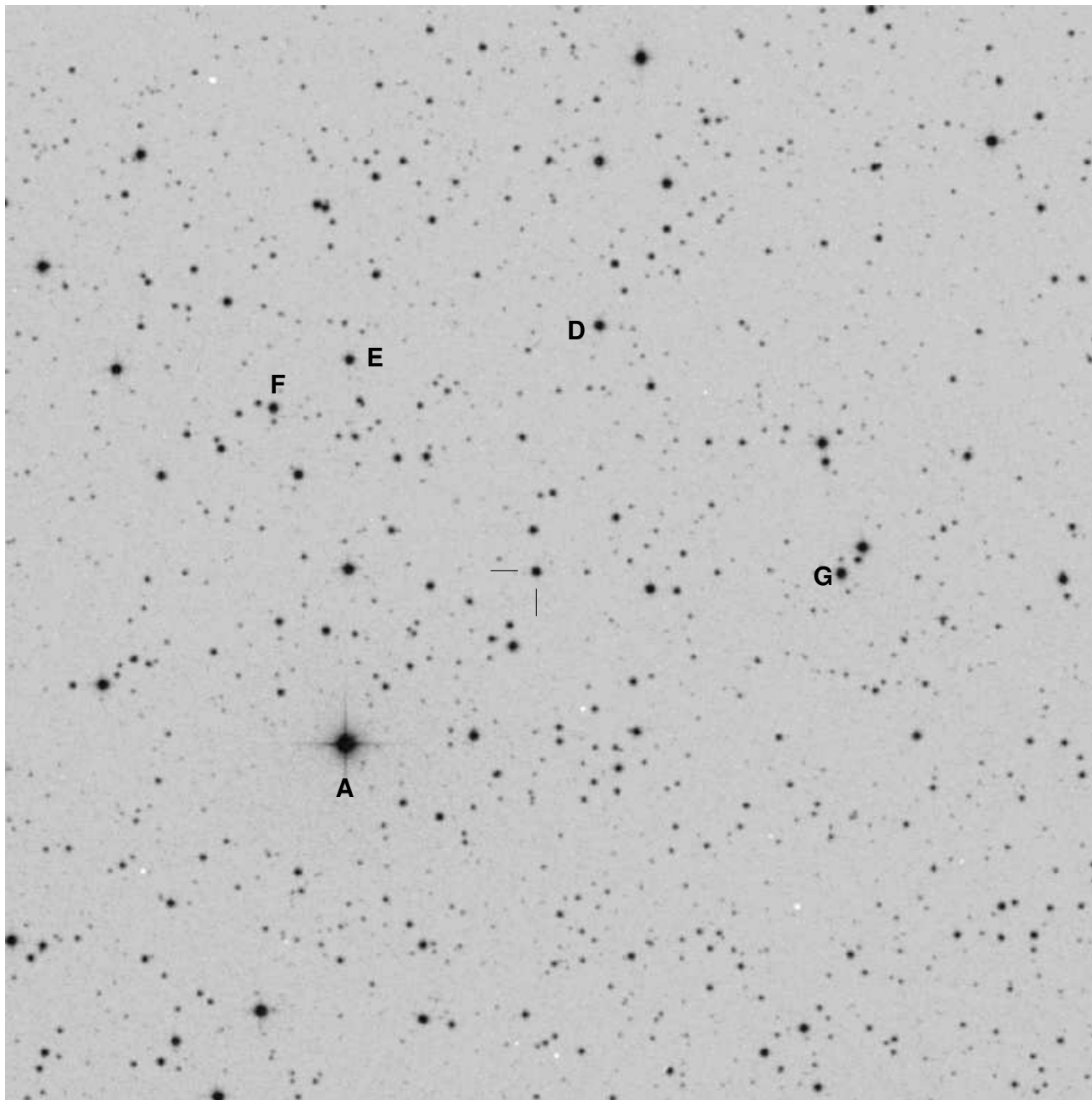
0556+286 (HD 249179) (LPH057)

(5h55m,+28d46m lim: 11.0)

- | | | |
|------|-----|-----|
| ● 1 | ● 2 | ● 3 |
| ● 4 | ● 5 | ● 6 |
| ● 7 | ● 8 | ● 9 |
| ● 10 | | |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ✕ Asteroid | ○ variable |
| ⊙ Cluster | ⊙ Globular | ☄ Comet |
| ◇ Nebula | ✦ Planetary | ○ Open |
| ● Galaxy | ● Elliptical | ◇ Diffuse |
| ? | ⊗ Other | ● Spiral |
| | | ★ Quasar |



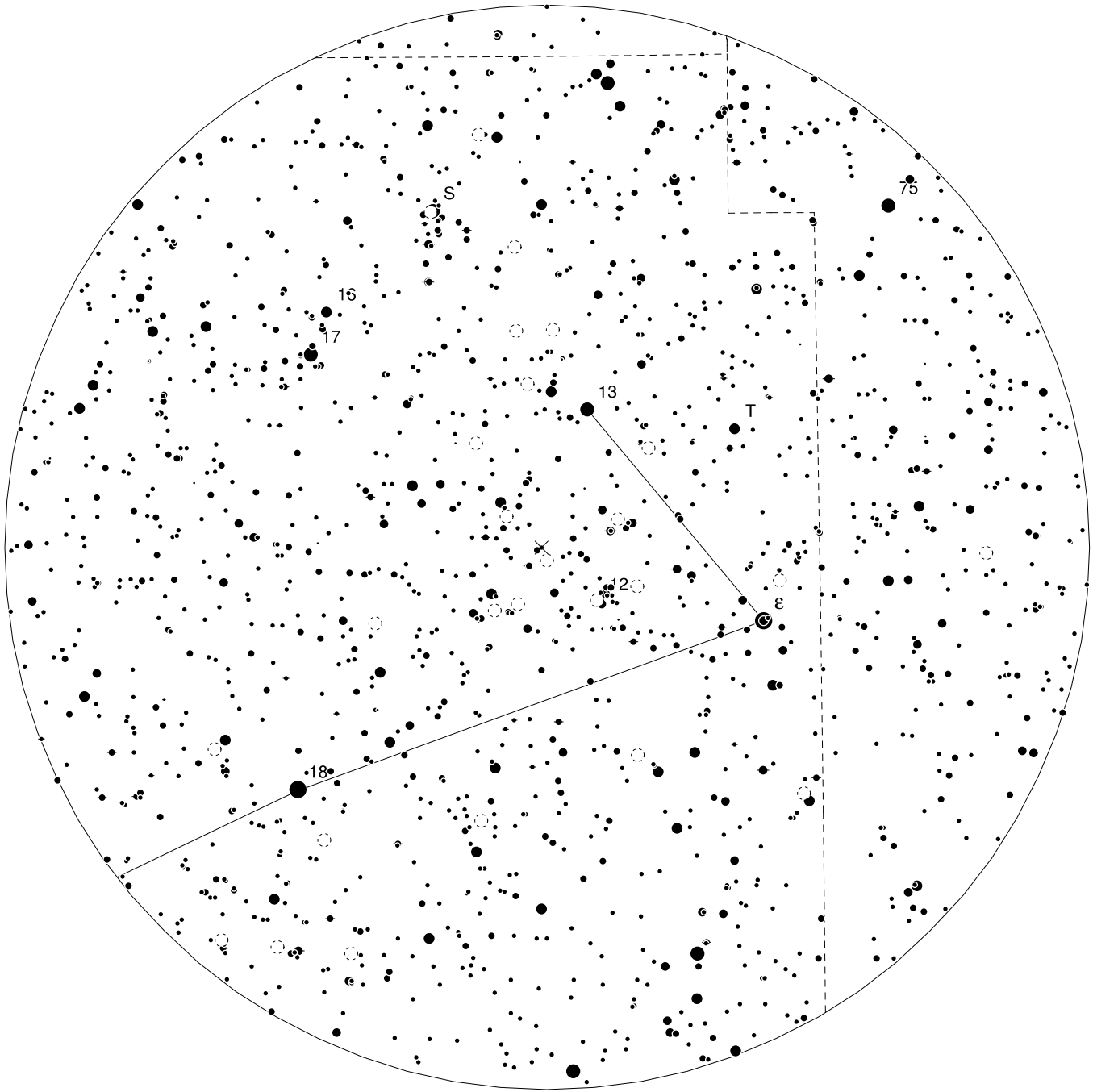
SAX J0635+0533 (LPH058)



SAX J0635+0533: $06^h35^m18^s.29 +05^\circ33'6''.3$ (J2000) $V=12.83$, $B-V=0.98$
15m ($1/4^\circ$) sq field — North up. Near Rosette Nebula in Monoceros, Uranometria 182.
Position from: Kaaret P, Piraino S, Halpern J, Eracleous M. 1999, ApJ, 523,197

Reference star data from SIMBAD

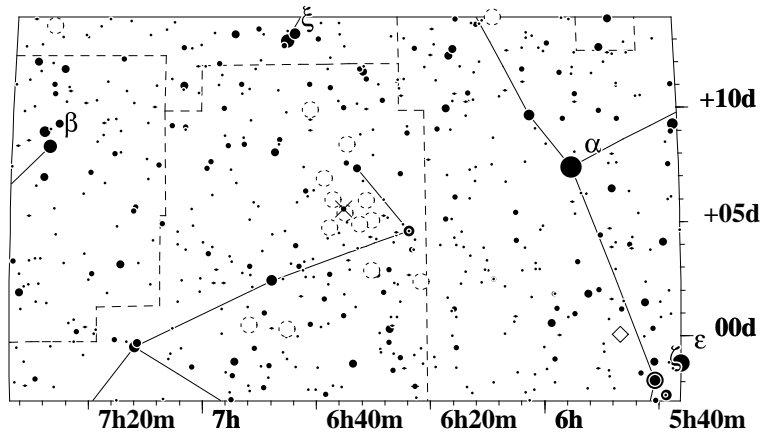
Ref Star	ID	RA	Dec	B	V
A	HD46784	06 35 28.79	+05 30 45.3	9.74	8.01
D	GSC 00154-00181	06 35 14.8	+05 36 28		13.2
E	GSC 00154-00555	06 35 28.6	+05 36 01		13.0
F	GSC 00154-00865	06 35 32.7	+05 35 21		12.7
G	GSC 00154-00217	06 35 01.5	+05 33 04		12.3



