SKY TREKKER

OBSERVERS' PROGRAM

LEVELS I & IC

INDIANA FAMILY STAR PARTY

2018

Sky Trekker Observer's Program

Welcome to the Indiana Family Star Party and welcome to the hobby of astronomy! Sky Trekker helps you learn star patterns in the sky and see objects in telescopes!

At this star party, you can qualify for a Sky Trekker Level I, IC, II, or IIC certificate and badge (and ice cream treat!). To choose your program level, see the Sky Trekker Levels poster in the Nature Center and/or talk to Lisa Wieland, the Sky Trekker Coordinator.

The Level I Program is designed for absolute beginners or those who would like to increase their knowledge of constellations. The Sky Trekker Challenge Program (that is, Level IC) is an optional program for kids who have gone through Sky Trekker before, or kids who just enjoy a challenge. The Challenge Level requires finding four more constellations and offers the hands-on experience of a Telescope Slew!

For the Sky Trekker Level I certificate, you will need to:

1. Identify and point out the six anchor constellations/asterisms on p. 4 of this booklet
2. Locate Polaris
3. Look at three different objects through telescopes: Jupiter, Saturn, & a Globular Cluster. The Sky Trekker Examiners will find these objects with their telescopes for you to see.

For the Level IC program, you will do the same plus find 4 more constellations, and participate in a Telescope Slew.

Note: If it's cloudy, then all observing requirements are dropped, and we will reconvene at the Nature Center or Lodge (to be decided) for a constellation party game, ice-cream and drawings for prizes.

You may use the planisphere provided, or any other planisphere or star map that you own (or borrow). Note that this is a "program", not a contest. Everyone can "win". Share your maps and share your knowledge. Help each other succeed! Have fun!

Some Definitions

Note: By some terms you may see a small number up and to the right. This is a footnote number. Check the "Addendum: Footnotes" Section, inside back cover, for explanations of these terms.

Constellations and Asterisms:

Simply put, constellations are groupings of stars identified by the ancients to tell stories. In the past, different cultures "connected the dots" in different ways to tell different stories, but now the International Astronomical Union has formally recognized an official set of star groupings that are used world-wide so that all astronomers will have a common reference, no matter what their cultural heritage is.

Asterisms are parts of the official constellations that make clear and common pictures across the sky. They're not complete, they're not official, but they can make a great starting point for learning your way around the sky.

Deep-Sky Objects:

There are several different types of deep-sky objects; each of the kinds that Sky Trekker IIs will be asked to find are described briefly below:

Star Clusters:

Star Clusters come in two basic types: Open Clusters, and Globular Clusters. Both types are groups of stars that are bound together by gravity, an attractive force. .

Globular Clusters: Globular Clusters are basically spherical groupings of stars whose members number from 10,000 to several million. Some of them are only a few tens of "light-years"[1] across and some of them are up to 200 light-years across! All of them have a common characteristic: they're OLD—and made up of mostly yellow and red stars weighing a bit less than 2 "solar masses"[2]. Being, as they are, little satellites of the galaxy—and being just a few hundred million years less old than the universe itself, these clusters tend to be populated with old stars simply because the bigger and hotter stars that they once may have contained have all exploded as "supernovae" (see Nebulae: Planetary Nebula, below) or collapsed into "white dwarf stars" (again, see Nebulae: Planetary Nebula, below) by now. Oh, they may have an occasional "blue straggler," a rare blue star in a globular thought to be formed by star collisions in the crowded inner regions of the cluster, but they are generally old objects with generally old stars.

Open Clusters: Unlike Globular Clusters (see above), which are distributed about a galaxy in a basically spherical (ball) shape, Open Clusters are found in the galactic plane[3] and are just about always found within a galaxy's spiral arms. In general, they contain less than a few hundred member stars—which are often hot, young, and blue—within a region that's up to about 30 light-years across. Being less crowded and more loosely populated than globular clusters, the gravity holding the stars together is not as tight so, over time, open clusters can be disrupted by the gravitational influence of giant gas or dust clouds, or other clusters as they move through the galaxy. Some cluster members can also be lost by a process known as "evaporation": when the close passing of two stars in the cluster results in a change of direction of one of them, setting it on a path that makes it eventually wander out of the cluster. Even if this happens, cluster stars will still continue to move in the same basic direction through space even if they are no longer held together by gravity. If it happens that all of the cluster's stars are no longer held together by gravity, but are just all moving in a similar direction, the stars are then called a “stellar association”, or a “moving group”.

