Easy Star Gazing

Slide 1
Welcome to Easy Star Gazing. This presentation will acquaint you with the basics of star gazing. We want you to leave this presentation knowing more about what there is to see in the sky and how to see it. This presentation focuses on star gazing from your backyard or darker locations. None of this requires a telescope or a degree in astrophysics.

Slide 2
Here are the topics we'll discuss tonight. These are fun and easy and knowing them will help you get around the night skies. After learning about these topics, you'll be able to have more fun star gazing any time you're outdoors at night.

Slide 3
First, let's talk about sunset and something that most people over look, the earth's shadow.

Slide 4
Our eyes stand above the horizon, so we can see down the other side of the earth. Because of this, we can see the projection of the earth's shadow on the atmosphere. Not only that, but we also see the projection of the dusk's light on the atmosphere. How does this look?

Slide 5
I took this picture of the earth's shadow and the full moon about seven minutes after sunset. You can see the full moon within the dark band of the earth's shadow below the red glow of sunset. This picture hardly does justice as I was also able to see a bit of yellow in the red. This picture was taken in Bowmont, Idaho so you all live in places where you can see the earth's shadow if you know to look for it. The earth's shadow is visible opposite of the sunrise or sunset. Watch for 15 or more minutes before sunrise or after sunset you'll see the uniformly darker earth shadow rise or fall. A simple camera and short exposure was all I needed to record this image on film.

PASS AROUND THE EARTH SHADOW BOOK

Slide 6
To get around the night sky, you need a road map and this part of our presentation will give you that map. This map involves just a few widely spaced constellations and their brightest stars. The constellations are easy to learn and cover a large portion of the night sky.

So please open your handouts to the page with the star map so that you can follow along and see where the constellations we'll discuss are in relation to each other.

Slide 7
Our first constellations are Ursa Major and Ursa Minor. In Latin they mean the Big Bear and the Little Bear. But most people know them by the names, the Big Dipper and the Little Dipper. In summer, the Big Dipper is descending in the high northwest.

Two important stars in the Big Dipper are its pointer stars, Dubhe and Merak. They're important because they point nearly straight to this star in the Little Dipper. Who knows the name of this star?

Polaris is the lucida, or brightest star of Ursa Minor. Some times you'll hear people call this star the North Star or the Lode Star, but astronomers call it Alpha Ursae Minoris. Polaris gets these other popular names because it's the guide to true north. To some one at the North Pole, Polaris appears straight overhead. Unlike what you may have heard, Polaris is not the brightest star in the sky nor is it exactly true north. Polaris is the 40th brightest star in the sky and 1-1/2 moon diameters away from the point of true north.

At 430 light years away, you're seeing light from Polaris that was emitted in the year 1579.

Slide 8
Going in the opposite direction, the pointer stars take you to the constellation of Leo the Lion. You'll find it easier to identify Leo if you look for a backwards question mark first. These stars represents the back of his head, or mane.

Slide 9
The brightest star of Leo is Regulus. Regulus is Latin for "Little King" and is the heart of the lion. The little king is 77 light years away. So if you were born in 1932, Regulus is your birthday star this year. Regulus is 3-1/2 times heavier and larger than our sun and 240 times brighter.

This slide compares Regulus to the sun at the same scale. If viewed from Regulus, our sun would be so dim that we couldn't see it without the aid of a telescope. Regulus spins so fast on its axis that its shape is squashed.

Slide 10
Next to Leo's hind quarters is a faint scattering of stars called Coma Berenices. Coma Berenices is Latin for Berenice's Hair. Berenice II was the queen of Egypt and wife to King Ptolemy III. Queen Berenice was known for her long amber-colored hair and when her husband went to war, Berenice promised her tresses to the goddess Aphrodite if her husband would return safely. Ptolemy III did return and his queen kept her word and cut off her tresses. They were then placed in the temple of Aphrodite as an offering. Later the tresses were discovered to have disappeared. Their royal astronomer, Conon, convinced the couple that the tresses had been placed in the heavens and were now visible as what we call Coma Berenices.

Originally, Coma Berenices was seen as the tuft on the end of Leo's tail. It's actually a star cluster named, Melotte 111, or MEL 111. The cluster is 5 degrees across and 280 light years away. There are at least 37 stars in the cluster and its brightest stars are 50 times brighter than our sun. Our sun, if viewed from MEL-111, would hardly be visible in a pair of binoculars.

MEL-111 is too large for a telescope. So use a pair of binoculars to observe this cluster. In binoculars, the stars of this cluster will fill most of the field of view.

Slide 11
Now go back to Ursa Major once again and follow the arc of its handle to the bright star Arcturus. Arcturus is the lucida of the constellation Bootes the Herdsman. If you were born in 1971, then Arcturus is your birthday star this year. The name Arcturus means "Bear Guardian" and refers to Arcturus' closeness to the Great Bear, Ursa Major. As the constellation of the Big Bear wheels around the sky, the bright star Arcturus follows closely behind.