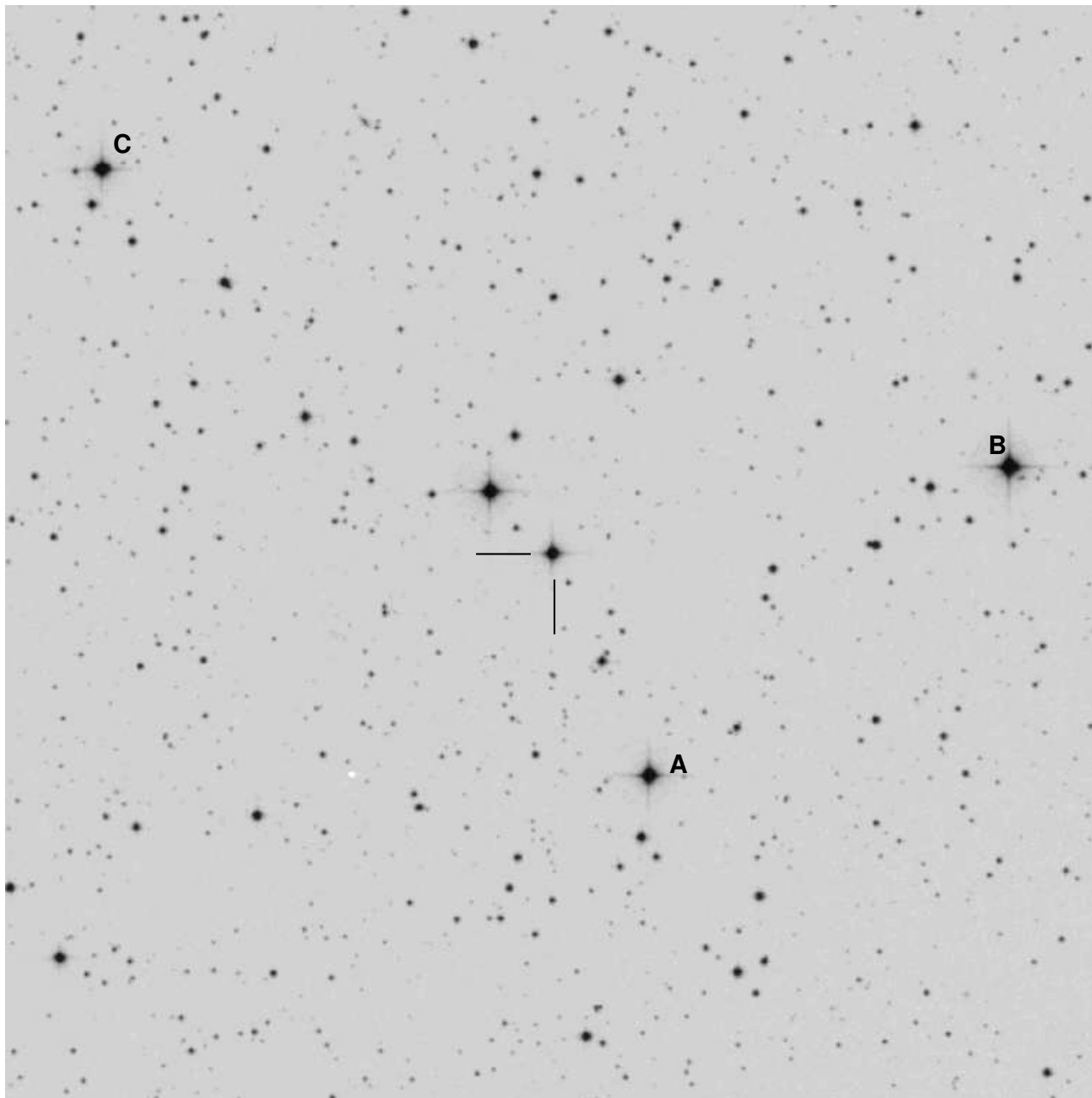
J0635+0533 (LPH058)

(6h34m,+05d32m lim: 11.0)

- | | | |
|-----|------|-----|
| ● 3 | ● 4 | ● 5 |
| ● 6 | ● 7 | ● 8 |
| ● 9 | ● 10 | |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ● double | ○ variable |
| ⊖ Cluster | × Asteroid | ☾ Comet |
| ◇ Nebula | ⊙ Globular | ○ Open |
| ◆ Galaxy | ♁ Planetary | ◇ Diffuse |
| ? | ● Elliptical | ☉ Spiral |
| | ⊗ Other | ★ Quasar |



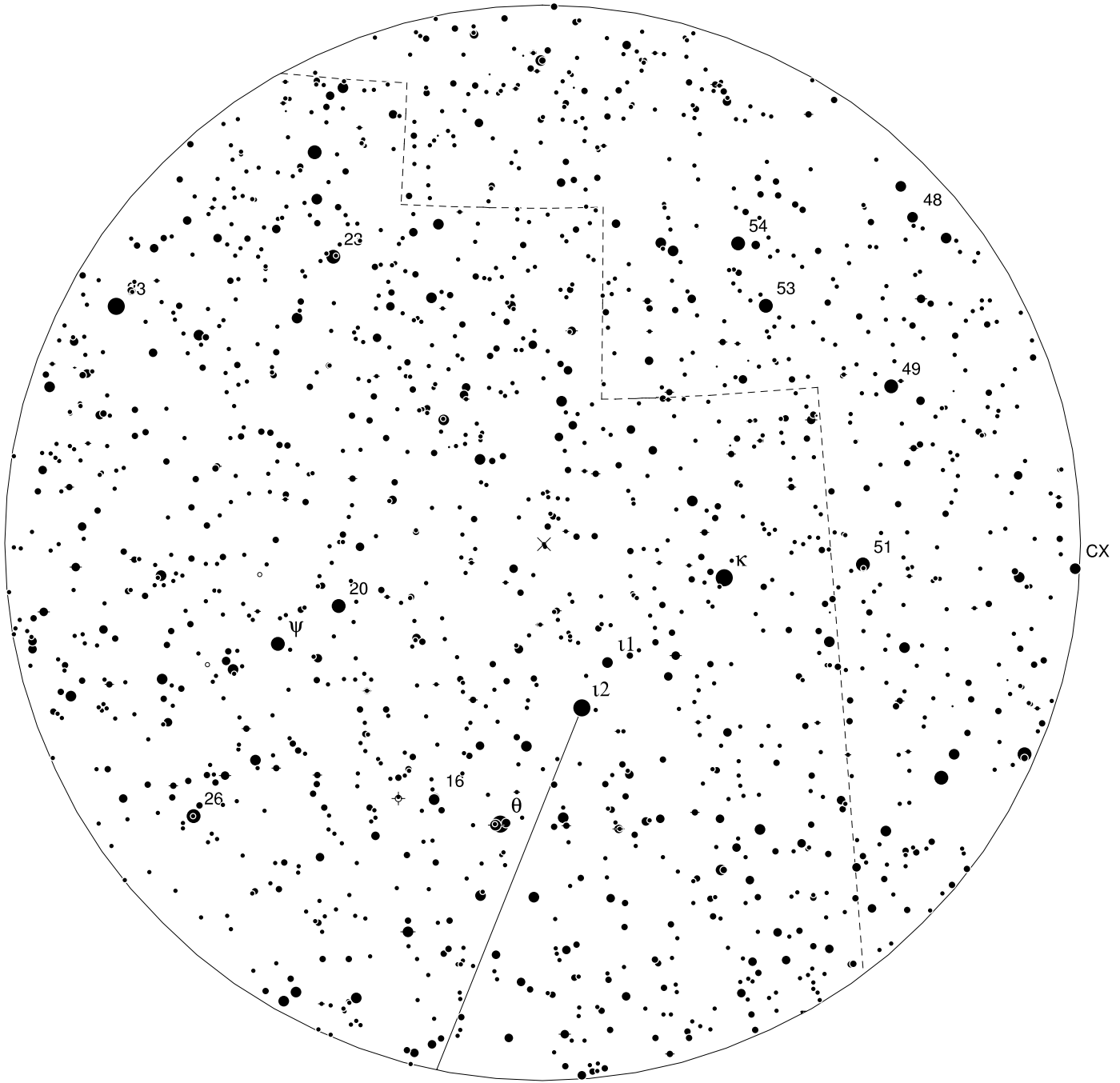
1936+541 (DM+53°2262) (LPH115)



1936+541: $19^h32^m52^s.31 + 53^\circ52'45''.5$ (J2000) $V=9.8$
15m ($1/4^\circ$) sq field — North up. In Cygnus, Uranometria 55.
Position from: SIMBAD

Reference star data from SIMBAD

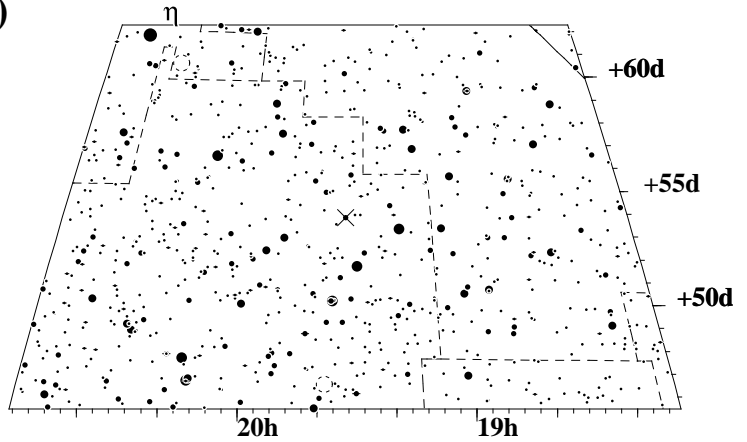
Ref Star	ID	RA	Dec	B	V
A	HD 184658	19 32 44.53	+53 49 39.5	9.70	9.68
B	GSC 03921-01933	19 32 09.51	+53 53 34.9	10.66	9.54
C	GSC 03934-00892	19 33 32.14	+53 58 19.9	10.57	10.14



