

DEG. 54

CYGNUS

HERCULES

DELPHINUS Altair

STAR

AQUILA

SERPENS

OPHIUCHUS

AQUARIUS

TALK

CAPRICORNUS

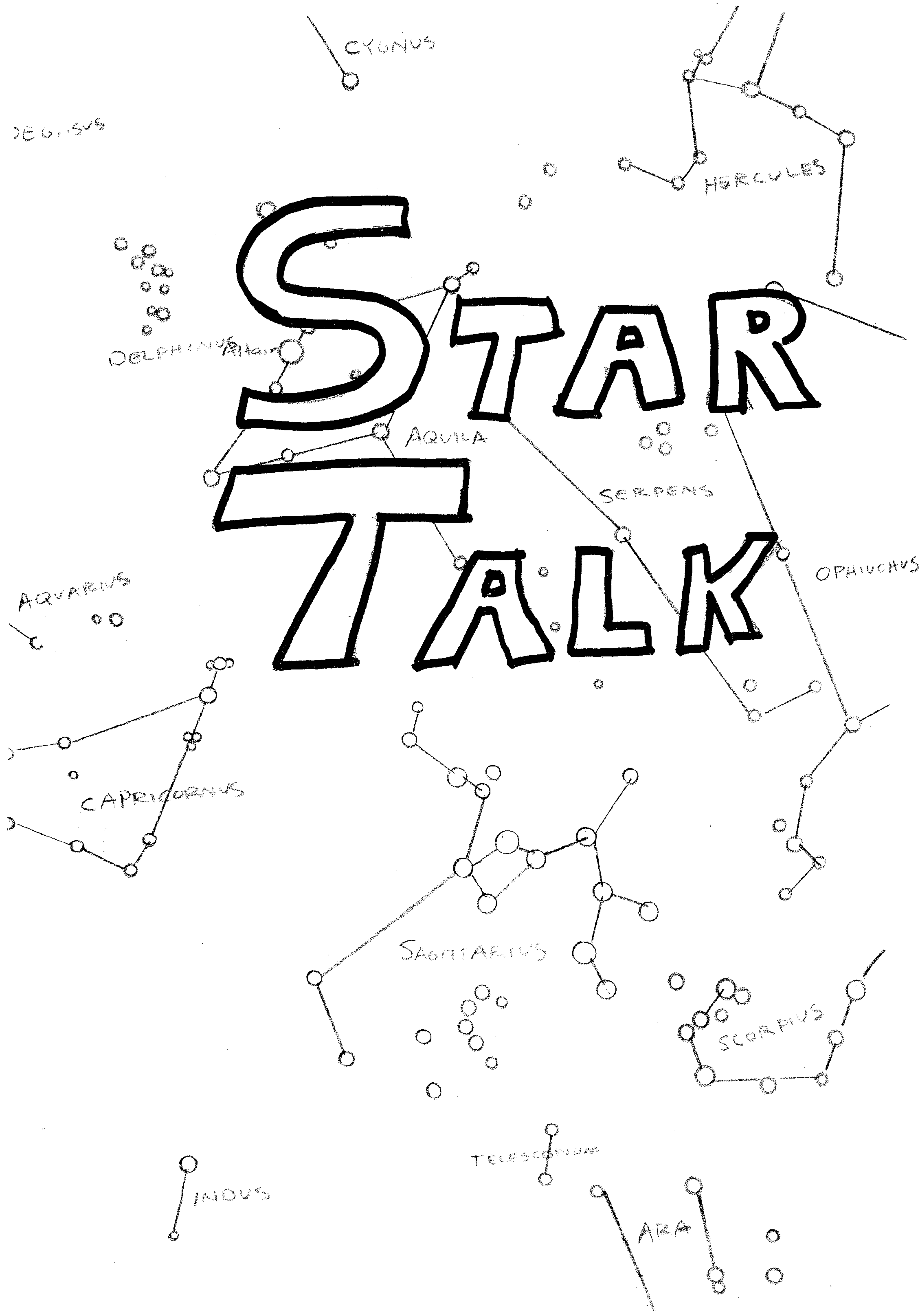
SAGITTARIUS

SCORPIUS

INDUS

TELESCOPUM

ARA



2005-06 Celestial Events

- March 6 **Mars** above **crescent Moon** about 75 minutes before sunrise.
 7 Best time to see **Mercury** this year; look low in the west 75-85 minutes after sunset for the next two weeks.
 11 **Mercury** to the right of the **crescent Moon** about 75 minutes after sunset
 19 **Moon** near **Saturn** tonight
 25-26 **Full Moon** near **Jupiter**
- April 4 **Jupiter** nearest to **Earth** this year, about 667 million km.
 8 **Partial solar eclipse**, possibly visible from Costa Rica.
 15 **Moon** near **Saturn**.
 21 **Lyrid** meteor shower
 22 **Moon** near **Jupiter**.
- May 13 **Moon** above **Saturn** in evening.
 20 **Moon** near **Jupiter**
 21 **Moon** above **Mars** and **Saturn** – Saturn is the brighter of the two.
 26 **Moon** beside **Jupiter**.
- June 9 **Crescent Moon** near **Saturn** and **Pollux**
 15 **Moon** very close to **Jupiter** (about 2200 ADST).
 17 **Venus** visible near northwest horizon at dusk, forms triangle with **Saturn** (to its left) and **Pollux** (above).
 22 **Moon** beside **Jupiter**.
 24 On this date in 1947, the term “flying saucer” was coined by a pilot who reported flying disks over Washington’s Cascade Mountains.
 25 For the next week, **Venus** and **Mercury** and **Saturn** form a three-planet cluster on the WNW horizon near **Castor** and **Pollux** about 50 min after sunset.
- July 5 **Earth** at aphelion (farthest point from **Sun**, about 152.1 million km).
 8 **Crescent Moon** above **Venus** at dusk.
 13 **Moon** near **Jupiter**.
- August Meteor Month! The best month to see meteor showers.
 7 **Crescent Moon** close to **Venus** at dusk.
 9 **Crescent Moon** close to **Jupiter** at dusk.
 11 **Perseid** meteor shower tonight – may be the best meteor show of the year.
 24 **Moon** near **Mars** late evening.
 25 **Mercury** below **Saturn** on eastern horizon about 75 minutes before sunrise for the next week or so.
 28 Best time to see the **Milky Way** this summer (next ten days or so).
 31 **Moon** near **Saturn** at morning twilight.
- Sept. 1 **Venus** very close to **Jupiter** after sunset.
 7 **Crescent Moon** near **Venus** and **Jupiter** after dusk.
 21 **Moon** near **Mars** mid-evening
- Oct. 6 **Crescent Moon** below **Venus** in SW at dusk.
 16 **Mars** is closest to **Earth** and brightest in the sky for then next month than it will be until 2018.

- 17 **Partial lunar eclipse** about 1700 PDST; probably not visible from the West Coast but worth a look.
- 18 **Moon** near **Mars** in early evening
- 21 **Orionid** meteor shower.
- 24 **Moon** near **Saturn** late evening
- 29 **Mars** nearest **Earth** tonight. Closest approach until 2018. Very bright in the sky near **Aldebaran**.
- Nov. 5 **Crescent moon** near **Venus** in SW at dusk.
- 14 **Moon** near **Mars**
- 17 **Leonid** meteor shower
- 21 **Moon** near **Saturn** early evening
- 29 **Moon** near **Jupiter** a couple hours before Early Riser.
- Dec. 4 **Venus** very close to **crescent Moon** at dusk.
- 11 **Moon** near **Mars** tonight
- 13 **Geminid** meteor shower.
- 18 **Moon** near **Saturn** early evening.
- 26 **Crescent Moon** near **Jupiter** after 0100.
- Jan. 1 **Venus** near **Moon**.
- 3 **Quadrantid** meteor shower.
- 15 **Saturn** near **Moon**.
- 22 **Jupiter** near **Moon**.
- 27 **Venus** near **Moon**.
- Feb. 5 **Mars** near **Moon**.
- 6 **Venus** near **Moon**.