NEBULAE:

“Nebulae” is the plural (more than one; for example, “dogs” is the plural of “dog) of the word “nebula”, a word that comes from the Greek word for “cloud.” Some nebulae are the shells of gas thrown off by dying stars: Planetary Nebulae and Supernova Remnants are this type. Other nebulae represent the gas and dust surrounding young stars: Reflection and Emission nebulae are of this type. Yet another type of nebula is seen not by reflecting light, or glowing itself, but by blocking light. This type is called a “Dark Nebula” or an “Absorption Nebula.” All of these types are briefly described below.

Planetary Nebulae: These are formed when old stars of a size similar to our Sun's have used up most of their hydrogen fuel after burning for billions of years. Their hydrogen gets converted to helium and as the star's gravity and nuclear forces (big explosions in the very center of the star) wobble and war, it throws off shells of gas and expands to become a Red Giant. At the Giant phase, the star does not so much explode as much as it ejects (or throws off) gases at much lower speeds and at different times. As the star continues to evolve (change over time), its central core becomes a very hot White Dwarf, whose high temperature radiation causes the thrown off shells of gas to become “ionized” (a chemistry term) and glow. A very long time after this, those glowing shells can drift away altogether leaving nothing but the very hot, very small (some are Earth-sized—which is TINY for a star) White Dwarf Star.

Supernova Remnants: A Supernova happens when a high-mass star reaches the end of its life and nuclear forces stop in its core. Without the nuclear forces to prop up the star's mass, it all comes collapsing in toward the center where it all then either bounces rapidly back or gets so strongly heated (or both) that it expands rapidly back outward in a violent explosion. A shell of glowing gas expands away from the blast, putting out its own light.

Reflection Nebulae: Sometimes, the light of new stars gets reflected off the gas and dust around them so we can see it. This type of nebula is called a “Reflection Nebula”.

Emission Nebulae: Also born from the influence of young stars, an Emission Nebula glows because the heat and radiation energy of young stars excites the atoms (tiny particles of a single element, like hydrogen) in the gas of the nebula, causing the gas to “emit” or put out its own light. Note that in this case, the gas makes its own light, it doesn't just reflect light back.

Dark/Absorption Nebulae: Dark nebulae are clouds of gas and dust that absorb some light from behind them. This absorbed light heats up the gas and dust particles, causing them to re-radiate or emit some of the absorbed energy as infrared light, which can't be seen with our eyes. What we *do* see, when we *can* see dark nebulae, are dark clouds in front of more distant stars or in front of emission nebulae. Sometimes they look like big dark holes in an otherwise well-dotted, rich, field of stars—they're the big blank spots, where it looks like there's nothing there. It can sometimes be tough to determine dark nebulae from actual blank spots in space.

Double Stars:

When we look at the sky through binoculars and telescopes, we often find that what looked like one single star to our naked eyes turns out to be two or more stars. Sometimes these small groups of stars are bound together by gravity; sometimes they're not, they're light-years apart, but only appear close together due to our line of sight. Sometimes these small groups or pairs of stars have different colors or brightnesses, making them interesting objects to observe and study.

Astronomers usually separate double stars into two groups: two stars close enough together to be bound by gravity are called "binaries"; two stars that only look close together are called "optical doubles."

Binaries: Stars form from nebulae, nebulae tend to be pretty big and it is usually the case that more than one star forms from the same nebula. At least half and possibly many more stars in our galaxy are members of double- or multiple-star systems. Binary stars are two stars that are held together by gravity and orbit each other as if they were tied together by a string.

Astronomers like to study binaries to see how long it takes them to go around each other: some take a couple of days and some take hundreds of years. Often the brightness of binaries will change when one star blocks the light of the other as they orbit. These systems are called "eclipsing binaries."

While the *definition* of "binaries" refers to just two stars, the *term* "binary" is sometimes used in general to refer to "Multiple Star Systems," systems of three stars or more.

Optical Doubles: These stars only appear to be together in space, but are actually not bound together by gravity at all. In fact, these stars can be hundreds of light-years apart. Sometimes these pairs appear to have differing brightnesses because one of the stars in the pair is so much farther away that its light is much weaker by the time it reaches Earth.

There are several interesting double stars. Most star charts use a special symbol to mark binary stars.

