

The Meaning Of Life

This observing list tells a story of birth, life and death within the Universe. Each entry has the essential facts about the object in tabular form and then a paragraph or two explaining why the object is important astrophysically and where it sits on the timeline of the Universe. To get the most out of the list, be sure to read the textual descriptions and physical characteristics as you observe each object.

In order to get your "Meaning of Life" observing pin, observe 20 of the 24 objects during the 2007 Eldorado Star Party. The objects are not necessarily listed in the best observing order but a summary sheet at the end lists them in order of setting time. Turn your completed sheet into Bill Tschumy sometime during the event to claim your pin. If you miss me at ESP you can also mail the completed list to the address given at the end of the list.

******Birth** ****

NGC 6618 , M 17, Cr 377, Swan Nebula

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Sgr	DN, OC	18h 20.8m	-16° 11'	7.5	11'x11'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
1 Myr	6,800 ly	15.1°	-0.8°	3,757 Suns	22x22 ly	

The Swan Nebula houses one of the youngest open clusters known in the Galaxy. At the tender age of 1 million years, the cluster is still embedded in the irregularly shaped nebulosity from which it arose. Although the cluster appears to have around 35 stars, most are not true cluster members. Most of the young stars are heavily obscured by gas and dust and only 5 of them are visible in amateur scopes. However, come back in a few million years and you'll see the cluster in all its glory after the hot young stars have dispersed the surrounding nebula.

The Swan is located within the thin disk of the Galaxy along the inside edge of the Sagittarius Arm, which is the next spiral arm inwards from ours.

IC 1590, Cr 8 (embedded in NGC 281 the Pac-Man Nebula)

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Cas	DN, OC	00h 52.8m	56° 38'	7.4	4'x4'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
3.5 Myr	7,500 ly	123.1°	-6.2°	5,000 Suns	9x9 ly	

This open cluster is also quite young, having formed only 3.5 million years ago. Like most very young clusters, it is still embedded in nebulosity. The cluster contains 63 members brighter than 17th magnitude. Most of the emission nebula is being energized by the 7.4 mag star at its center. Look for it.

This cluster and nebula is part of a much larger giant molecular cloud (GMC) in the next spiral arm outwards from us, the Perseus Arm.

NGC 1624

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Per	DN, OC	04h 40.6m	50° 28'	11.8	3'x3'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
3.9 Myr	20,000 ly	155.3°	2.5°	620 Suns	17x17 ly	

At 20,000 light-years away, this is one of the most distant clusters with nebulosity that can be seen in our galaxy. It has the added attraction of being one of the youngest as well. About a dozen stars are visible as we see this cluster through a gap in the dust within the galactic plane that normally blocks much of our view of distant objects. The NGC 1624 lies out on the periphery of the galactic disc, beyond the Perseus Arm and possibly in the Outer Arm itself.

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NGC 6726-27 and NCG 6729

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
CrA	DN	19h 02m	-36° 53'	7.2	9'x7'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
< 50 My	420 ly	0.0°	-17.8°	19 Suns	1x0.9 ly	

These two nebulae are low and in the south in the constellation Corona Australis, below Sagittarius. Of the two, 6726-27 is the larger and more noticeable. It is a double-lobed reflection nebula. The southwest section reflect the light of a type A star and the northeast section reflects the light of a variable B2 star. The other nebula, NGC 6729 will appear 5' to the southeast, two magnitudes fainter. It is a combination emission+reflection nebula illuminated by a nebular variable star. It varies in brightness and structure similar to Hubble's Variable Nebula (it even has a similar comet shape). Both are part of a larger complex of gas and dust in the region. The large, prominent dark nebulae, Be 158 is 30' to the southeast. The globular cluster NGC 6723 is 30' to the northwest. Be sure to look for them.

**** *Middle Age* ****

NGC 1245, Cr 38

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Per	OC	03h 14.7 m	47° 15'	8.4	10'x10'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
500 Myr	7,400 ly	146.6°	-8.9°	1940 Suns	22x22 ly	

This open cluster, at 500 million years old, is distinctly middle aged. It is fairly rich with a mixture of stars of various sizes. The cluster currently lies 1,300 light-years above the galactic plane and may be migrating out of the thin disk of the galaxy to join its more evolved brethren. It is located on the inner edge of the Perseus Arm of the Galaxy.