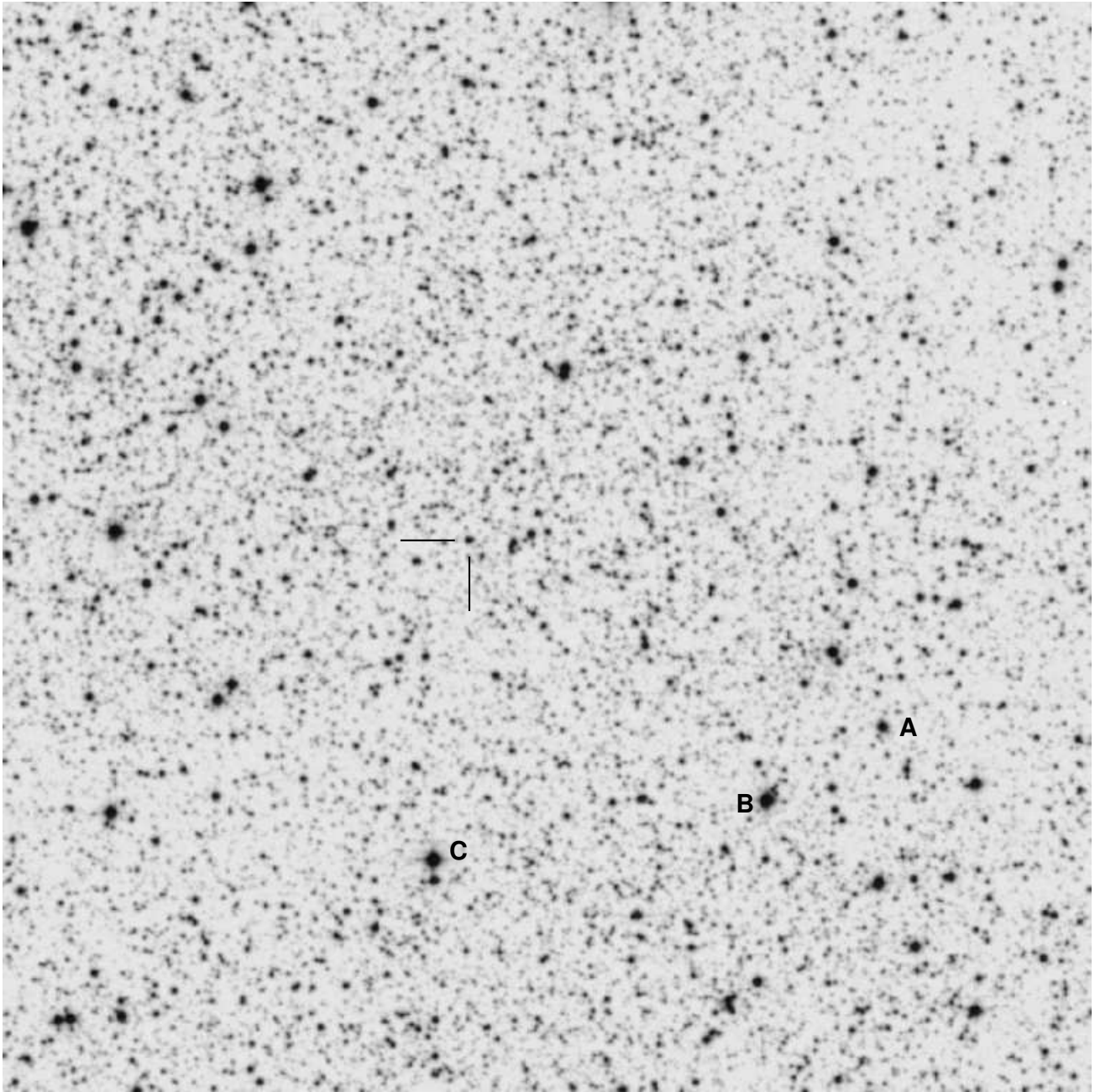
1936+541 (DM+53 2262) (LPH115)

(19h32m,+53d52m lim: 11.0)

- | | | |
|-----|------|-----|
| ● 3 | ● 4 | ● 5 |
| ● 6 | ● 7 | ● 8 |
| ● 9 | ● 10 | |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ● double | ○ variable |
| ⊙ Cluster | × Asteroid | ☄ Comet |
| ◇ Nebula | ⊛ Globular | ○ Open |
| ◆ Galaxy | ⊕ Planetary | ◇ Diffuse |
| ? | ● Elliptical | ◆ Spiral |
| | ⊗ Other | ★ Quasar |



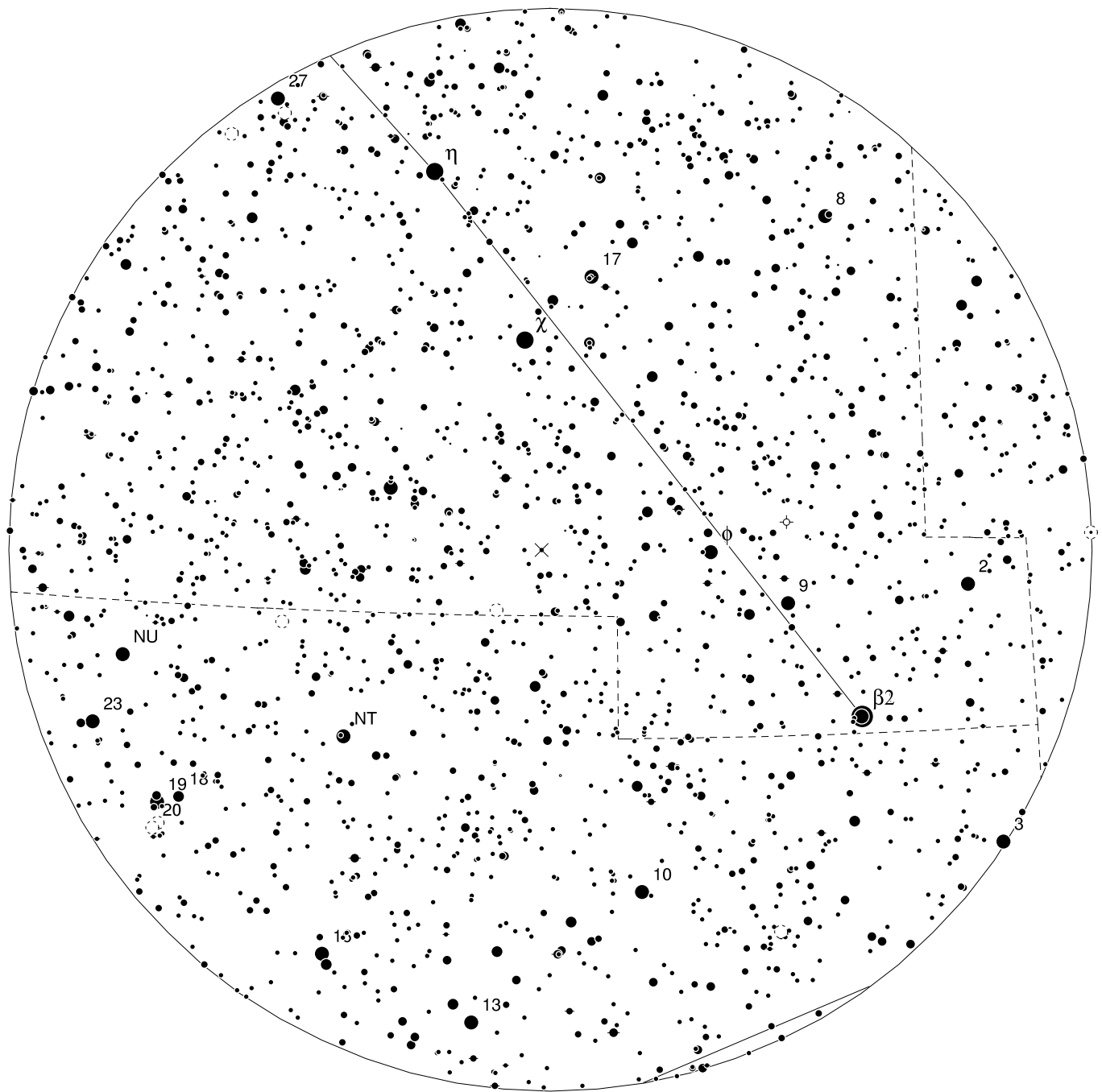
KS 1947+300 (LPH117)



KS 1947+300: $19^h49^m34^s.47 +30^\circ12'24''.2$ (J2000) $V=14.2$, $B-V=0.9$
15m ($1/4^\circ$) sq field — North up. Near Alberio in Cygnus's neck, Uranometria 119.
Pos'n from: Grankin KN, Shevchenko VS, Yakubov SD. 1991 Sov. Astron. Lett. 17,415

Reference star data from SIMBAD

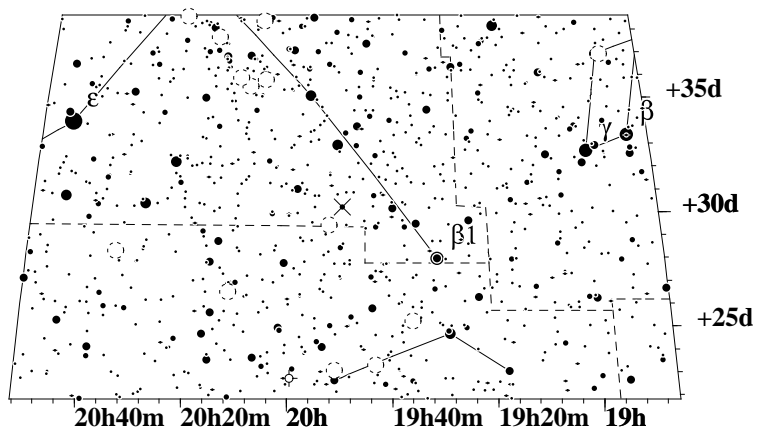
Ref Star	ID	RA	Dec	B	V
A	V990 Cyg	19 49 09.4	+30 09 51	14.00	
B	HD332670	19 49 16.84	+30 08 52.6	10.59	10.21
C	HD332828	9 49 38.16	+30 08 09.0	11.9	10.5