Galaxies:

Galaxies are groupings of billions of stars that form starry islands in the great emptiness of space. Our galaxy is the Milky Way; there are MANY others.

Spiral galaxies have two or more arms encircling a bright center. The "tightness" of the wind of the spiral arms and the character of their flow to the galactic center make for different types of spirals.

Elliptical galaxies are basically plain, spherical systems of stars with a bright center, but they have a wide range of different masses, making for different classes of ellipticals. There are also Irregular galaxies whose weird, irregular shapes suggest past collisions of galaxies and the disruption of order that follows such events. Galaxies can be dim and difficult to find with small telescopes, but they are fabulous in photos because cameras can collect more light than our eyes can.

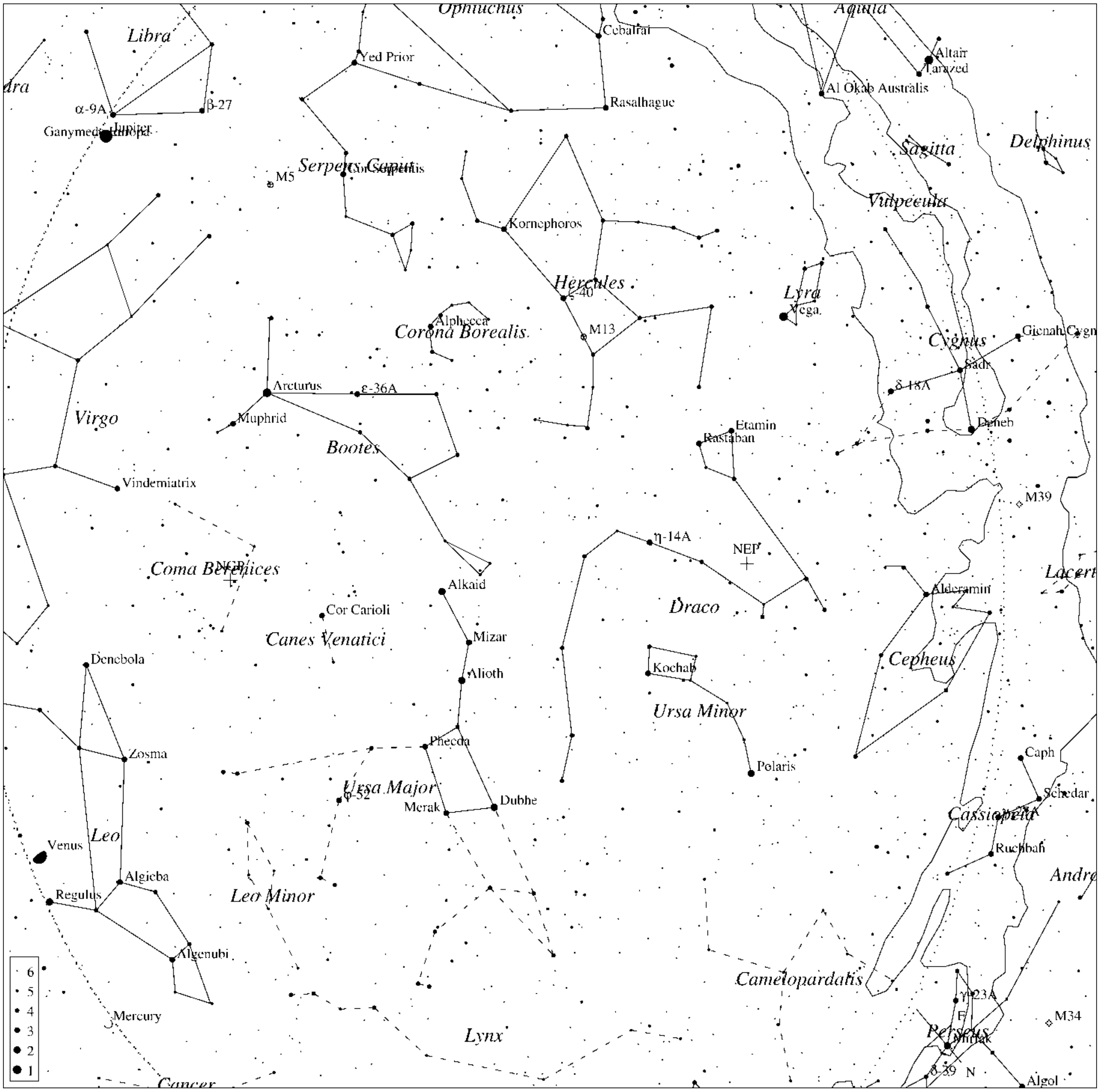
Star Map Practice & Checklists

To help you practice your constellations/asterisms, three To-6th-Magnitude[4] star maps are provided on the following pages. Each map contains constellations (or asterisms) from the ST Anchor, and ST Challenge Constellations Lists. One map will show the constellations with lines drawn in, and then the flip side will show the same region of sky without the lines. Can you draw the constellation lines in without looking back at a star map? Try it!