Glossary

asterism•group of stars seen as a shape, such as a constellation, or part of one.

celestial equator•projection of Earth's equator onto the celestial sphere.

degree•celestial map unit of measurement. $\frac{1}{2}$ degree = diameter of the Moon.

double or multiple star•apparently single star with two or more components. **Binary double**•components orbit one another.

ecliptic•line that traces the apparent annual path of the Sun around the celestial sphere.

globular star cluster•dense collection of thousands of very old stars. **Open star cluster**•less dense, includes tens to hundreds of young hot stars.

magnitude•measure of perceived brightness. Lower numbers = brighter magnitudes.

nebula•immense clouds of dust and gasses where stars are born.

precession•wobble in Earth's axis that shifts its orientation to the stars.

right ascension (RA)/declension (dec)•grid lines projected onto the celestial sphere to indicate position; similar to Earth's latitude and longitude, respectively.

zodiac•literally, "circle of animals." An 18° path following the ecliptic.

NAVIGATIONAL STARS AND THE PLANETS

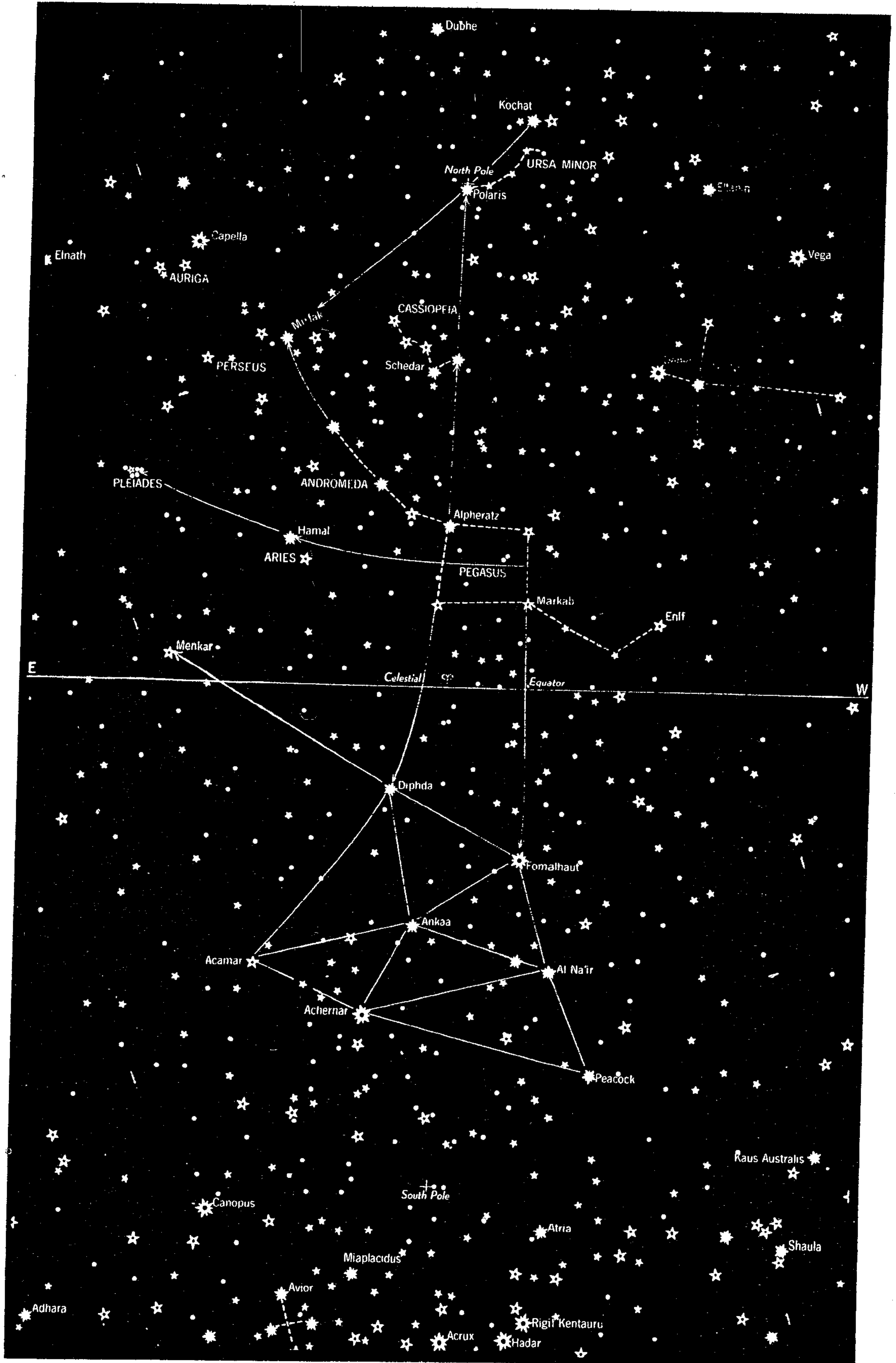
Name	Pronunciation	Bayer name	Origin of name	Meaning of name	Distance*
Acamar	ā'kâ-mâr	θ Eridani	Arabic	another form of Achernar	120
Achernar	ā'kêr-nâr	α Eridani	Arabic	end of the river (Eridanus)	72
Acrux	ā'krûks	α Crucis	Modern	coined from Bayer name	220
Adhara	â-dâ'ra	ε Canis Majoris	Arabic	the virgin(s)	350
Aldebaran	âl dêb'â-rân	α Tauri	Arabic	follower (of the Pleiades)	64
Alioth	âl'î-ôth	ε Ursa Majoris	Arabic	another form of Capella	49
Alkaid	âl-kâd'	η Ursa Majoris	Arabic	leader of the daughters of the bier	190
Al Na'ir	âl-nâr'	α Gruis	Arabic	bright one (of the fish's tail)	90
Alnilam	âl'nî-lâm	ε Orionis	Arabic	string of pearls	410
Alphard	âl'fârd	α Hydrae	Arabic	solitary star of the serpent	200
Alphecca	âl'fêk'â	α Corona Borealis	Arabic	feeble one (in the crown)	76
Alpheratz	âl'fê'râts	α Andromeda	Arabic	the horse's navel	120
Altair	âl-târ'	α Aquilae	Arabic	flying eagle or vulture	16
Ankaa	ân'kâ	α Phoenicis	Arabic	coined name	93
Antares	ân-tâ'rêz	α Scorpii	Greek	rival of Mars (in color)	250
Arcturus	ârk-tû'rûs	α Bootis	Greek	the bear's guard	37
Atria	ât'ri-â	α Trianguli Australis	Modern	coined from Bayer name	130
Avior	â'vî-ôr	ε Carinae	Modern	coined name	350
Bellatrix	bê-lâ'trîks.	γ Orionis	Latin	female warrior	250
Betelgeuse	bê't'êl:jûz	α Orionis	Arabic	the arm pit (of Orion)	300
Canopus	kâ-nô'pûs	α Carinae	Greek	city of ancient Egypt	230
Capella	kâ-pêl'â	α Aurigae	Latin	little she-goat	46
Deneb	dên'êb	α Cygni	Arabic	tail of the hen	600
Denebola	dê-nêb'ô-lô	β Leonis	Arabic	tail of the lion	42
Diphda	dîf'dâ	β Ceti	Arabic	the second frog (Fomalhaut was once the first)	57
Dubhe	dûb'ê	α Ursa Majoris	Arabic	the bear's back	100
Elnath	êl'nâth	β Tauri	Arabic	one butting with horns	130
Eltanin	êl-tâ'nîn	γ Draconis	Arabic	head of the dragon	150
Enif	ên'îf	ε Pegasi	Arabic	nose of the horse	250
Fomalhaut	fô'mâl-ôt	α Piscis Austrini	Arabic	mouth of the southern fish	23
Gacrux	gâ'krûks	γ Crucis	Modern	coined from Bayer name	72
Gienah	jê'nâ	γ Corvi	Arabic	right wing of the raven	136
Hadar	hâ'dâr	β Centauri	Modern	leg of the centaur	200
Hamal	hâm'âl	α Arietis	Arabic	full-grown lamb	76
Kaus Australis	kôs ôs-trâ'îls	ε Sagittarii	Ar., L.	southern part of the bow	163
Kochab	kô'kâb	β Ursa Minoris	Arabic	shortened form of "north star" (named when it was that, c. 1500 BC-AD 300)	100
Markab	mâr'kâb	α Pegasi	Arabic	saddle (of Pegasus)	100
Menkar	mên'kâr	α Ceti	Arabic	nose (of the whale)	1,100
Menkent	mên'kênt	θ Centauri	Modern	shoulder of the centaur	55
Miaplacidus	mî'â-plâs'î-dûs	β Carinae	Ar., L.	quiet or still waters	86
Mirfak	mîr'fâk	α Persei	Arabic	elbow of the Pleiades	130
Nunki	nûn'kê	σ Sagittarii	Bab.	constellation of the holy city (Eridu)	150
Peacock	pê'kôk	α Pavonis	Modern	coined from English name of constellation	250
Polaris	pô-lâ'ris	α Ursa Minoris	Latin	the pole (star)	450
Pollux	pôl'ûks	β Geminorum	Latin	Zeus' other twin son (Castor, α Geminorum, is first twin)	33
Procyon	prô'sî-ôn	α Canis Minoris	Greek	before the dog (rising before the dog star, Sirius)	11
Rasalhague	râs'âl-hâ'gwê	α Ophiuchi	Arabic	head of the serpent charmer	67
Regulus	rêg'û-lûs	α Leonis	Latin	the prince	67
Rigel	rî'jêl	β Orionis	Arabic	foot (left foot of Orion)	500
Rigel Kentaurus	rî'jêl kên-tô'rûs	α Centauri	Arabic	foot of the centaur	4.3
Sabik	sâ'blk	η Ophiuchi	Arabic	second winner or conqueror	69
Schedar	shêd'âr	α Cassiopeiae	Arabic	the breast (of Cassiopeia)	360
Shaula	shô'lâ	λ Scorpii	Arabic	cocked-up part of the scorpion's tail	200
Sirius	sîr'î-ûs	α Canis Majoris	Greek	the scorching one (popularly, the dog star)	8.6
Spica	spî'kâ	α Virginis	Latin	the ear of corn	155
Suhail	sôo-hâl'	λ Velorum	Arabic	shortened form of Al Suhail, one Arabic name for Canopus	200
Vega	vê'gâ	α Lyrae	Arabic	the falling eagle or vulture	27
Zubenelgenubi	zôo-bên'êl-jê-nû'bê	α Librae	Arabic	southern claw (of the scorpion)	66