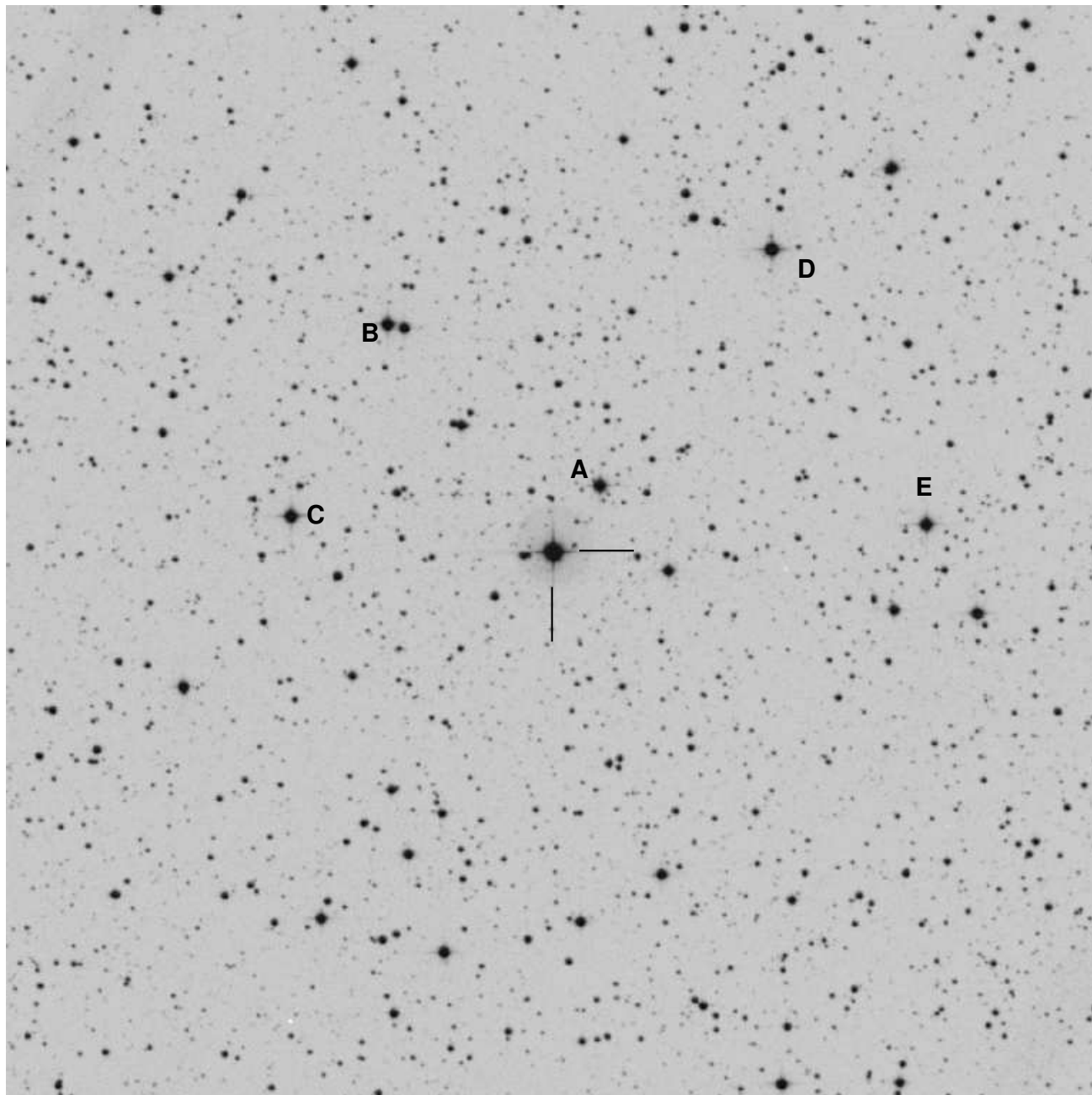
KS 1947+300 (LPH117)

(19h48m,+30d12m lim: 11.0)

- | | | |
|-----|-----|------|
| ● 2 | ● 3 | ● 4 |
| ● 5 | ● 6 | ● 7 |
| ● 8 | ● 9 | ● 10 |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ● double | ○ variable |
| ⊖ Cluster | × Asteroid | ☾ Comet |
| ◇ Nebula | ⊙ Globular | ○ Open |
| ◆ Galaxy | ♁ Planetary | ◇ Diffuse |
| ? | ● Elliptical | ◆ Spiral |
| | ⊗ Other | ★ Quasar |



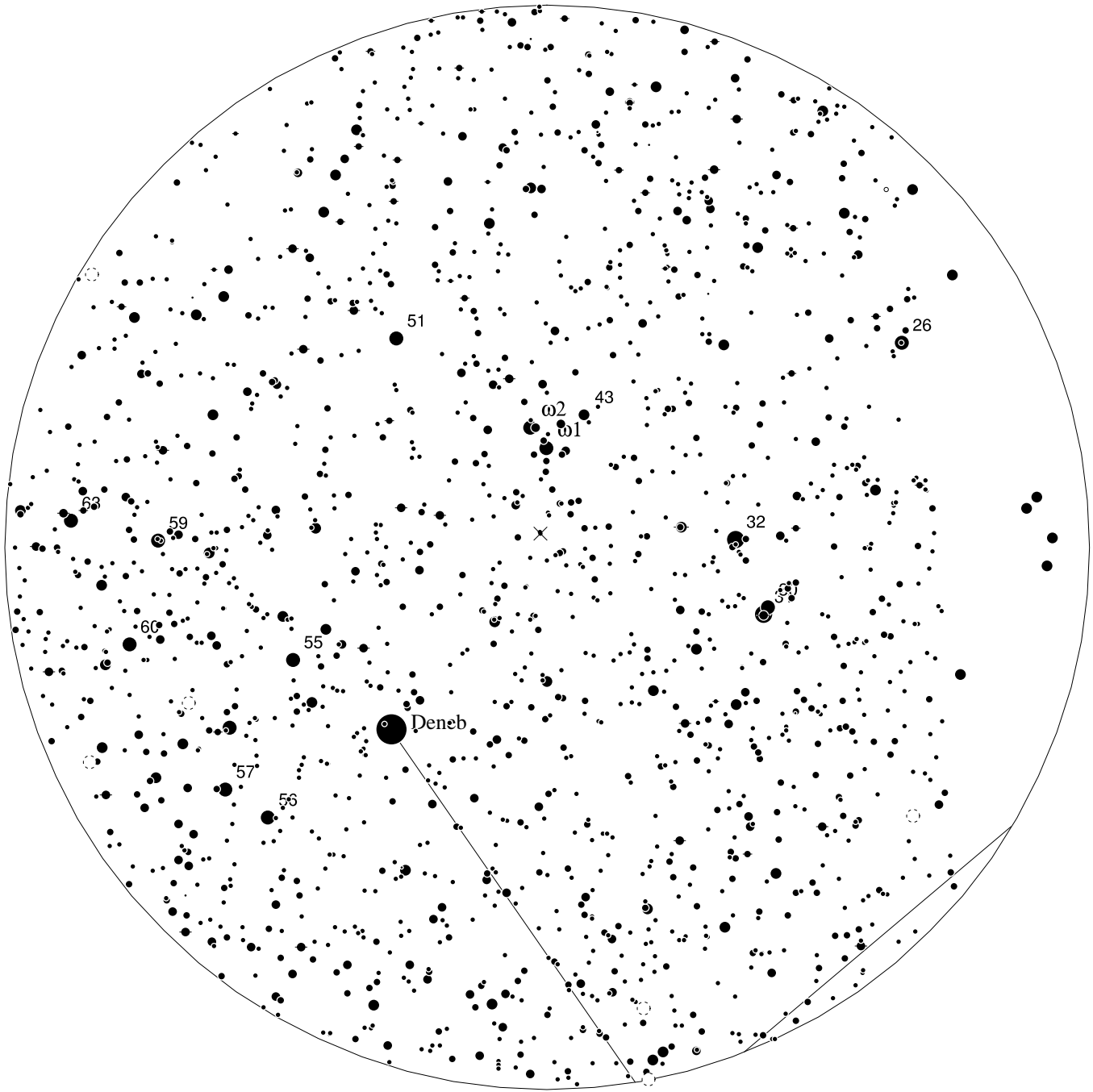
J2030.5+4751 (SAO 49725) (LPH123)



J2030.5+4751: $20^h30^m30^s.85$ $+47^\circ51'50''.7$ (J2000) $V=9.27$, $B-V=0.38$
15m ($1/4^\circ$) sq field — North up. Near Deneb in Cygnus, Uranometria 85.
Position from: Motch C et al. 1997, A&A 323,853 / SIMBAD

Reference star data from SIMBAD

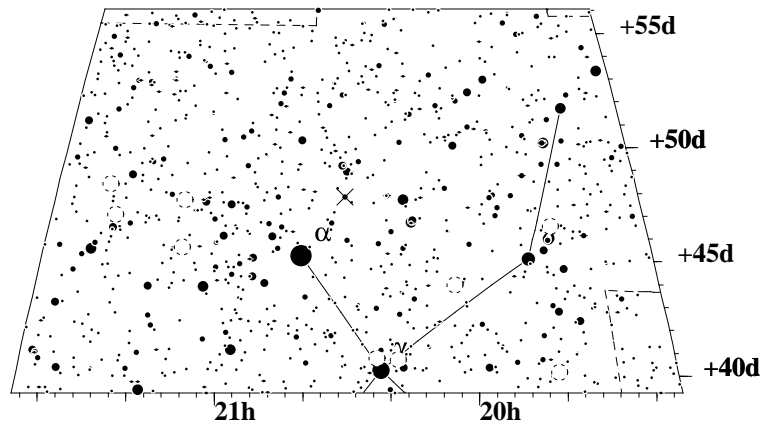
Ref Star	ID	RA	Dec	B	V
A	GSC 03577-00762	20 30 27.04	+47 52 45.3	11.5	11.4
B	GSC 03577-02561	20 30 44.31	+47 54 58.2	11.6	11.3
C	GSC 03577-02189	20 30 52.20	+47 52 20.8	11.5	11.2
D	GSC 03577-01288	20 30 12.92	+47 55 58.6	11.9	10.0
E	GSC 03577-02138	20 30 00.40	+47 52 12.2	11.8	10.9