To complete the Sky Trekker Level I, or Level IC programs, you will be asked to find the 6 constellations/asterisms on the ST Anchor Constellations List, and Polaris from the ST Bright Stars List (see lists below). You must also see the objects on the Telescope Objects list. To complete Level I Challenge (Level IC), you will have to find the same six anchor constellations & Polaris, see the Telescope Objects, and find the additional 4 constellations on the Sky Trekker Challenge List as well. You can also participate in the Telescope Slew.

Sky Trekker Level I/IC Checklists				
Anchor Constellations & Asterisms (I & IC)	**Bright Star (I & IC)**	**Telescope Objects (I & IC)**	**Challenge Constellations (IC only)**	**Telescope Slew (IC only)**
Big Dipper (in UMa)	Polaris	Jupiter	Boötes	
Little Dipper (in UMi)		Saturn	Corona Borealis	
Cassiopeia		Globular Cluster	Hercules	
Cygnus			Virgo	
Teapot (in Sgr)				
Scorpius				

Note: If you have your own telescope or binoculars, and have practice finding objects, you may want to consider Sky Trekker Level II or IIC. If you are interested in either of these programs, you must first gain approval for this level from Lisa Wieland, the Sky Trekker Coordinator. If you have approval for this level, please pick up a Sky Trekker Level II/IIC Booklet from the Coordinator.



XEphem Alt/Az Sky View
Camp Cullom, IN

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Epoch:	2000.00	UTC Date:	7/14/2018
Altitude:	71:45:00	UTC Time:	2:30:00
Azimuth:	330:30:00	Latitude:	40:18:48 N
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Created by XEphem Version 3.7.7 August 9, 2015

http://www.xephem.com
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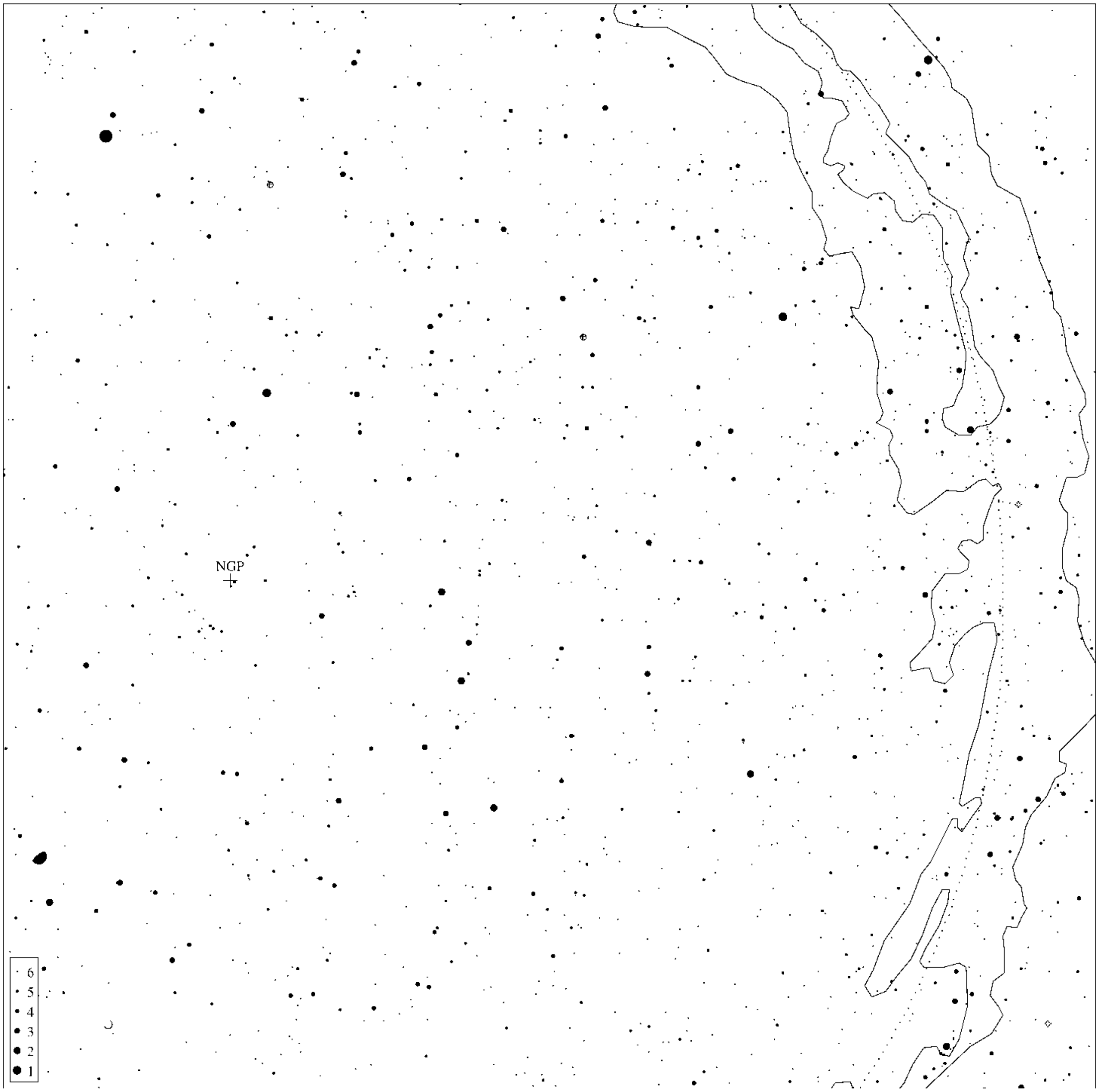