PLANETS

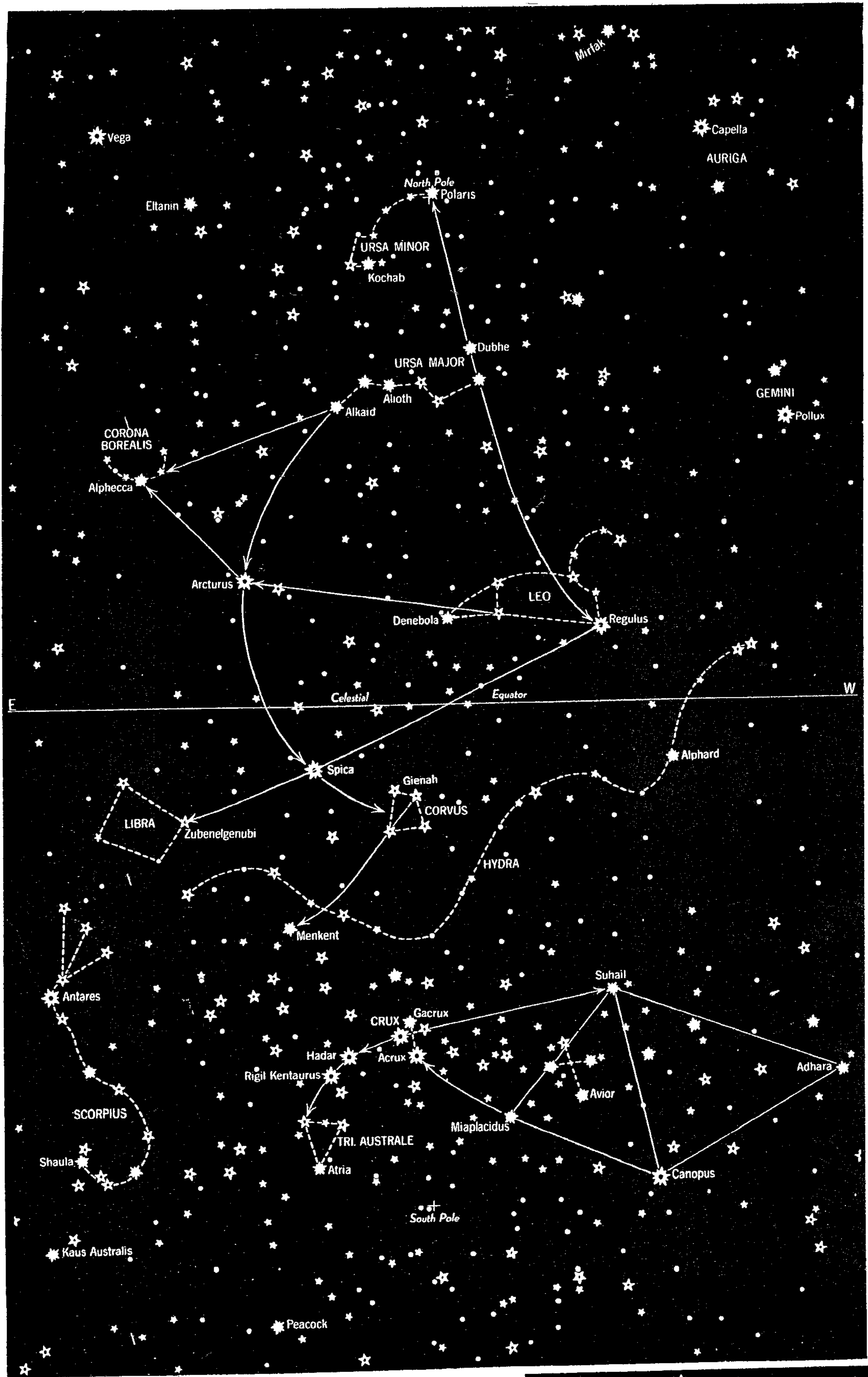
Name	Pronunciation	Origin of name	Meaning of name
Mercury	mûr'kû-rî	Latin	god of commerce and gain
Venus	vê'nûs	Latin	goddess of love
Earth	êrth	Mid. Eng.	—
Mars	mârz	Latin	god of war
Jupiter	jôô'pî-têr	Latin	god of the heavens, identified with the Greek Zeus, chief of the Olympian gods
Saturn	sât'êrn	Latin	god of seed-sowing
Uranus	û'râ-nûs	Greek	the personification of heaven
Neptune	nêp'tûn	Latin	god of the sea
Pluto	plôô'tô	Greek	god of the lower world (Hades)

Guide to pronunciations:

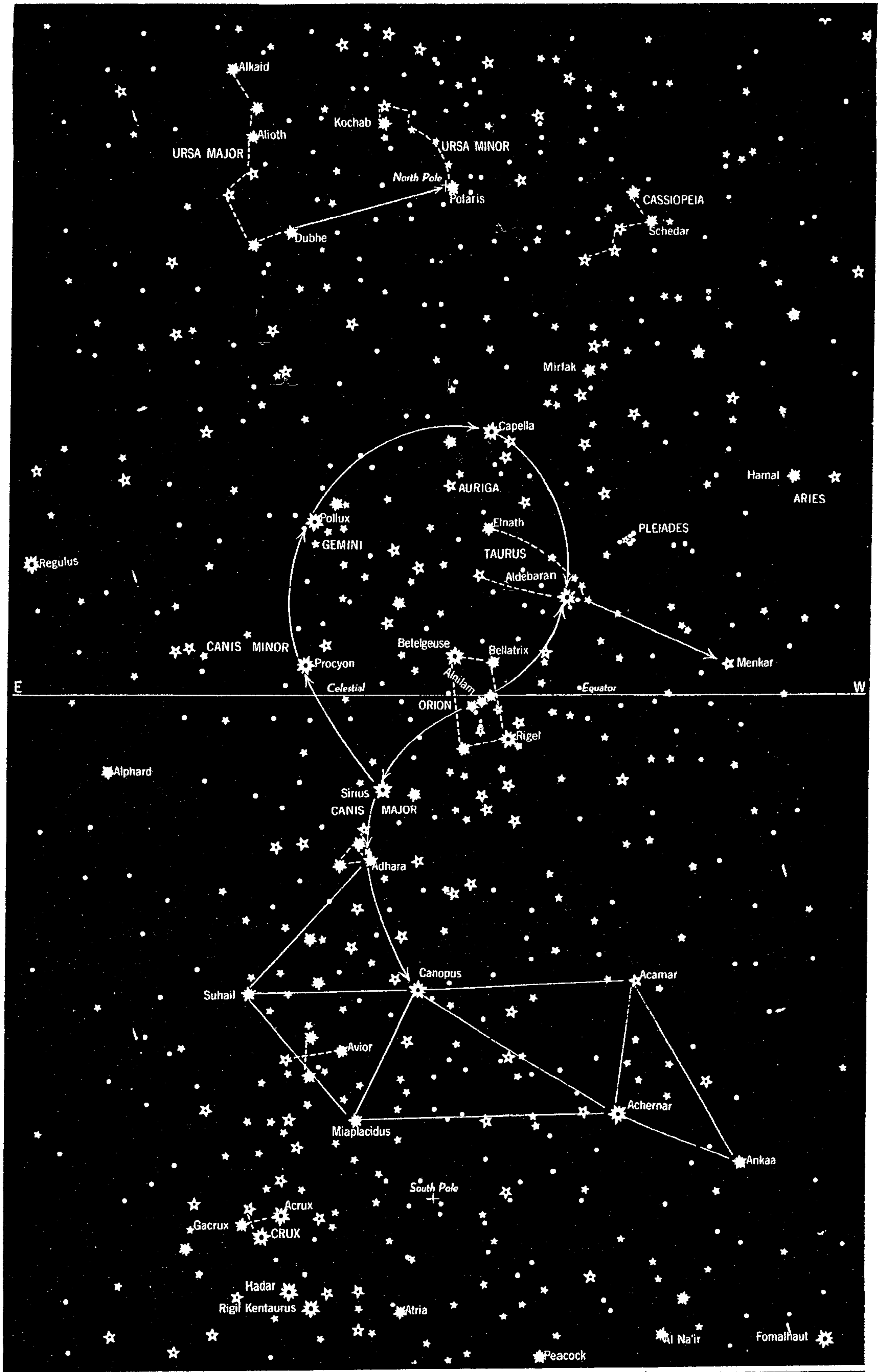
fâte, ädd, fînal, lâst, äbound, ärm; bê, ênd, camêl, readêr; îce, bîl, ânîmal; ôver, pôetic, hôt, lôrd, môon; tûbe, ûnite, tûb, cîrcûs, ûrn
 *Distances in light-years. One light-year equals approximately 63,300 AU, or 5,880,000,000,000 miles. Authorities differ on distances of the stars; the values given are representative.



Scale of magnitudes: 1st  2nd  3rd  4th  5th 



Scale of magnitudes: 1st 2nd 3rd 4th 5th



Scale of magnitudes: 1st  2nd  3rd  4th  5th 

Constellation Notes

Ursa Major – The Greater Bear

In Greek mythology, Zeus fell in love with Callisto. A jealous Hera turned the beauty into a bear, but left Callisto with human awareness. Callisto wandered the forest, afraid of the other animals, until Zeus put her into the sky.

In some native American cosmologies, the bear is seen as pursued by three hunters.

The Greek word for bear is “arktos.” Thus, “Arctic” literally means bearish, for the latitudes where the constellation dominates the sky.

Legend has it that Roman legionnaires has to pass a vision test by distinguishing Alcor and Mizar.

Ursa Minor – the Lesser Bear

Another version of the above myth. Arcas was the son of Zeus and Callisto. After Hera turned Callisto into a bear, Callisto encountered Arcas and tried to embrace him. Thinking a bear was attacking her, he jabbed at her with his spear, but before Zeus intervened and put them both in the sky as bears.

Polaris and precession

Polaris is one degree from the celestial north pole and continues to move closer. It will be closest about 2105.

Polaris was 3½ degrees from the pole in the time of Columbus.

Precession occurs on a 28,500-year cycle called the Platonic Year.

Approx year.	Star	Comments
3000 BC	Thuban (α Draconis)	Only $\frac{1}{4}$ as bright as Polaris, but sat right on the celestial north pole.
500 BC	Kochab (β Ursa Minoris)	It's motion was still apparent.
Present day	Polaris (α Ursa Minoris)	
AD 4000	γ Cephei	
AD 6000	α Cephei	
AD 8000	β Cephei	

AD 10,000	Deneb (α Cygni)	A few faint stars will actually be closer to the pole.
AD 14,000	Vega (α Lyrae)	
AD 18,000	τ Herculis	
AD 23,000	Thuban again!	

Polaris is a Cepheid variable, meaning its magnitude varies over a given period. Its pulsations have diminished over the last hundred years and are now undetectable visually.

Polaris is also a double – possibly a triple – star, with a smaller companion of magnitude 8.2.

Boötes – The Herdsman

Boötes is commonly seen as driving Ursa Major. This constellation has also been associated with Icarus, the mythological inventor of wine making.

Arcturus, the brightest star in the northern hemisphere, is the first to be spotted through a telescope in the daytime (1635).

Arcturus is the fastest-moving visible object outside the Solar System. It has moved about $\frac{1}{2}$ degree – the width of the full Moon – since the end of the first millennium AD.

Hercules

In Roman mythology, a son of Jupiter famous for his strength.

Lyra – The Lyre

Associated with the lyre in the Orpheus myth, a gift to the hero from Apollo.

Vega was the first star to be photographed, in 1850.

Vega is the baseline star for the magnitude system (Vega=0)

Epsilon Lyrae, a four-star system, is a visual binary to the sharp-eyed observer.

Sagittarius -- The Archer

The Archer is shooting at Scorpius to avenge the killing of Orion.

Sagittarius is one of two centaurs in the sky

The center of the Milky Way galaxy lies in the direction of Sagittarius.

Cygnus – The Swan

In one myth, Zeus turned himself into a swan to seduce Leda. In another, Cygnus was the friend of Apollo's son Phaeton, who died trying to drive the sun chariot. A grieving Cygnus tried to recover Phaeton's body from the river in which it had fallen, diving repeatedly until exhausted. Zeus turned him into a swan and placed him in the sky.

Pegasus – The Winged Horse

Born from the blood of Medusa, who was killed by Perseus, Pegasus subsequently helped the hero in his adventures. Later, he carried Zeus's thunderbolts for him.

In 1972, the star Enif flared about 10 minutes to five times its usual brightness.

Cassiopeia – Queen of Ethiopia

The queen, wife of King Cepheus (another constellation) claimed to be more beautiful than Poseidon's daughters. The god sent the sea monster Cetus (another constellation) to attack Ethiopia. To appease Poseidon, Cassiopeia's daughter Andromeda (another constellation) was sacrificed. But Andromeda was rescued by Perseus (another constellation – oh, never mind).

Taurus – The Bull

An ancient constellation. In myth, Zeus assumed the form of the bull to seduce Europa. Some scholars have argued that this constellation was the real "golden calf" worshipped by the Israelites while waiting for Moses to return from Mt. Sinai.

The Pleiades – the Seven Sisters – were the inspiration for the Subaru logo, representing six companies becoming one.

Orion – The Hunter

Hera, in a typical fit of jealousy, sent Scorpius to kill handsome hunter Orion. He was saved at the last moment by the healer Ophiuchus.

The Egyptians called this constellation Osiris, god of light. The Bororo of Brazil saw a crocodile. The Maori see a canoe.

Betelgeuse varies from 550 to 900 times the diameter of the sun.

Canis Major – The Great Dog

Australian aborigines see the star Sirius as a dog.

The Egyptians saw Sirius's rising as a sign the Nile was about to flood.

Sirius is a double star. The white dwarf companion and the larger star orbit each other every 60 years.

Canis Minor – The Lesser Dog

Procyon has a white dwarf companion very similar to Sirius's.