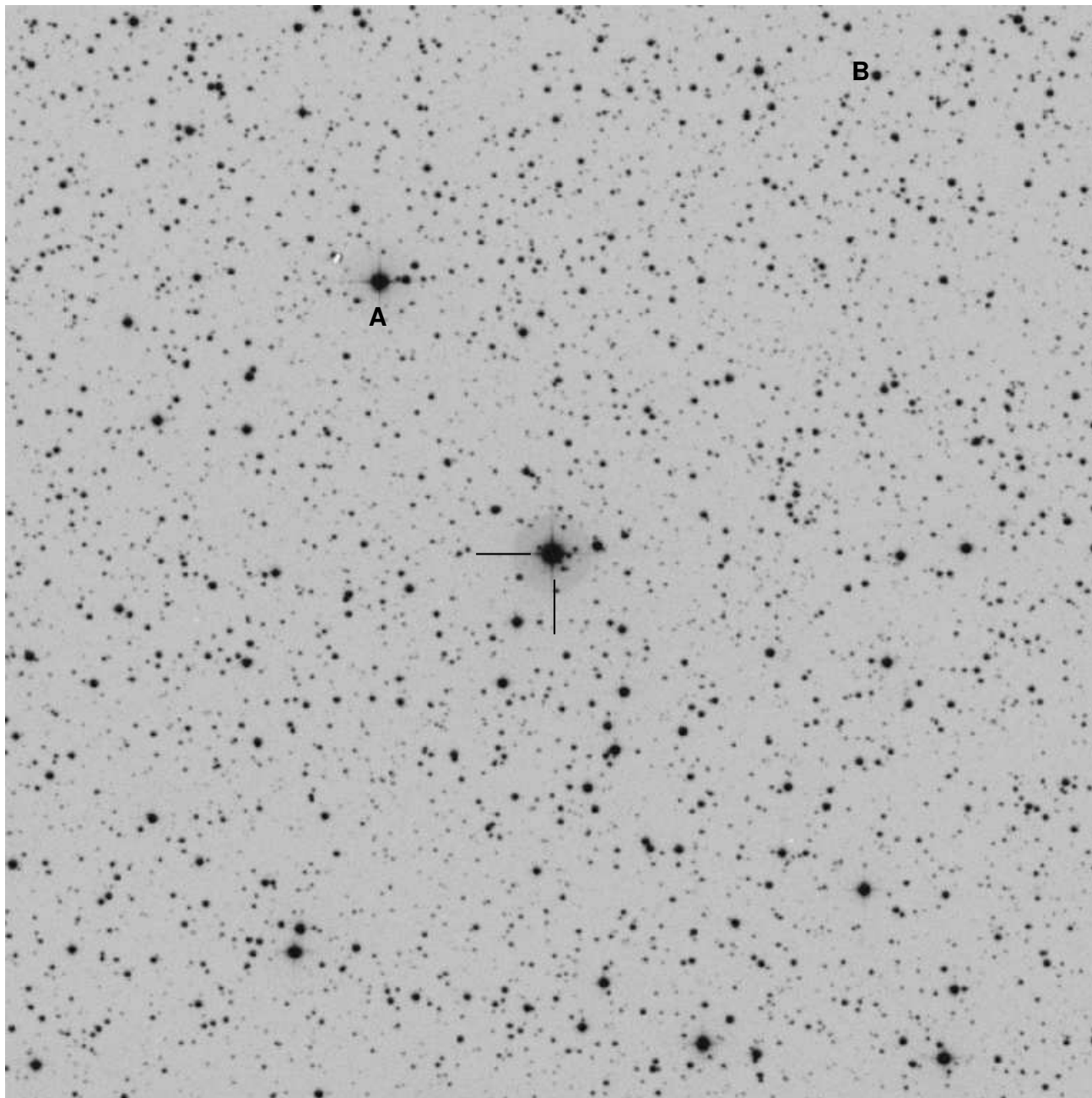
J2030.5+4751 (LPH123)

(20h30m,+47d39m lim: 11.0)

- | | | |
|-----------|--------------|------------|
| ● 0 | ● 1 | ● 2 |
| ● 3 | ● 4 | ● 5 |
| ● 6 | ● 7 | ● 8 |
| ● 9 | ● 10 | |
| ⊕ Planet | ● double | ○ variable |
| ⊙ Cluster | × Asteroid | ☄ Comet |
| ◇ Nebula | ⊙ Globular | ○ Open |
| ◆ Galaxy | ⊕ Planetary | ◇ Diffuse |
| ? | ◆ Elliptical | ◊ Spiral |
| | ⊗ Other | ★ Quasar |

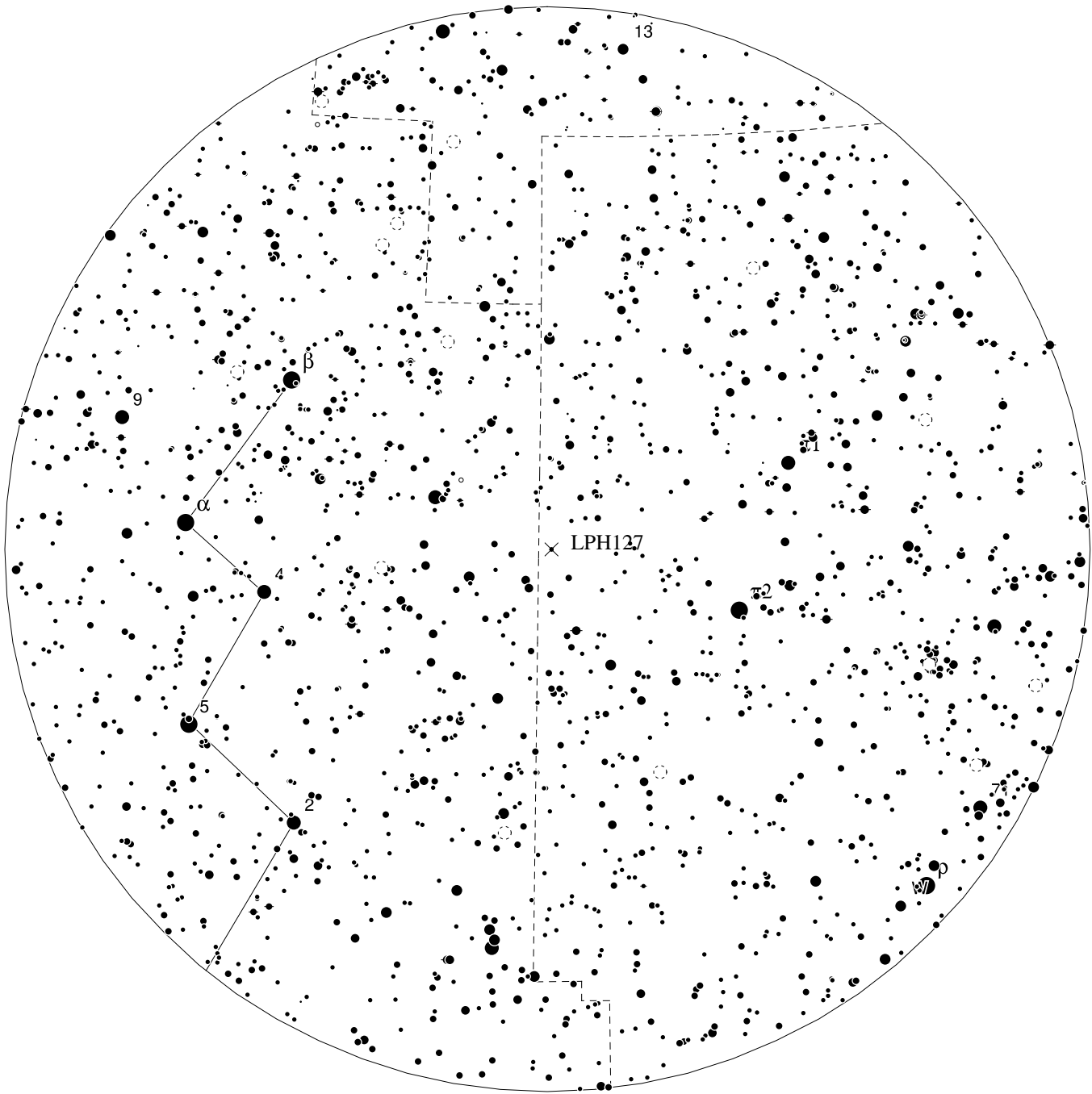


2202+501 (SAO 51568, V2175 Cyg) (LPH127)



2202+501: $22^{\text{h}}01^{\text{m}}38^{\text{s}}.20 + 50^{\circ}10'04''.6$ (J2000) $V=8.8$
15m ($1/4^{\circ}$) sq field — North up. Near Cyg, Lac border, Uranometria 57.
Position from: SIMBAD

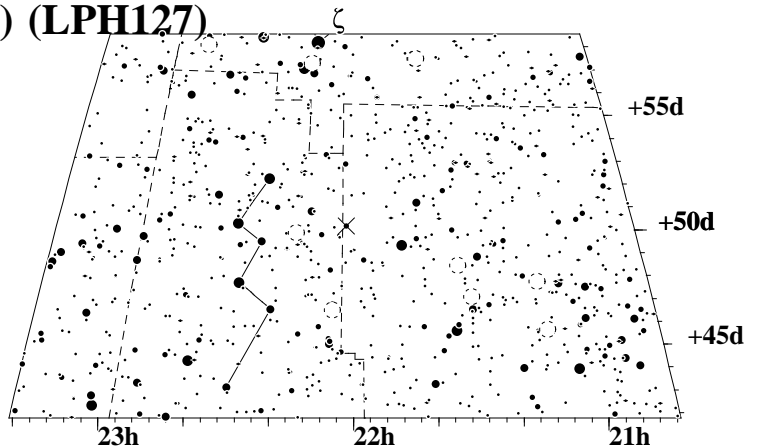
Reference star data from SIMBAD					
Ref Star	ID	RA	Dec	B	V
A	ALS 12095	22 01 52.95	+50 13 47.5	10.46	10.48
B (Var)	MV Cyg	22 01 10.1	+50 16 32	14.20	