NGC 185 (C18) & NGC 147 (C17)

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Cas	Glx	00h 39.0m	48° 20'	9.2	17'x14'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
12 Gyr	2.3 Mly	120.8°	-14.5°	89.9 Mil Suns	11,400x9,500 ly	

This dwarf elliptical galaxy is gravitationally bound to M31, the Andromeda Galaxy and lies about 2.3 million light years away from us. Most dwarf elliptical galaxies are composed primarily of older Population II stars that formed early in the galaxy's history. However, in 1999 it was discovered that NGC 185 has had a burst of new star formation its core within the past 100 million years. It is not clear what triggered this round of star birth.

NGC 147 is another dwarf elliptical lying only 1° away from 185. Together, the two form a "binary galaxy" and orbit around their common center of gravity. NGC 147 doesn't appear to have gone through the recent star formation period as NGC 185 did.

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NGC 6522, NGC 6528

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Sgr	GC	18h 03.6m	-30° 02'	8.6	6'x6'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
11 Gyr	25,400 ly	1°	-3.9°	19,000 Suns	41x41 ly	

These globular clusters have a galactic longitude of 1° indicating that they are found in the direction to the galactic center. In fact, these two globular clusters are located deep within the the galactic bulge itself. The only reason they are visible at all at this location is because they lie in Baade's Window, and area in the galactic bulge that is relatively free of gas and dust. Their ages are uncertain but they appear to have formed long ago when the galaxy itself formed.

NGC 7006, C42

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Del	GC	21h 01.5m	16° 11.3'	10.6	4'x4'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
11 Gyr	128,000 ly	63.8°	-19.4°	77,000 Suns	134x134 ly	

Besides being an ancient ball of stars, this globular cluster also has the distinction of being the 9th furthest globular in our galaxy. You'll find it glowing dimly at the farthest reaches of the Galaxy's fringe. Lying at a shallow angle from the galactic plane, NCG 7006 is heavily obscured by gas and dust, which partly accounts for it dimness. In the 1920's, Harlow Shapley's observations of RR Lyrids in NGC 7006 was instrumental in furthering understanding of the size of our Galaxy.

Pal 11

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Aql	GC	19h 45.2m	-08° 00.4'	9.8	10'x10'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
10 Gyr	43,350 ly	31.8°	-15.6°	18,375 Suns	126x126 ly	

Pal 11 sits more than 11,000 light-years below the plane of the Milky Way. Nevertheless, its relatively high concentration of metal-rich stars indicates that it belong to the "disk population" of globular clusters. These globulars orbit the galactic center as part of a rapidly rotating group that doesn't stray far from the galactic plane. This is in contrast to "halo population" whose orbits take then far out into the galactic halo. The "disk population" globulars appear to be somewhat younger than the "halo population" with ages as young as 9 to 10 billion years old—about as old as the oldest open clusters.

The listed magnitude of 9.8 might be somewhat misleading. Pal 11 is often described by visual observers as a "somewhat pathetic globular".

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Mu Draconis, 21 Draconis, Arrakis

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Dra	Dbl Star	17h 05.3m	54° 28.2'	4.9	2.2"	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
???	88 ly	82.3°	37.0°	6.9 Suns	59 AU	

The two stars making up Mu Draconis are separated by a distance equal to 3/4 the diameter of our solar system. They sit like twin headlights in the vastness of space. Recent calculations estimate their orbital period as being 672 years. Their minimum (visual) separation appears to have been in the 1970s and they are now opening up again. Both components are F7 stars, meaning they are yellow-white in color. The age of this pair is uncertain but is probably less than 3-4 billion years. They lie within our spiral arm, above us in the galactic plane.

NGC 835 (and 833, 838, 839), Arp 318, Hickson 16,

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Cet	Gal Grp	02h 09.4m	-10° 08'	12.1	1.9'x1.6'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
> 12 Gyr	180 MLy	152.5°	-48.2°	38.1 Billion Suns	99,500x84,000 ly	

NGC 835 is the brightest member of the Hickson-16 compact group of galaxies. Galaxy groups are possibly the oldest large-scale structures in the Universe, pre-dating clusters of galaxies, and are highly evolved. This group of small galaxies is exceptional in the having the highest concentration of starburst activity in the nearby Universe.