Cancer – The Crab

Hera sent the crab after Heracles to prevent him from killing the Hydra. Cancer was crushed and placed in the sky as a reward for his bravery.

The Egyptians called this constellation Scarabaeus, the sacred beetle.

Hydra – The Water Snake

A dragon slain by Hercules, who grew two heads for every one the hero cut off. Hydra was eventually killed by fire.

Leo – The Lion

An old constellation, recognized in Mesopotamia 5,000 years ago. The Greeks associated Leo with the Nemean Lion killed by Heracles.

The Southern Sky

Alpha Centauri (Rigel Kentaurus)

The closest star to our sun, Alpha Centauri is a triple star 4.3 light years away. Associated with the centaur Chiron, the teacher of the Jason and the Argonauts myth.

Canopus (α Carinae)

Second brightest star in the sky.

Magellanic Clouds

Two irregular companions to our own Milky Way galaxy.

Southern Cross (Crux)

Points toward the celestial south pole, about 5 "Crux lengths" from the lower tip of the cross.

Smallest of the 88 constellations.

Don't confuse with the "False Cross" in Carina.

The Moon

Distance from Earth: 238,000 miles

Diameter: 2,160 miles

The Moon circles the Earth every 29.5 days.

Atmosphere: Virtually none

Gravity: About 1/8 Earth's

Casual observers routinely believe the Moon to be bigger in the sky than it really is. It occupies only $\frac{1}{2}$ a degree in the sky (meaning it would take 180 Moons to reach from the horizon to straight overhead).

Only two other celestial objects – Mercury and Venus – have phases visible from Earth.

The Moon's brightness varies by its position on its elliptical orbit. It is also 7% brighter in winter, when the Earth/Moon system is closer to the Sun.

A "Harvest Moon" is a full Moon near the autumn equinox that, because of the tilt of the Earth on its axis, rises at about sunset every evening for several consecutive evenings (thus, providing more uninterrupted light for the harvest). Look for the Harvest Moon around Sept. 18 in 2005.

A "Blue Moon" is the second full Moon to appear in a calendar month.

The large lava fields called maria, or seas dominate the near side of the Moon. The far side is pockmarked with craters.

Earthlight, when seen from the Moon, is five times brighter moonlight seen from Earth and the planet's diameter four times that of the Moon's. The Earth's phase complements the Moons, i.e. the fatter the Moon appears to us, the thinner the earth appears to Moon people.

The first probe to send back images of the far side of the Moon was Luna 3 (USSR) in 1959.

Prior to the landing of the first probes, the mountains of the Moon were assumed to have jagged peaks, unaffected by erosion. The mountaintops turned out to be rounded, eroded by the bombardment of tiny meteorites over the ages.

The first manned landing on the Moon was the Apollo 11 lander *Eagle* (USA) on July 20, 1969. The last person to walk on the Moon was astronaut Eugene Cernan in December 1972.

The surface of the Moon is covered with several inches of a fine, talcum-fine soil probably the result of the meteoric erosion mentioned above.

Moonquakes don't abate in a few minutes like those on earth, but "ring" throughout the satellite's crust for up to 3 hours.

Until very recently thought to be airless and waterless, it now appears the Moon may have both. Recent observations show not only some trace gases streaming off the satellite in the solar wind, but indications of water near the poles. This latter discovery caused President George W. Bush to propose last year that a permanent base be built on the Moon.

The stress caused by Earth's gravity may cause the Moon to break up into a ring like Saturn's in several billion years from now. Some paleontologists speculate that Earth may have had a second moon that broke up for the same reason, possibly causing one of the mass extinctions evident in the fossil record.

Moon Finder

Phase	Rises	Sets
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New Moon	Sunrise	Sunset
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*Note that the Moon rises about 50 minutes later each day.

Waxing Crescent	A few hours after Sun	A few hours after Sun
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*You may see the rest of Moon dimly lit by "Earthlight" in this phase. This is called "the old Moon in the new Moon's arms."

*Through binoculars, you can clearly see the Mare Crisium and several large craters.

First Quarter	6 hours after Sun	6 hours after Sun
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*The familiar name for this phase is the "half moon."

*Mare Traquillitatis, Mare Nectaris, and Mare Foecunditatis visible to the naked eye.

With binoculars, you can make out the Apennine Mountains surrounding the Mare Imbrium, and the craters Ptolemaeus, Alphonsus, and Arzachel. Late in this phase: the crater Tycho and the Clavius plain.

Waxing Gibbous	Late afternoon	Early to mid morning
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*With the naked eye see the huge Oceanus Procellarum and Mare Nubium. With binoculars it's the best time to see the dramatic Copernicus crater.

Full Moon	Sunset	Sunrise
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*Although bright, this is a poor time for making out detail on the Moon.

Waning Gibbous	Mid to late evening	Mid morning
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Last Quarter	6 hours before sunrise	Noonish
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*The familiar name for this phase is the "half moon."

Waning Crescent

Early morning

Mid afternoon

The Moon & The Tides

The gravitational attraction of the Sun and Moon causes tides Earth. A **spring tide** is not a reference to the season, but is a tide that occurs when the Sun and Moon are in a line or nearly so. Thus, spring tides occur during new or full Moons because the gravity of Moon and Sun are reinforcing each other. You thus get the greatest range of tide with spring tides. A **neap tide** occurs when the moon is at or near its first or last quarter. The gravity of the Sun and Moon work against each other, so you get the least range of tide during a neap tide.

The seas are not the only parts of the Earth affected by the Moon's gravity. Our planet's crust deforms about eight inches at a "spring tide," and there is a correlation between lunar phase and cloudy weather. There have also been studies showing a small but distinct correlation between lunar phase and earthquakes.

Moon Myths

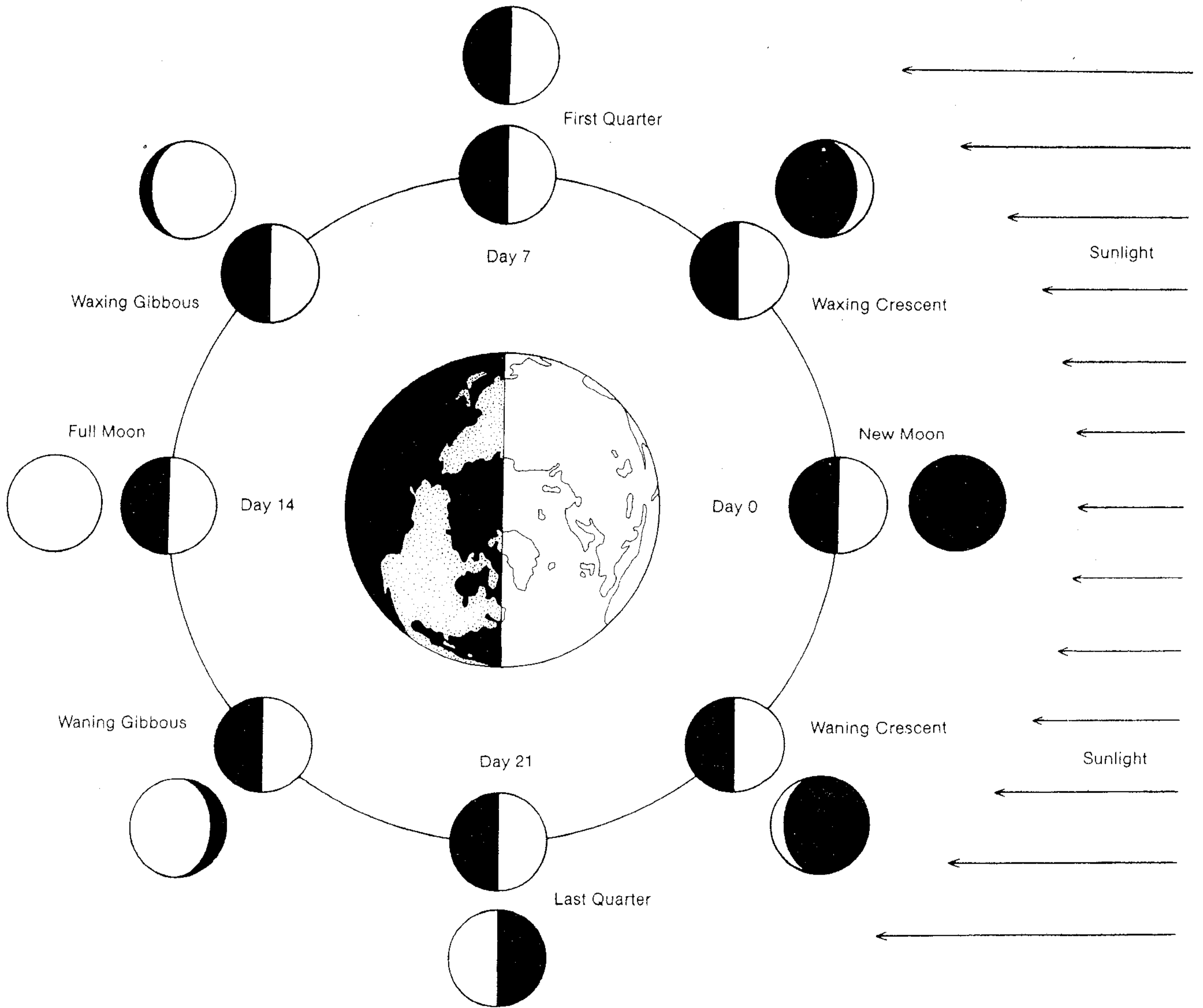
There is no "dark side of the Moon." Each side gets as much sunlight as the other. The proper term is "far side."