XEphem Alt/Az Sky View
Camp Cullom, IN

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XEphem Alt/Az Sky View
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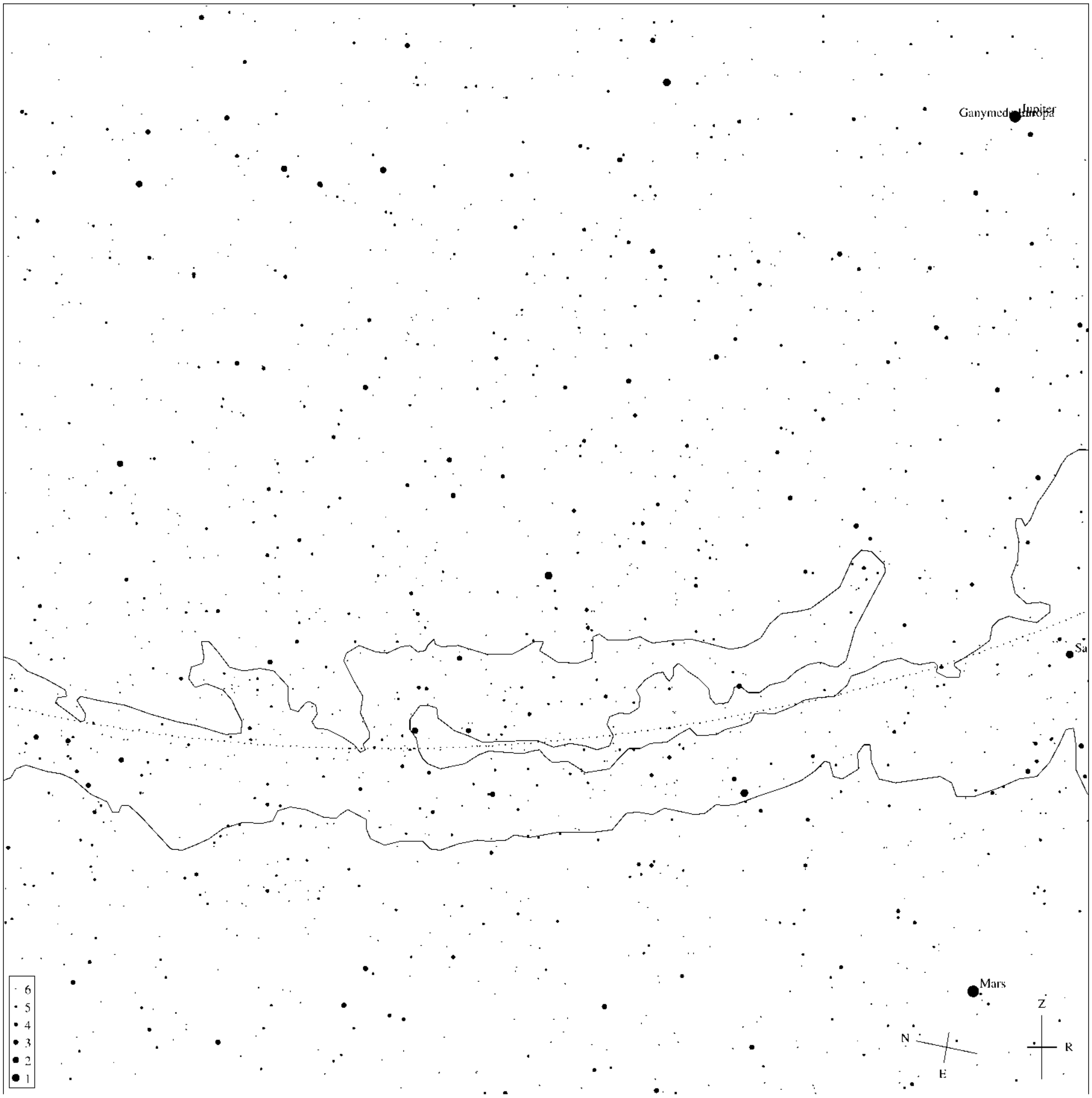