This group is also known as Arp 318 since the galaxies are "peculiar", probably due to tidal interactions between them. In particular, there seems to be an interaction between 835 and 833 immediately to its west. It is possible they are in the process of merging.

M71 , NGC 6838

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Sge	GC	19h 53.8m	18° 47'	8.2	6.1'x6.1'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
9-10 Gyr	13,000 ly	56.8°	-4.6°	6,580 Suns	27x27 ly	

M71 is one of the closest globular clusters to us. It would look more spectacular were it not for the fact that it is also one of the smallest globular clusters known. It has a mass of only 40,000 Suns and a modest size of 27 light-years in diameter. For some time it was debated whether this was a compact open cluster (a.la. M11 - the wild duck cluster) or a true globular. The consensus now is that it is indeed a globular cluster.

The high abundance of "metals" in its stars is explained by it only being 9 or 10 billion years old; young for a globular. Like Pal 11, this globular belong to the "disk population" of globular clusters that orbit in the plane of the Galaxy.

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NGC 7814, C43

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Peg	Glx	00h 03.3m	16° 09'	10.6	6'x2'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
???	49 Mly	106.4°	-45.2°	11.2 billion Suns	78,400 x 32,800 ly	

NGC 7814 is an edge-on galaxy. It has a dust lane that may be visible in larger scopes (> 20"). There has been some question as to whether this is an early spiral galaxy or a lenticular galaxy. Near-infrared images reveal the disk is substantially larger than visible images show. This would suggest that large amounts of gas and dust are present in the disk's outskirts.

NGC 6946, C12

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Cep	Glx	20h 34.8m	60° 09'	8.8	13'x13'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
???	18 Mly	95.7°	11.7°	8 billion Suns	58,600x46,000 ly	

This spiral galaxy lies in a region known as the "Local Void". This is a volume 30 million light-years in diameter that contains relatively few galaxies. NGC 6946 also holds the record for the most supernovae recorded in any galaxy with 7 having been seen. One of the spiral arms contains a huge (one million solar masses), young (15 million years old) star cluster that is thought to be a globular cluster in the process of formation. A low power view of the galaxy will show a foreground cluster NGC 6939 40' to the northwest.

NGC 663, Cr 20, C10, Horseshoe Cluster

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Cas	OC	01h 46.3m	61° 13'	7.1	15'x15'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
16.2 Myr	9,200	129.5°	-1.0°	9,900 Suns	40x40 ly	

Like most open clusters found in Cassiopeia, NGC 663 is located in the next spiral arm outward from ours. The cluster contains the largest percentage of "Be" stars of any known cluster. Be stars are hot "B" type stars that are encircled by equatorial disks of material that radiate hydrogen emission lines. The Be stars belong to a class of stars known as "eruptive variables".

The cluster has a north-south dark lane that divides it in half. This gives rise to the name "Horseshoe Cluster".

NGC 6520, Cr 361

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Sgr	OC	18h 03.4m	-27° 53.5'	7.6	5'x5'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
53 Myr	5,200 ly	2.9°	-2.8°	2,005 Suns	8x8 ly	

This tightly compressed open cluster resides in the Sagittarius Arm in the direction of the galactic center. It can be considered an "adolescent" cluster at 53 My old. It has been around long enough to disperse the nebulosity from which it formed, yet is still young enough to contain hot bright stars. The dark nebula Barnard 86 may be found just 10' to the northwest.

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**** *Death* ****

Mu Cephei, Garnet Star

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Cep	Star	21h 43.5m	58° 46.8'	3.9	0.018"	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
< 10 Myr	3,000 ly	100.6°	4.3°	38,000 Suns	7 AU	

Mu Cephei is a star nearing the end of its life. Having exhausted its store of hydrogen in the core, it has begun to fuse helium into carbon. Hydrogen fusion still occurs in the outer shell which causes the star to swell and cool on its surface. This accounts for the star's huge size and deep red color. Mu Cephei is 40 percent larger than the orbit of Jupiter and has a surface temperature of only 3500° K. These combine to make it one of the reddest stars in the northern sky. It is also one of the few stars whose actual disk is discernible with professional equipment.