The Moon does not cause measurable tides in human bodies.

The Moon does not govern menstrual cycles.

There is no evidence linking full Moons with birth rates, crime rates, emergency room admissions, etc.

While brightest of the Moon varies (see above) its size does not, except as caused by atmospheric distortion. All else is a trick of human perception.



ASTORIA (Tongue Point) ■
Harmonic station (NOAA)

Lat 46°12' N Lon 123°46' W
Station ID: 889

Moonrise: 3:11 am
Moonset: 11:00 am
Neap Tide
3rd Qtr moon yesterday

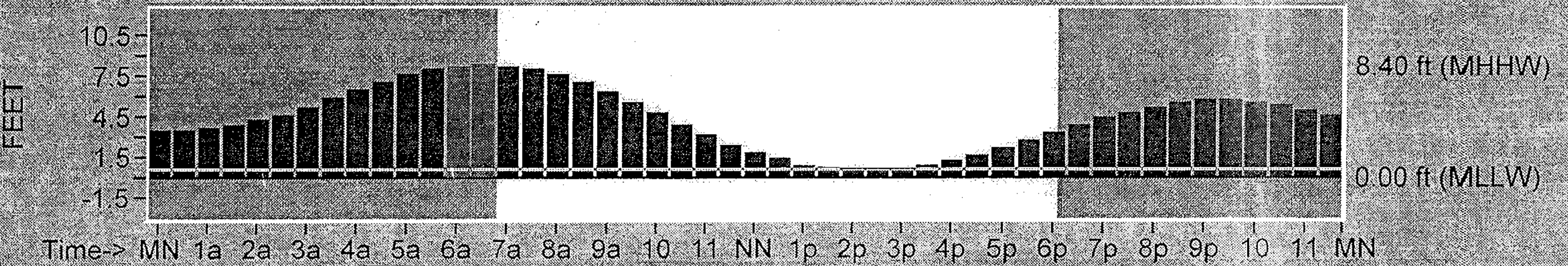
Daily Highs & Lows:
Low 12:17 am 3.7 ft
High 6:29 am 8.5 ft
Low 2:24 pm 0.6 ft
High 9:13 pm 5.9 ft

Average Tides:
Mean Range 6.60 ft
MHHW: 8.40 ft
Mean Tide 4.40 ft

Friday, March 4, 2005
Pacific Standard Time

Sunrise: 6:48 am

Sunset: 6:06 pm



3:00 pm 0.7 ft

ASTORIA (Tongue Point) ■
Harmonic station (NOAA)

Lat 46°12' N Lon 123°46' W
Station ID: 889

Moonrise: 7:03 am
Moonset: 6:57 pm
Spring Tide
New moon today

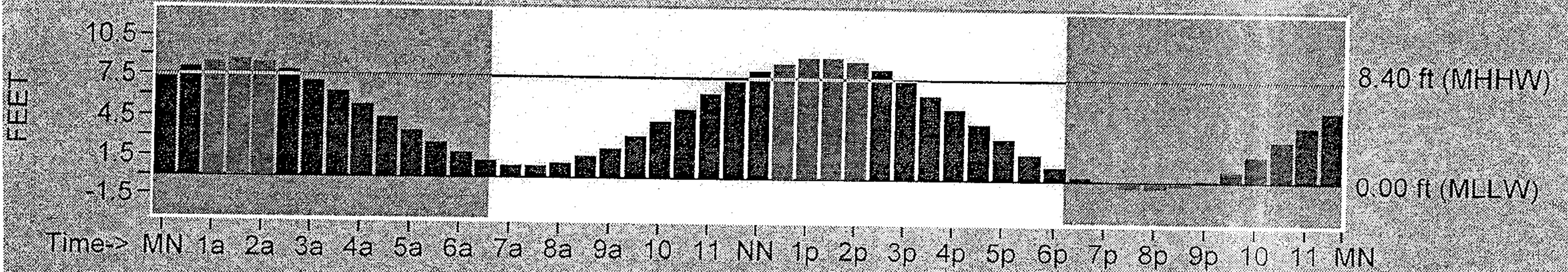
Daily Highs & Lows:
High 1:26 am 8.6 ft
Low 7:23 am 1.0 ft
High 1:19 pm 9.1 ft
Low 7:50 pm -0.6 ft

Average Tides:
Mean Range 6.60 ft
MHHW: 8.40 ft
Mean Tide 4.40 ft

Thursday, March 10, 2005
Pacific Standard Time

Sunrise: 6:37 am

Sunset: 6:14 pm



3:00 pm 7.5 ft

The Planets

Planet Finder

Like the Sun, the planets move through the ecliptic. The table below shows which constellation in the zodiac a planet will lay in during a given month. Because Mercury is usually too close to the Sun to make out constellations clearly, it is omitted. See 2005 Celestial Events for best viewing times. For Venus, an E means its an evening star, an M means it's a morning star, a * means it's too close to the Sun to be seen well.

Month	Venus	Mars	Jupiter	Saturn
Mar 2005	*	Sagittarius	Virgo	Gemini
Apr 2005	*	Capricorn	Virgo	Gemini
May 2005	Aries (E)	Aquarius	Virgo	Gemini
Jun 2005	Taurus (E)	Aquarius	Virgo	Gemini
Jul 2005	Cancer (E)	Pisces	Virgo	Cancer
Aug 2005	Leo (E)	Pisces	Virgo	Cancer
Sep 2005	Virgo (E)	Aries	Virgo	Cancer
Oct 2005	Libra (E)	Taurus	Virgo	Cancer
Nov 2005	Sagittarius (E)	Aries	Virgo	Cancer
Dec 2005	Sagittarius (E)	Aries	Virgo	Cancer
Jan 2006	Sagittarius (E)	Aries	Libra	Cancer
Feb 2006	Sagittarius (M)	Aries	Libra	Cancer

Mercury

Distance from Sun:	.39AU
Diameter:	3,014 miles
Length of year:	88 days
Length of day:	58.67 days
Atmosphere:	Virtually none
Moons:	None

Up through Victorian times, some postulated the existence of a planet, named Vulcan, closer to the Sun than Mercury. Indeed, the laws of celestial mechanics would just allow a small planet to squeeze in about 9 million miles closer to the Sun.

In 1881, Giovanni Schiaparelli was the first astronomer to distinguish and draw surface features on Mercury. He also concluded that Mercury always keeps the same face to the Sun, a conclusion accepted until 1965 when radar observations showed the planet rotating slowly, in about 2/3 the time of its short year.

Radar observations also seem to indicate deposits of ice at Mercury's poles, virtually inexplicable considering temperatures at the surface (up to 800F at the equator, as low as -210F at the poles).

The first space probe to fly by Mercury was Mariner 10 (USA) in March 1974.