XEphem Alt/Az Sky View
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Created by XEphem Version 3.7.7 August 9, 2015

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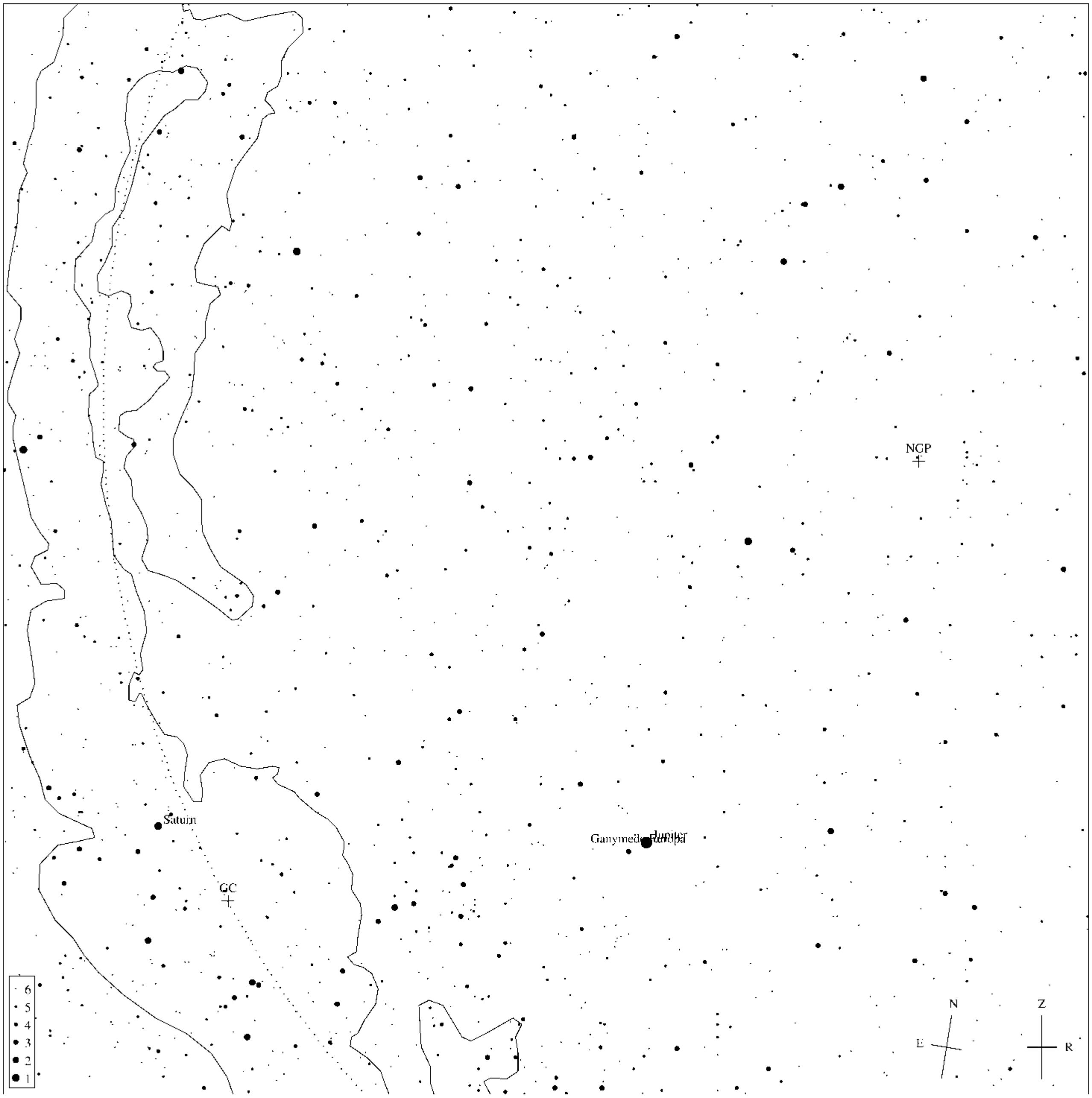