Although the star is nearing the end of its life, it hasn't lived all that long. Mu Cephei is about 40 times the mass of the Sun and stars that massive may live only a few million years before going supernova.

M54, NGC 6715

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Sgr	GC	18h 55.1m	-30° 29'	7.7	12'x12'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
~12 Gyr	87,400 ly	5.6°	-14.1°	517,000 Suns	305x305 ly	

M54 is commonly thought of as a globular cluster in our galaxy, but in 1994 it was determined that it is probably is part of the newly discovered Sagittarius Dwarf Elliptical Galaxy (SagDEC), a member of our local group. It has even been suggested that M54 is the nucleus of SagDec itself. The companion galaxy is in the process of being gravitationally disrupted by our galaxy and M54 will collide with the disk of our galaxy in a few tens of millions of years. M54 is one of the largest and most massive globular clusters known with a mass of 1.5 million solar masses.

I have placed this object in the "Death" collection of the list since it seems to be an example of a galaxy being absorbed and destroyed by ours.

NGC 1193, Cr 35

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Per	OC	03h 05.9m	44° 23'	12.6	3'x3'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
7.9 Gyr	14,000 ly	146.8°	-12.2°	145 Suns	12x12 ly	

NGC 1193 is one of the oldest open clusters known. At the ancient age of 7.9 billion years, it now consists of only small, cool stars. All the hotter stars originally part of the cluster have lived out their lives and have either gone supernova or turned into white dwarves. Because of its great distance and inherent dimness, you will probably need a larger scope to view this one.

It is not clear what conditions allowed this cluster to stay together all these years. Most would have drifted apart by now and become part of the background stars. Like many old open clusters, this one has migrated out of the plane (thin disk) of the Galaxy.

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NGC 6791

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Lyr	OC	19h 20.9m	37° 46.5'	9.5	10'x10'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
4.4 Gyr	12,400 ly	70.0°	10.9°	1,980 Suns	36x36 ly	

While only half the age of ancient NGC 1193, this cluster still qualifies for the geriatric division. NCG 6791 is a very rich cluster of old faint stars. Photographs show it has a very high concentration of golden stars similar to a loose globular cluster. Like NGC 1193, this cluster has migrated out of the plane of the Galaxy. It is currently sitting about 2,000 light-years above our own spiral arm in the direction where it winds into the galactic core.

NCG 6888, Crescent Nebula

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Cyg	DN	20h 12.0m	38° 21'	8.8	18'x13'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
???	6,000 ly	75.5°	2.4°	880 Suns	31x23 ly	

This object could be considered both young and old. The Crescent nebula is illuminated by a Wolf-Rayet star, a massive star that is nearing the end of its short life. It has already quickly proceeded through its red supergiant phase and is now emitting a fast stellar wind that is plowing into the material that was ejected earlier. The Wolf-Rayet star will soon (a few hundred thousand years) go supernova. If you imagine the nebula as a bow, the 7th magnitude star is located halfway along the bow-string stretched between the ends.

The Crescent Nebula and star are located about 6,000 light-years away along the inner of our own spiral arm in the direction in which it winds inward to the galactic core.

IC 5148

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Gru	PN	21h 59.6m	-39° 23'	13.0	???	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
???	2,900 ly	2.7°	-52.4°	4.3 Suns	2x2 ly	

Appearing in the famous Eldorado Star Party constellation of Grus, this large, dim planetary will be a bit of a challenge do to its relatively large size and low surface brightness. Try a UHC filter on it. The nebulosity has an expansion velocity of 53.4 km/s - one of the fastest expansion velocities of any planetary known. Like all planetaries, IC 5148 will be short lived. In a few tens of thousands of years the glowing nebula will disappear into the interstellar medium.

NCG 6445

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Sgr	Pn	17h 49.3m	-20° 01'	12.0	0.6'x0.6'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
3,300 yr	5,300 ly	8.1°	3.9°	36 Suns	0.8x0.8 ly	

Located in the sky 21' northwest of the dim globular cluster NGC 6440, this planetary nebula actually resides an estimated 5,300 light-years away in the Sagittarius Arm of the galaxy (the next arm inward from ours). The globular is much farther away at 27,000 light-years.

The planetary is an older, evolved nebula (estimated age of 3,300 years) with an asymmetric, bipolar structure.