Venus

Distance from Sun:	.72AU
Diameter:	7545 miles
Length of year:	225 days
Length of day:	243 days
Atmosphere:	Carbon dioxide 96.5%, nitrogen 3.5%, traces of sulfur dioxide, argon, carbon monoxide, and oxygen.
Moons:	None

Galileo's observations of the phases of Venus in 1609-10 provided proof of a heliocentric, Copernican Solar System.

Venus may have originally been covered with liquid water, but as the Sun grew older and hotter it created a greenhouse effect. Venus's atmosphere accounts for 1/10,000 of its mass, a ratio 100 times that of Earth and 1,000 times that of Mars.

Venus and Uranus are the only planets that rotate east to west.

The surface temperature on Venus is about 850F and, because of the dense atmosphere; it varies little with latitude and night or day.

The first flyby of Venus was by Mariner 2 (USA) in 1962. Venera 7 (USSR) touched down on the surface in 1969. A 97%-complete map of the surface was completed by Magellan (USA) in 1990.

There may still be active volcanoes on Venus, including the 5-mile high Maat Mons on the Aphrodite Terra plateau.

Mars

Distance from Sun:	1.5AU
Diameter:	4,220 miles
Length of year:	687 days
Length of day:	24.5 hours
Atmosphere:	95% carbon dioxide, 2.7% nitrogen, 1.6% argon
Moons:	2

Like Earth, Mars had definite season, though they are twice as long thanks to Mars's longer year. The swelling and shrinking of the ice and dry ice polar caps is readily observable through a telescope.

Wide plains mark the northern hemisphere surface while the southern hemisphere is pockmarked with craters.

Christiaan Huygens drew the first map of Martian surface features in 1659. The “canals” were first drawn by Giovanni Schiaparelli in 1877. They are now believed to be channels carved by catastrophic flooding.

The volcano Olympus Mons is three times the height of Mt. Everest and 375 miles across at the base.

The Valles Marineris is four times deeper, six times wider, and ten times longer than the Grand Canyon.

More than 30 space probes have been launched toward Mars. The Viking 1 lander (USA) was, in July 1976, the first surface probe to touch down.

Mars’s moons, Phobos (Greek for “fear”) and Deimos (Greek for “terror”) were first observed in 1877. Only 11 and 6 km in diameter, respectively, Phobos orbits Mars three times in a Martian day, Deimos every 30 hours or so.

Jupiter

Distance from Sun:	5.2AU
Diameter:	89,000 miles
Length of year:	11.86 years
Length of day:	9 hours, 10 minutes
Atmosphere:	88% hydrogen, 11% helium, traces of methane, ammonia, water, and carbon dioxide.
Moons:	16

Jupiter is 318 the mass of Earth and accounts for 70% of the mass of the Solar System, excluding the Sun. If it had been a little more massive, it may have become a small star itself.

Jupiter’s surface is probably a rocky silicate core about 15,000 miles in diameter. Surface gravity is more than twice Earth’s.

Two faint rings circle Jupiter; their existence was not even suspected until the Voyager probes passed the planet in 1979.

The four largest satellites – Io, Europa, Ganymede, and Callisto – were first spotted by Galileo and can be easily seen using shipboard binoculars. The latter two are larger than Earth’s Moon. Their relative positions were used in the 18th and 19th centuries as a way of determining longitude.

The moon Europa has a layer of ice covering a slushy mixture of water and ice over a rocky core. Io is volcanically active, and leaves a trail of dust in its path around Jupiter.

Saturn

Distance from Sun:	9.5AU
Diameter:	74,580 miles
Length of year:	29.45 years
Length of day:	10 hours, 13 minutes
Atmosphere:	96.3% hydrogen, 3.3% helium, 0.4% methane
Moons:	18

Saturn has no solid surface and is less dense than water (it is the only planet that would in a bathtub).

Galileo first spotted handles on Saturn in 1610, but could never explain them. Huygens first distinguished the rings in 1656.

For years it was thought that Saturn had three rings, but it actually has six. The whole system extends out a quarter of a million miles. Their most likely origin is from a moon that disintegrated.

Saturn is the most distant naked-eye object in the Solar System. (Some have claimed they can see Uranus given the right conditions and knowing where to look).

Saturn's moon Titan is the largest in the Solar System – it is larger than Mercury. In January 2005, the Cassini/Huygens probe (EU) sent back photos indicating liquid of some kind had once flowed on Titan.

Planets Beyond Saturn

	Uranus	Neptune	Pluto
Distance from Sun:	19.2AU	30AU	29-49AU
Diameter:	32,500 mi	30,200mi	1,500mi
Length of year:	84 years	161.8 years	248 years
Length of day:	17 hrs, 12 min.	16 hrs, 6 min.	6 days, 9 hrs
Moons:	15	8	1
Year Discovered:	1781	1846	1930

Uranus's rotational axis lies almost perpendicular to the plane of the ecliptic – its north and south poles alternate pointing at the Sun.

Uranus has a system of 11 faint rings, first discovered in 1977.

Neptune has a system of four rings, mostly faint. Before Voyager 2 (USA) passed the planet in 1989, it was thought Neptune had incomplete rings, or arcs.

Neptune's moon Triton travels in a retrograde orbit, suggesting it is a captured object of some kind.

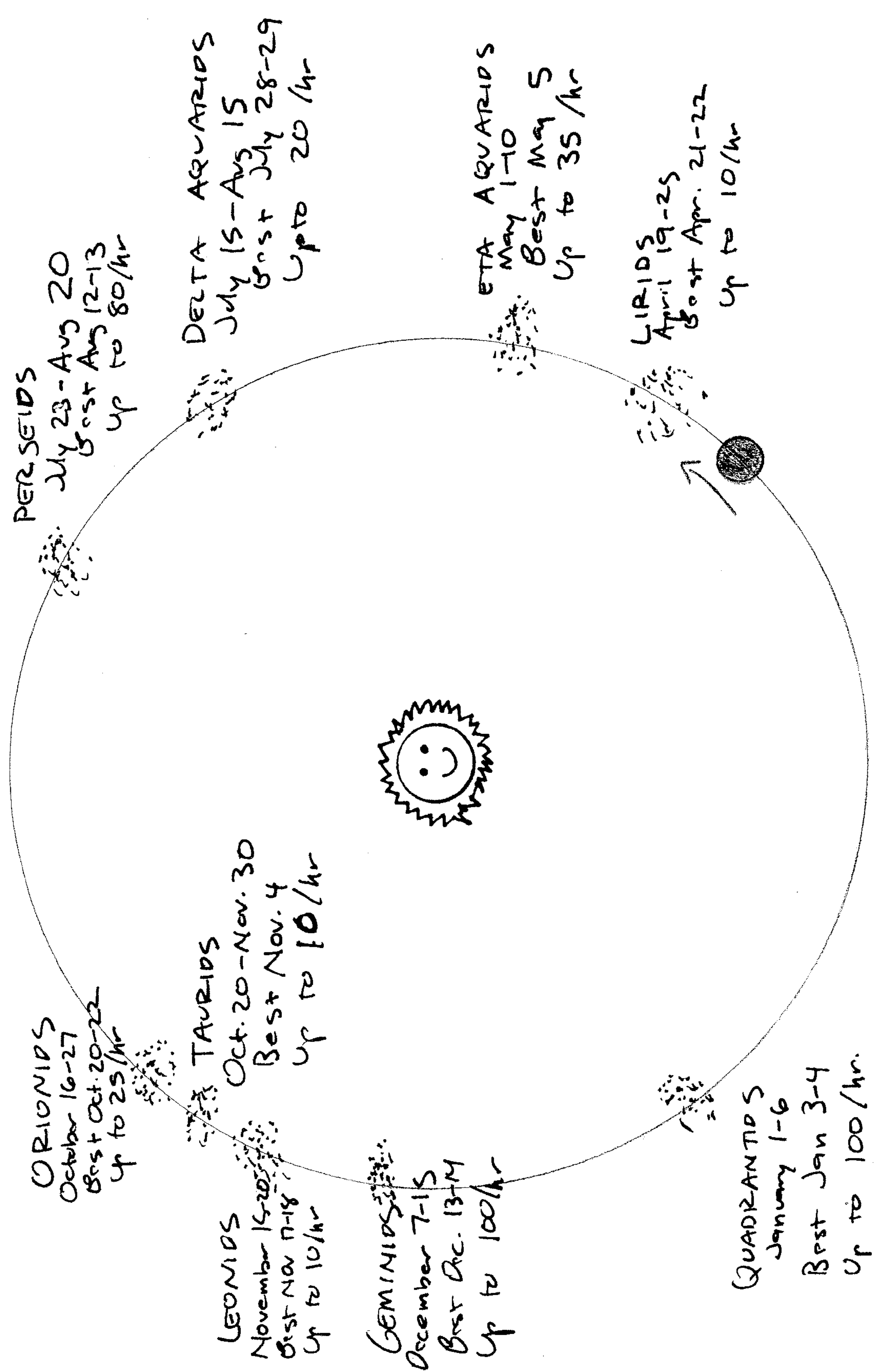
Pluto is smaller than all the other planets and six of their moons. Its own moon, Charon, is half its size and moves in a close, nearly circular orbit, leading some to call Pluto/Charon a "double planet."