XEphem Alt/Az Sky View
Camp Cullom, IN

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Created by XEphem Version 3.7.7 August 9, 2015

http://www.xephem.com
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ADDENDUM

FOOTNOTES:

1: Light-Year: A light year is a measure of distance, like an inch or a foot, only it's MUCH larger: it's the distance that light can travel in one year: about 5,865,696,000,000 miles per year (read: 5 trillion, 865 billion, 696 million miles/year). That's a long way.

2: Solar Mass: The amount of material (number of atoms) that make up our star, the Sun.

3: Galactic Plane: If you could take a really big piece of paper and stick it through the middle of a galaxy as if you were cutting a bagel, some of the galaxy's stars would be above the paper, and some would be below the paper, but all of the visible stars would be close to the paper, and the paper would be called the “galactic plane.” An actual galactic plane isn't made of paper though, it's imaginary.

4. Magnitude: A measure of brightness of stars. The magnitude scale, however, seems more set up to measure dimness: the higher the number given for magnitude, the dimmer the star.

GLOSSARY:

Atoms: Teensy particles that are made of varying numbers of protons, neutrons, and electrons (that is, the subatomic particles, all of which are even teensier particles). The variation in the numbers of the subatomic particles make for the different, naturally occurring chemical elements.

Hydrogen: The most abundant gaseous element (“element” as in naturally occurring chemical element found on a chemistry class Table of the Elements) in the universe.

Helium: The number 2 gaseous element in the universe. It is created in stars when two Hydrogen atoms fuse together in the intense heat and pressure at the core of a star.

Light Speed: The speed of light is about 186,000 miles per second.

THE GREEK ALPHABET:

α Alpha	ι Iota	ρ Rho
β Beta	κ Kappa	σ Sigma
γ Gamma	λ Lambda	τ Tau
δ Delta	μ Mu	υ Upsilon
ε Epsilon	ν Nu	φ Phi
ζ Zeta	ξ Xi	χ Chi
η Eta	ο Omicron	ψ Psi
θ Theta	π Pi	ω Omega

SOME SUMMER CONSTELLATION ABBREVIATIONS:

Andromeda :And	Cepheus: Cep	Leo: Leo	Scorpius: Sco
Aries: Ari	Corona Borealis: CBr	Libra: Lib	Scutum: Sct
Aquarius: Aqr	Corvus: Cor	Lyra: Lyr	Serpens: Ser (Ser cap = S. caput)
Aquila: Aql	Cygnus: Cyg	Ophiuchus: Oph	Ursa Major: UMa
Boδtes: Boo	Draco: Dra	Pegasus: Peg	Ursa Minor: UMi
Cassiopeia: Cas	Delphinus: Del	Perseus: Per	Virgo: Vir
Canes Venatici: CVn	Equuleus: Equ	Sagitta: Sge	Vulpecula: Vul
Capricornus: Cap	Hercules: Her	Sagittarius: Sgr	

Acknowledgements:

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Thanks also goes to my husband, Jeff, for creating the star maps for the books, and to my daughter, Deedee, who created the prototype logo that Mr. Arvin used to make the final version.

Sky Trekker Logo by Scott Arvin, Graphic Artist.

—**LMW**

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