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NGC 1535

Constellation	Type	RA	Dec	Magnitude	Apparent Size	Observed
Eri	PN	04h 14.2m	-12° 44'	9.6	0.3'x0.3'	
Age	Distance	Gal Lon	Gal Lat	Luminosity	Actual Size	
7,500 yr	4,550 ly	206.5°	-40.6°	243 Suns	0.4x0.4 ly	

This planetary nebula is located on the other side of our own spiral arm. Although smaller in apparent size, it is similar to the Eskimo Nebula in many ways. Larger scopes will show distinct inner and outer layers, with the whole nebula having a pale blue color. The nebula is relatively old (for a planetary nebula) at an estimated 7,500 years. Larger scopes will show the central star that is on its way to becoming a white dwarf.

Abbreviations:

OC - Open Cluster
 DN - Diffuse Nebula
 PN - Planetary Nebula
 GC - Globular Cluster
 Glx - Galaxy

Myr - million years
 Gyr - billion years
 ly - light year

You can send your completed observations to:

Bill Tschumy
 6604 Lakewood Point Cove
 Austin, TX 78750

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Eldorado Star Paty 2007

Observing list summary -- in order of setting time

Name	Type	Const	RA	Dec	Mag	Size	Set Time	Observed
NGC 6522, NGC 6528	Globular	Sgr	18h03m36s	-30°02'00"	8.6	5.6'	11:13 PM	
NGC 6520, Cr 361	Open	Sgr	18h03m24s	-27°54'00"	7.6	6'	11:19 PM	
NGC 6445	P Neb	Sgr	17h49m12s	-20°01'00"	12.0	0.6'	11:28 PM	
NGC 6681	Globular	Sgr	18h43m12s	-32°18'00"	7.5	7.8'	11:45 PM	
NGC 6726-29	E Neb	CrA	19h01m42s	-36°53'00"	7.2	2'	11:49 PM	
M 54, NGC 6715	Globular	Sgr	18h55m06s	-30°29'00"	7.7	9.1'	12:03 PM	
Pal 11	Globular	Aql	19h45m14s	-08°00'26"	9.8	3.2'	01:55 AM	
IC 5148	P Neb	Gru	21h59m30s	-39°23'00"	13.0	2'	02:23 AM	
M71, NGC 6838	Globular	Sge	19h53m48s	+18°47'00"	8.2	7.2'	03:09 AM	
Mu Draconis, 21 Draconis	Triple	Dra	17h05m20s	+54°28'13"	4.9		03:24 AM	
NGC 6791	Open	Lyr	19h20m42s	+37°51'00"	9.5	16'	03:41 AM	
NGC 7006, C42	Globular	Del	21h01m30s	+16°11'00"	10.6	2.8'	04:10 AM	
NGC 6888, Cresent Nebula	E Neb	Cyg	20h12m00s	+38°21'00"	10.6	20'	04:35 AM	
NGC 7814, C43	Galaxy	Peg	00h03m18s	+16°09'00"	10.6	6.3'	07:10 AM	
NGC 835, Arp 318, Hickson 16	Galaxy	Cet	02h09m24s	-10°08'00"	12.1	1.4'	08:12 AM	
NGC 185, C18	Galaxy	Cas	00h39m00s	+48°20'00"	9.2	11.5'	09:57 AM	
NGC 1535	P Neb	Eri	04h14m12s	-12°44'00"	9.6	0.7'	10:10 AM	
IC 1590, Cr 8	Open	Cas	00h53m06s	+56°35'00"	7.4	4'	11:16 AM	
NGC 1193, Cr 35	Open	Per	03h05m48s	+44°23'00"	12.6	2'	11:57 AM	
NGC 1245, Cr 38	Open	Per	03h14m42s	+47°15'00"	8.4	10'	12:25 PM	
NGC 1624	Open	Per	04h40m24s	+50°27'00"	11.8	5'	02:15 PM	
NGC 6946, C12, Arp 29	Galaxy	Cyg	20h34m52s	+60°09'00"	8.8	1.6x9.9'	Circum	
Mu Cephei, Garnet Star	Triple	Cep	21h43m30s	+58°46'48"	3.9		Circum	
NGC 663, Cr 20, C10	Open	Cas	01h46m00s	+61°15'00"	7.1	16'	Circum	