At times, because of its highly eccentric orbit, Pluto is actually closer to the Sun than Neptune.

Charon was discovered in 1978, but it took the Hubble Space Telescope to make out distinct disks.

Many astronomers believe Pluto is not a true planet at all, but a "Kuiper Object," one of possibly many small bodies on the edge of the Solar System.

Beyond the Solar System, astronomers have inferred the existence of about 130 planets orbiting other stars, although none have been directly observed.



ANNUAL METEOR SHOWERS

References and Readings

The gathering and sharing of astronomical information predates the invention of writing, so any list of available resources is necessarily incomplete. Any of the large chain book stores will have several shelves of the most recent astronomy titles, a library even more, and large universities may have entire libraries devoted to the subject. Here I've tried to include works aimed specifically at "backyard", naked-eye astronomy (these are marked with an asterisk), as well as sources of information that address specific topics that may come up during Star Talks ("Is there life on Mars?", "What does 'Zubenelgenubi' mean?").

Field Guides

*Several good ones exist, often modeled on wildlife guides by the same publisher. Most have usable, if small, sky maps and tons of information. In fact, some are so comprehensive it can be difficult to find what you're looking for. Especially good are the Cambridge, National Audubon Society, Peterson, and Princeton field guides.

Books

Abell, George. *Exploration of the Universe*. The standard college astronomy text and thus dry at times, but nicely illustrated.

Allen, Richard Hinkley. *Star Names: Their Lore and Meaning*. Comprehensive and at times surprisingly technical, but definitely the last word on the subject.

*Berman, Bob. *Secrets of the Night Sky*. Takes a season-by-season approach to naked eye astronomy, wandering off occasionally into astrophysics and cosmology. Highly entertaining.

Bryson, Bill *A Short History of Nearly Everything*. Travel writer Bryson takes us on a tour of the current state of all scientific knowledge, not just astronomy, but this is the science book our passengers are most likely to have read recently. Chapter Two nicely sums up the recent debate about whether or not Pluto is actually a planet.

Burnham, Robert. *Burnham's Celestial Handbook*. This three-volume reference is to amateur astronomy what *Sibley's* is to bird watchers. Not only astronomical information, but myths, lore and so on. By far the most comprehensive work for the layman.

Capara, Giovanni. *The Solar System*. The most up-to-date general guide to the planets and other objects in the Solar System.

*Driscoll, Michael. *A Child's Introduction To the Night Sky*. A useful introduction to astronomy in general (sort of a *Cosmos* for kids) with "how-to-find" information, lore, and history.

Ferris, Timothy. *Coming of Age in the Milky Way*. The story of humanity's quest to understand the dimensions of space and time. This tale of discovery is made especially fascinating by the sketches of the discoverers from Plato to Stephen Hawking – you really get a sense of what they were (or are) like.

Hartmann, William K. *A Travelers Guide To Mars*. A great introduction to current knowledge of the Red Planet in the format of a travel guide (a la Lonely Planet). A fun approach to a serious popular science work.

*Heudier, Jean Louis. *The Night Sky Month-By-Month*. Published annually, a page-a-month guide great for finding planets, meteor showers, etc.

National Imaging And Mapping Agency. *The American Practical Navigator*. Called “Bowditch” (for its original author) by the boat-driving crowd, has an excellent section on navigational astronomy and finding your way around the sky from the point of view of a ship's navigator. The star maps I've included here are from “Bowditch.”

Plait, Philip. *Bad Astronomy*. Common myths about the sky and the space program exploded, from the “full Moon fallacy” to the National Star Registry.

*Rey, H.A. *Find The Constellations*. Look in the children's section for this one, but an excellent introduction for everyone to the constellations. Rey draws them a little different than we've seen them traditionally with an eye toward making them easier to distinguish.

*Rey, H.A. *The Stars*. More advanced than *Find The Constellations*, but still easy for anyone to understand. A great place to start. Rey's only fault is his use of English terms for the constellations instead of the traditional (i.e., “The Water Carrier” instead of “Sagittarius”) which can be confusing when you move on to other works.

Ridpath, Ian (editor). *Norton's 2000.0 Star Atlas and Reference Handbook*. Excellent sky maps, but much more detailed than anything you'd need for a Star Talk.

Robinson, Kim Stanley. *Red Mars, Green Mars, and Blue Mars*. For those who like their science fictional, this series describes the colonization and “terraforming” of Mars. Rigorously sticks to or extrapolates from current knowledge of Mars. Possibly the only work in the history of fiction to use plant succession as a plot device.

Sagan, Carl and Druyan, Ann. *Comet*. All about comets, from lore to the possibility that we all may get smushed by one some day.

Sagan, Carl. *Cosmos*. The companion volume to the 1980 PBS TV series. A great introduction to all aspects of astronomy, even if some of the science is now dated.

Sky Catalog 2000.0. If it's been observed in the universe, it's in here. Detailed data on all celestial objects.

Tirion, Will. *Sky Atlas 2000.0*. Similar to Ridpath. Professional astronomers use one or the other or both.

Ward & Brownlee. *Rare Earth*. Two University of Washington professors argue that complex life in the universe is rare, and possibly unique to earth. Controversial – the authors were accused by some of being closet Creationists – but a good overview of all the factors that go into make life possible here on Earth.

Magazines

Astronomy. The best monthly for the general reader. Detailed monthly sky maps as well as news about the latest discoveries, products for the amateur astronomer, etc.

Sky & Telescope. Aimed a bit more at the hard-core stargazer, tends to be more technical than *Astronomy*.

Internet and Software

Last year there was a brief craze of downloading pictures from the Mars rovers, and the National Geographic, NASA, and magazine (see above) web sites are all good sources of information. In Star Talk terms, the *Starry Night Backyard* software provides a view of the sky based on latitude, longitude, date and time. Dave Yurina has installed this on some ships' computers. If not, go online to the Your Sky website, fourmilab.ch/yoursky.com, where you can get a picture of the night sky based on time and position. This site is nice because you can just input a geographic location (i.e. "Lewiston ID") without needing to know lat and lon.

Film and Video

Cosmos. The original PBS series. Shortly before his death, Sagan recorded some Afterwords for each episode, updating the science and providing commentary.

2001: A Space Odyssey. Stanley Kubrick's 1968 classic is still one of the most realistic depictions of space flight ever filmed. Gives you a good idea what it might really be like to walk on the Moon or orbit Jupiter. Also cool because the spaceship is named *Discovery*. As you might expect, some of the science is a little old. The sequel, *2010: Odyssey Two*, portrays a mission to a Jupiter updated by the Voyager photos.

Deep Impact (dir Mimi Leder). For our purposes here, valuable mainly for its first few minutes, which show amateur astronomers at work. Otherwise, with a cast that ranges from Elijah Wood to Vanessa Redgrave, it's a must-see for fans of "Six Degrees of Kevin Bacon."

Mission To Mars (dir. Brian de Palma). Good for it's realistic depiction of space flight (very reminiscent of Kubrick's concepts, see above) and a Mars based on the latest

information (including a pink sky!). Bad for giving fresh life to the “face on Mars” hoax (see *Bad Astronomy*, above).