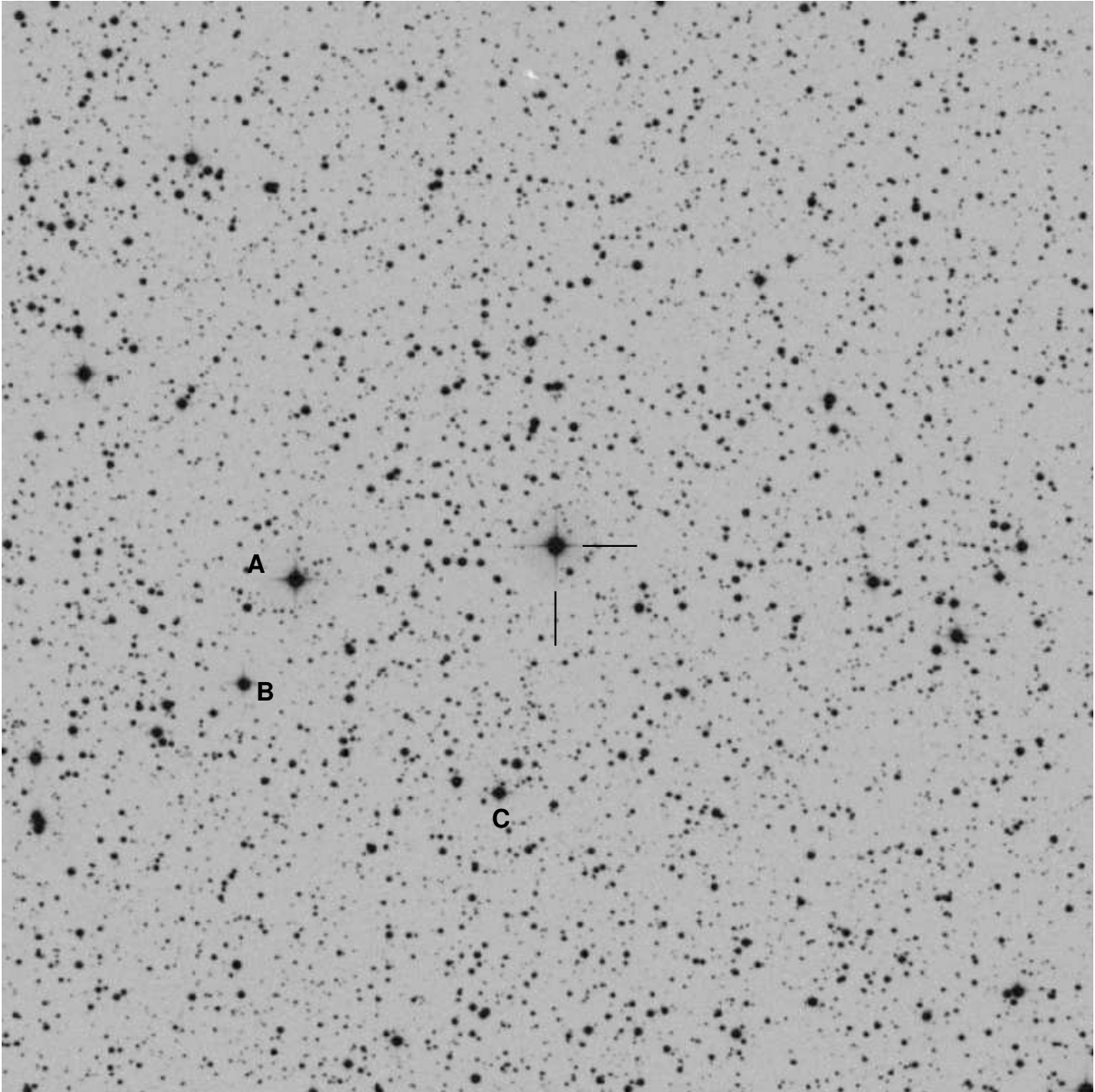
2202+501 (SAO 51568, V2175 Cyg) (LPH127)

(22h02m,+50d10m lim: 11.0)

- | | | |
|-----|------|-----|
| ● 3 | ● 4 | ● 5 |
| ● 6 | ● 7 | ● 8 |
| ● 9 | ● 10 | |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ● double | ○ variable |
| ⊙ Cluster | × Asteroid | ☄ Comet |
| ◇ Nebula | ⊛ Globular | ○ Open |
| ◆ Galaxy | ♁ Planetary | ◇ Diffuse |
| ⊙ Unknown | ● Elliptical | ♁ Spiral |
| | ⊛ Other | ★ Quasar |



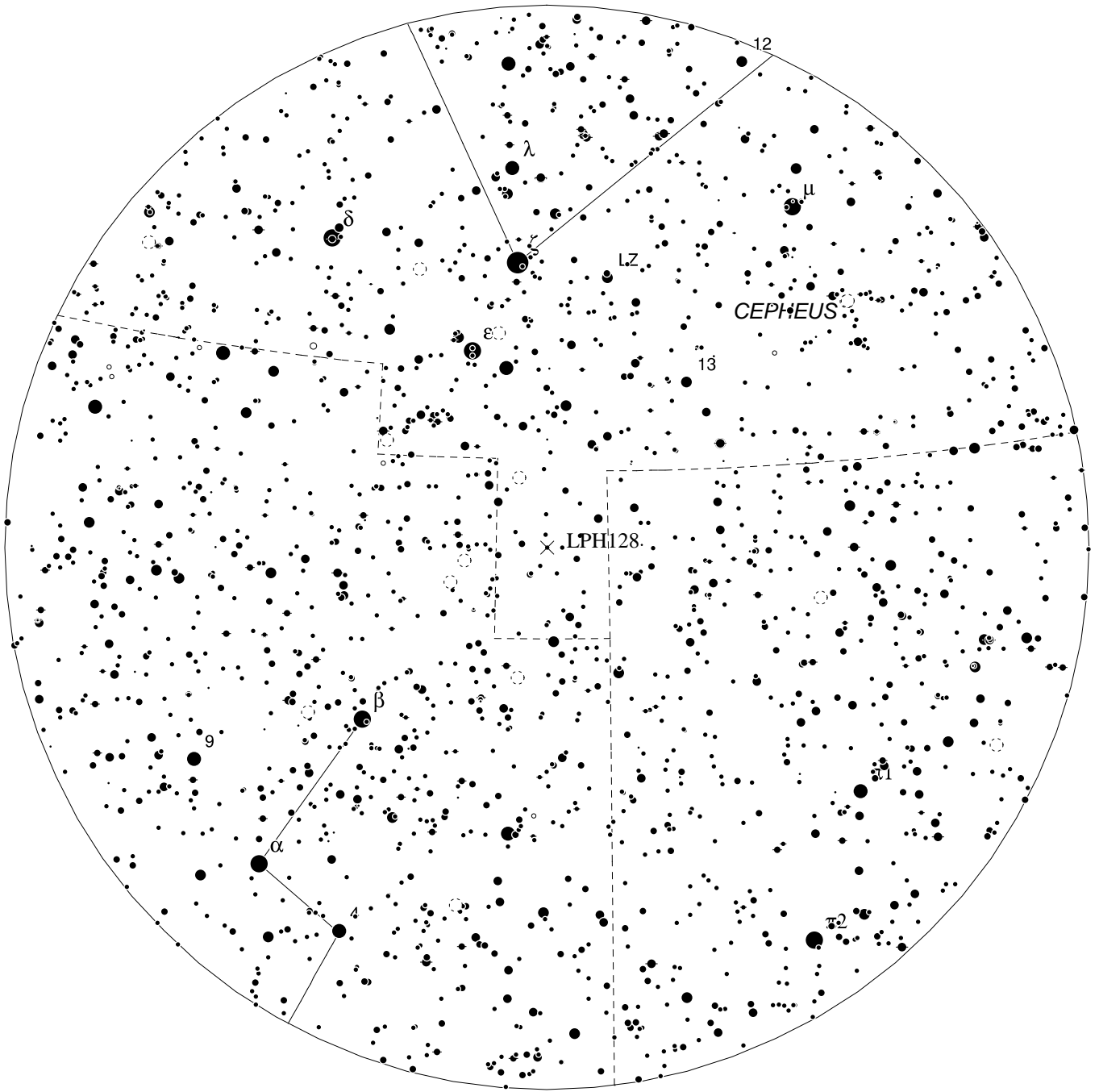
2206+543 (TYC 3973- 812-1, GSC 3973-0812)
(LPH128)



J2030.5+4751: $22^{\text{h}}7^{\text{m}}57^{\text{s}}.05$ $+54^{\circ}31'05''.8$ (J2000) $V=9.9$, $B-V=0.2$
15m ($1/4^{\circ}$) sq field — North up. Near Cyg, Cep, Lac border, Uranometria 57.
Position from: Steiner JE et al. 1984, ApJ 280,688

Reference star data from SIMBAD

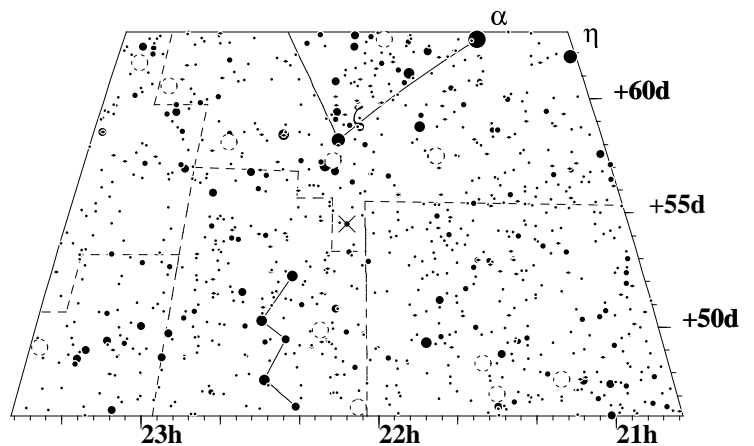
Ref Star	ID	RA	Dec	B	V
A	BD+53 2792	22 08 20.75	+54 30 33.2	10.70	10.6
B	[BBB73] 52	22 08 25.40	+54 29 06.7	12.12	11.87
C	[BBB73] 42	22 08 01.03	+54 27 41.7	12.35	11.76



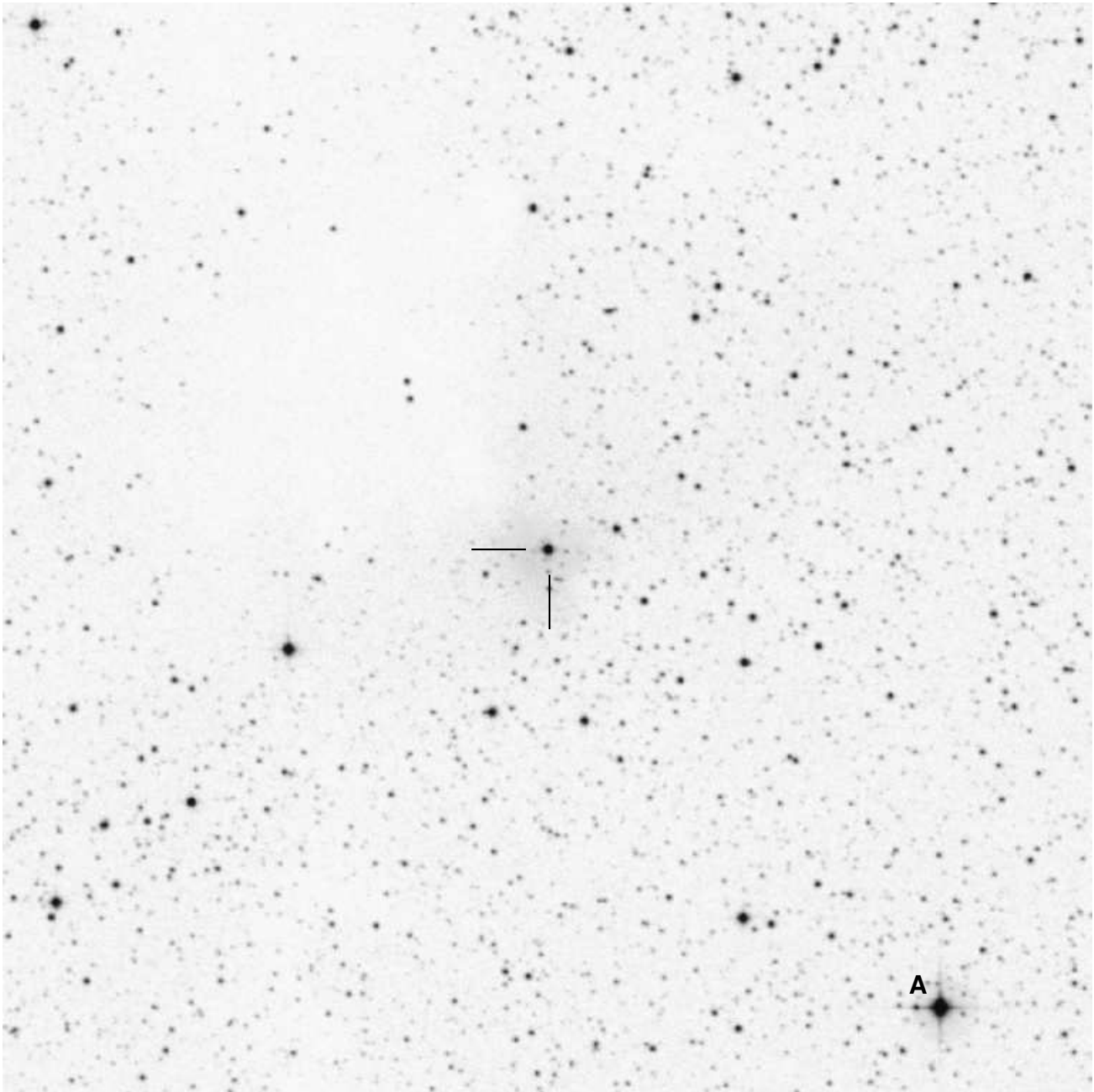
2206+543 (LPH128)

(22h07m,+54d31m lim: 11.0)

- | | | |
|-----|-----|------|
| ● 2 | ● 3 | ● 4 |
| ● 5 | ● 6 | ● 7 |
| ● 8 | ● 9 | ● 10 |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ● double | ○ variable |
| ⊙ Cluster | × Asteroid | ☾ Comet |
| ◇ Nebula | ⊙ Globular | ○ Open |
| ◆ Galaxy | ⊕ Planetary | ◇ Diffuse |
| ⊙ Unknown | ● Elliptical | ◆ Spiral |
| | ⊗ Other | ★ Quasar |



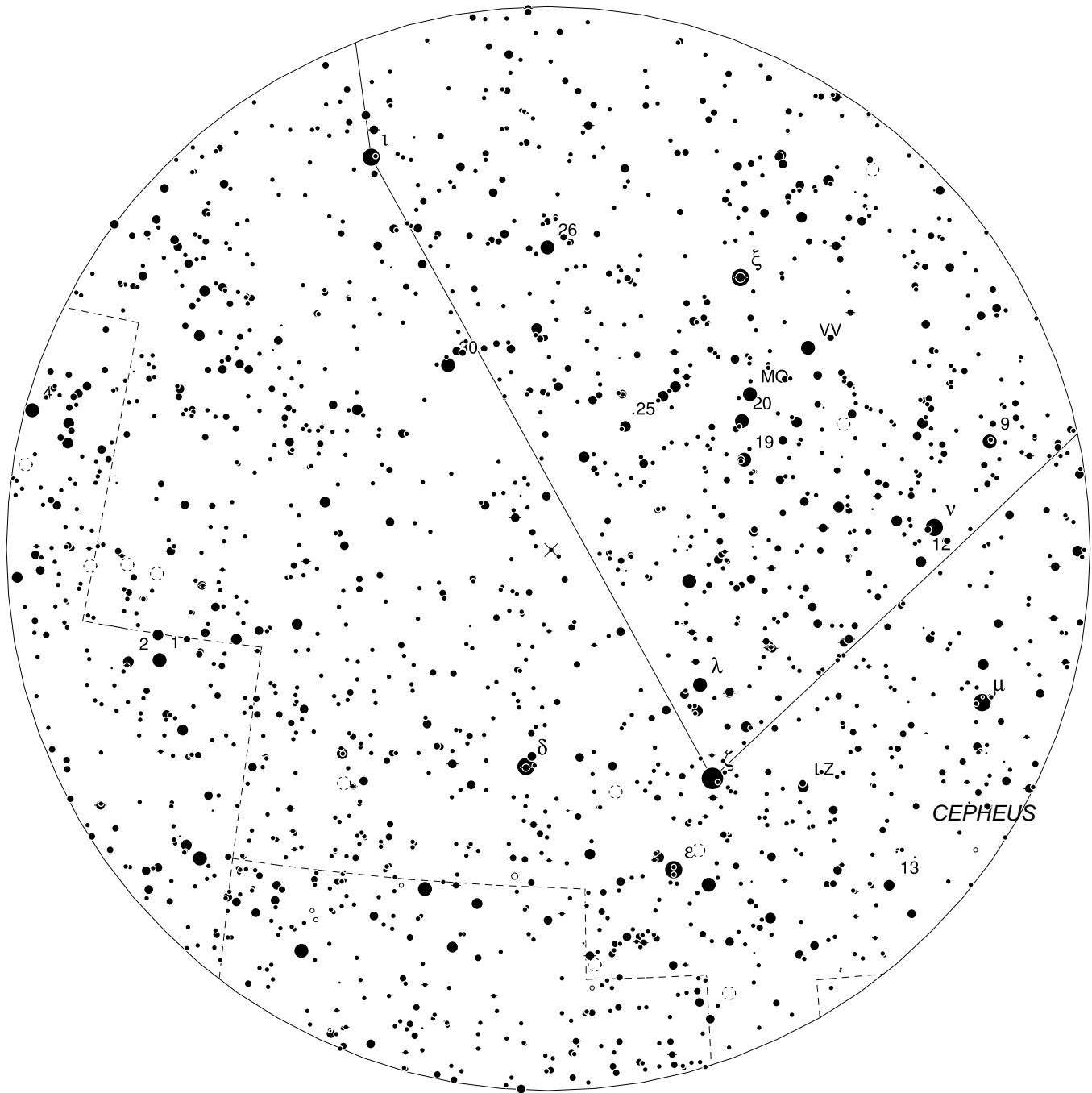
2214+589 (GG3 71, IRAS 22248+6058, V669 Cep)
(LPH129)



2214+589: $22^h26^m38^s.7 +61^\circ13'32''$ (J2000) V=11
15m ($1/4^\circ$) sq field — North up. In Cepheus, Uranometria 34.
Position from: SIMBAD

Reference star data from SIMBAD

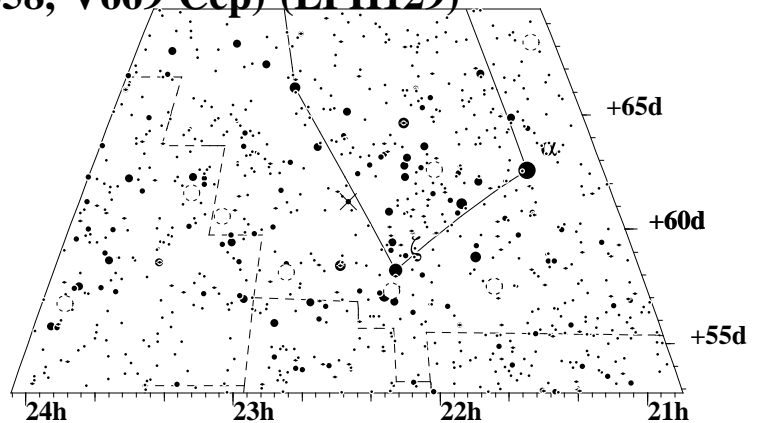
Ref Star	ID	RA	Dec	B	V
A	BD+60 2394	22 25 51.22	+61 07 33.3	10.62	9.47



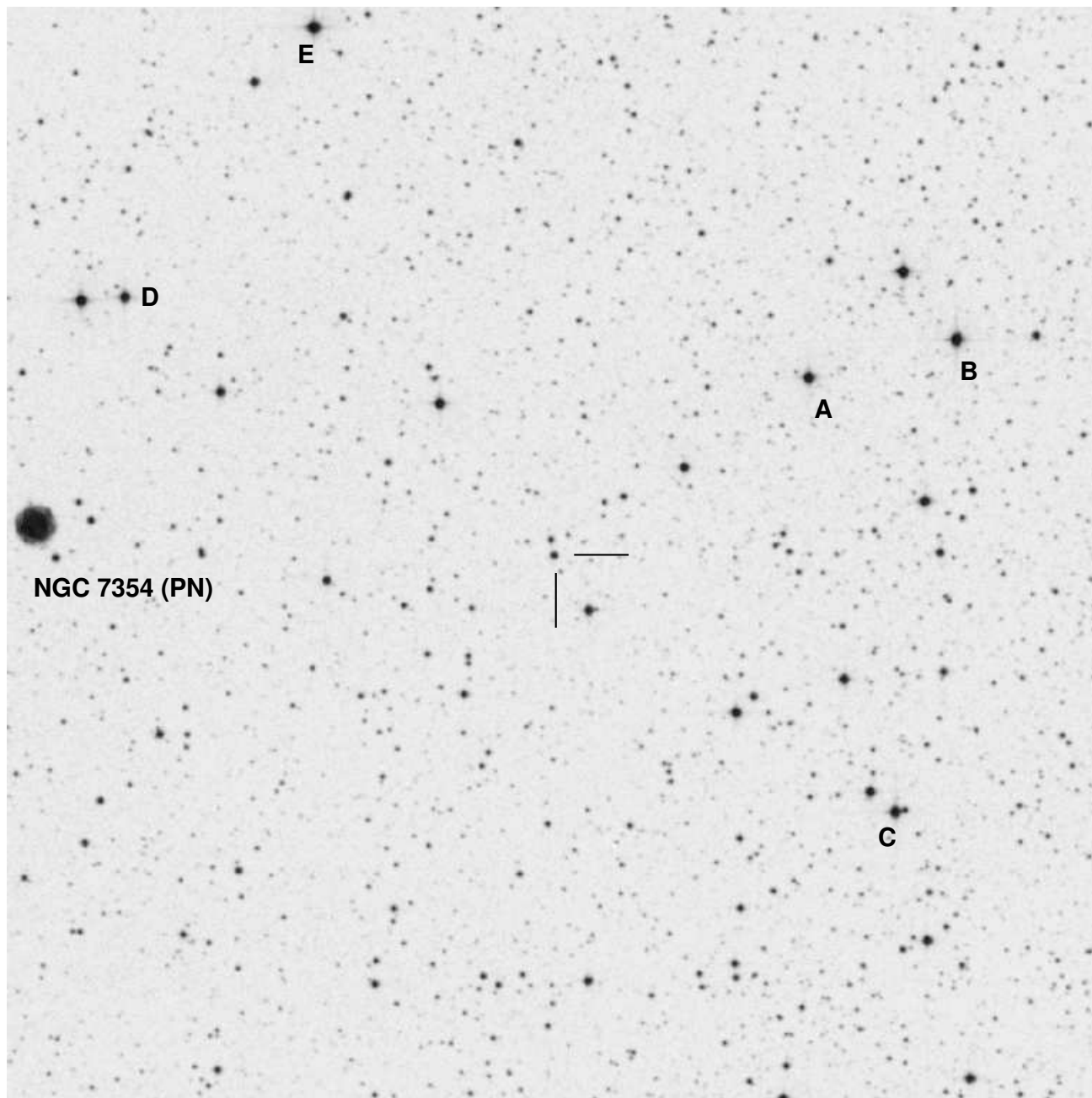
214+589 (GG3 71, IRAS 22248+6058, V669 Cep) (LPH129)

(22h27m,+61d14m lim: 11.0)

- | | | |
|-----|-----|------|
| ● 2 | ● 3 | ● 4 |
| ● 5 | ● 6 | ● 7 |
| ● 8 | ● 9 | ● 10 |
-
- | | | |
|-----------|--------------|------------|
| ⊕ Planet | ● double | ○ variable |
| ⊖ Cluster | × Asteroid | ☄ Comet |
| ◇ Nebula | ⊙ Globular | ○ Open |
| ◆ Galaxy | ♁ Planetary | ◇ Diffuse |
| ⊙ Unknown | ● Elliptical | ☉ Spiral |
| | ⊗ Other | ★ Quasar |



J2239.3+6116 (3A 2237+608) (LPH130)



J2030.5+4751: $22^h 39^m 20^s.90 + 61^\circ 16' 26''.8s$ (J2000) $V=15.4$, $B-V=1.4$

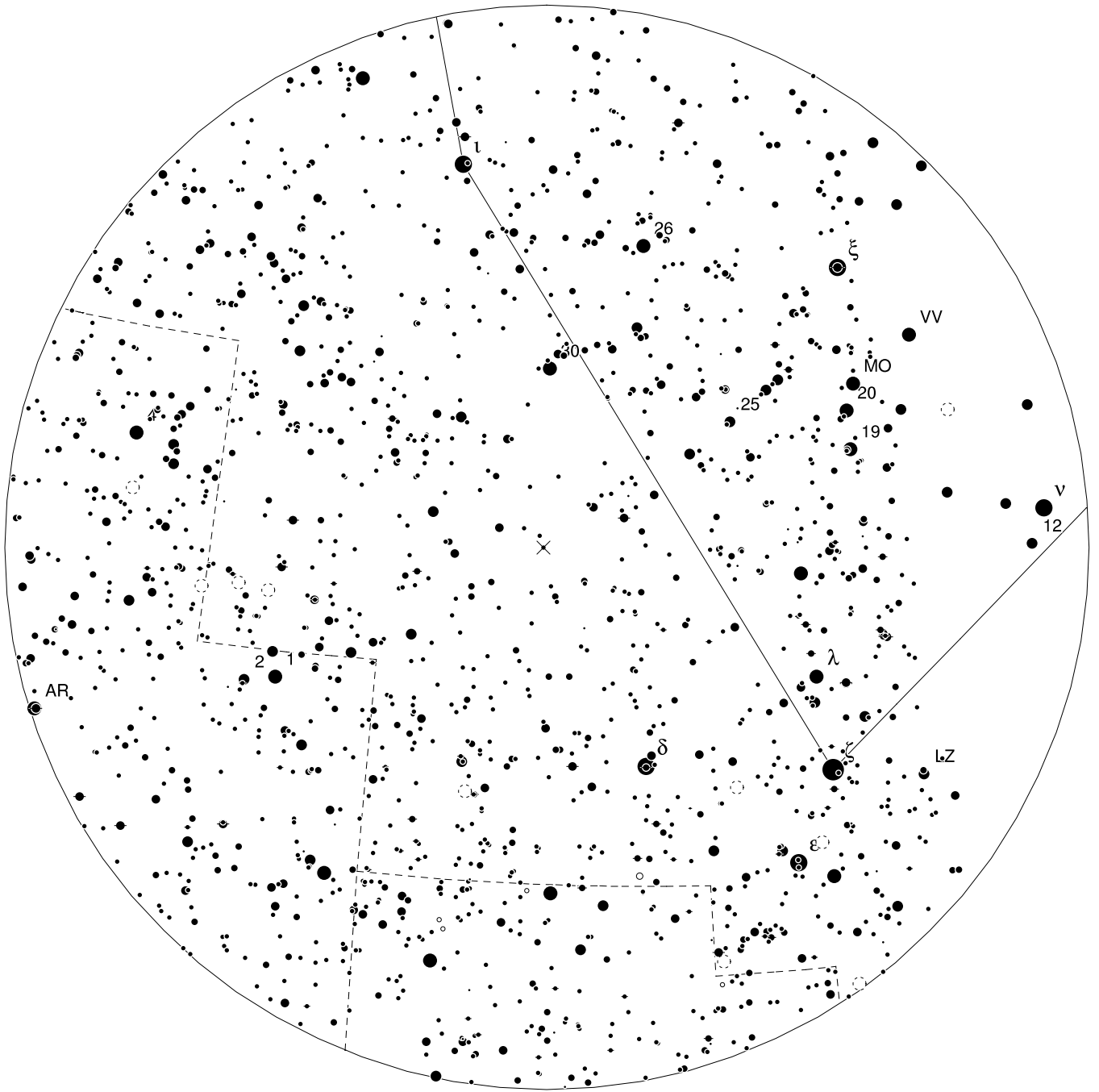
15m ($1/4^\circ$) sq field — North up. In Cepheus, Uranometria 34.

Position from: in't Zand JJM et al. 2000, A&A 361,85

Orbital Period = 262 days

Reference star data from SIMBAD

Ref Star	ID	RA	Dec	B	V
A	ALS 12529	22 38 50.93	+61 18 43.2	11.6	11.3
B	BD+60 2422	22 38 33.90	+61 19 08.6	11.3	10.67
C	GSC 04265-00290	22 38 43.27	+61 12 43.8	11.4	11.1
D	AG+61 1389	22 40 08.52	+61 20 12.7	13.2	12.4
E	BD+60 2425A	22 39 45.78	+61 23 47.7	11.13	10.62



J2239.3+6116 (LPH130)

(22h39m,+61d15m lim: 11.0)