Arcturus is the brightest star in the northern hemisphere. Arcturus is orange and cooler than the sun. But Arcturus is giant; it's 26 times larger than our sun. Because of its larger diameter, Arcturus shines over 100 times more brightly than our sun. This star did not form in the Milky Way Galaxy. Most likely, Arcturus formed in a dwarf galaxy that got too close to our galaxy and was torn apart by gravity.

Slide 12
Continuing from Arcturus, we draw a spike to the star Spica in Virgo the maiden. Spica is Latin for a spike or wheat. It was given this name because the Sun passes close to Spica in the autumn when the grain is being harvested.

Spica is a blue hot star that is 260 light years away. It's 11 times heavier and 8 times larger than our Sun. That makes Spica 2000 times brighter than the Sun. However, if you include its ultraviolet radiation, Spica is over 13,000 times brighter than our Sun. So be sure to wear SPF 10 million sunscreen when sun tanning in the light of Spica.

Occasionally, the Moon passes over Spica, blocking it light. When it does, the brightness of Spica drops in stages rather than all at once. This indicates that Spica is actually 5 stars.

Slide 13
High overhead late in the summer are three bright stars called the Summer Triangle. This pattern of stars is called an asterism, which means familiar pattern of stars. It's not a single constellation. It's made up of three constellations, Lyra, Aquila, and Cygnus.

Vega is the brightest of the three stars and the lucida of Lyra the Lyre. Vega appears as a bright bluish star and it passes almost directly overhead in Boise. Vega is 54 times brighter than our sun. Relative to other bright stars, Vega is not really all that bright. The reason Vega appears so bright is because it's only 25 light years away. So if you

were born in 1984, Vega is your birthday star this year. Vega is a young star at only 400 million years old.

The next brightest star is **Altair,** the lucida of Aquila the eagle. The name Altair means Flying Eagle. Altair is only 17 light years away. So it you were born in 1992, Altair is your birthday star this year. Altair is 10 times brighter than the sun and has a diameter that's twice as great as the sun's. Astronomical studies show that the star rotates in only 10 hours. That's as fast as Jupiter rotates and Altair is 18 times larger! Compare this rotation rate to our sun's. The sun takes an entire month to rotate just once.

The faintest star is the most distant. **Deneb** is the lucida of the constellation of Cygnus, the Swan. The word Deneb is Arabic for the word tail, and refers to the fact that the star represents the tail of the swan. Deneb is between 1600 and 2600 light years away and one of the most distant stars you can see without optical aid. Deneb is huge star with a diameter 200 times greater than our Sun's diameter. If it were to replace our Sun, Deneb would fill the orbit of Earth. For Earth to maintain its mild climate while in orbit around Deneb, we would have to orbit Deneb at a distance ten times greater than Pluto currently orbits the Sun.

Slide 14
Low in the southern sky in the middle of summer are the constellations of Scorpius and Sagittarius. Scorpius is one of the few constellations that actually looks like what it's suppose to represent. Its brightest star is Antares. Antares comes from the Greek for, Rival of Mars. Antares is nearly as red as Mars appears and as bright as Mars can get.

Sagittarius represents a Centaur, or a half man half horse. But it looks more like a teapot. Coming out of its spout is steam. That steam is the light of millions of stars in our home galaxy, the Milky Way galaxy

The reason to become familiar with these two constellations is that they contain a plethora of interesting objects for your binoculars.

Slide 15
The stars are like people, they come in all different sizes. Here's a comparison between some famous stars and the sun. The sun is so small that it appears as a single pixel in this image. The two stars we've talked about are Arcturus and Antares.

SHOW A STAR WHEEL AND RED FLASHLIGHT

You may feel overwhelmed trying to learn the constellations. If so, then you may want to get a star wheel or planisphere to see which constellations are visible at a given time. A star wheel is a great way to find your way around the sky. However, be sure to use a red colored flashlight when reading it. Red light does not affect your ability to see faint light as much as white light will. At the end of our presentation I will show anyone interested how to use the star wheel.

Slide 16
The easiest and most interesting celestial object to observe in your binoculars is the moon. In this section of Easy Star Gazing, we're going to show you some of the lunar landmarks you can see with your eyes and in binoculars.

Slide 17
First, as everyone knows, the moon has phases. But do you know what astronomers call the phases? Here are the names of the phases and the moons typical age during that phase.

There are four factors that go into a moon phase's name. When the moon grows in size it is waxing and when it gets smaller, it's waning. When the moon is less than half full it's a crescent and when it's greater than half full it's gibbous. Now let's put those names together.

The moon's phase begins at new moon when it's too close to the sun for us to see. Usually the moon is just above or below the sun at new, but occasionally, it covers the sun in a solar eclipse.

The moon is a waxing crescent until it's at first quarter phase, or half full. Then the moon becomes a waxing gibbous until it's full. From new moon to full moon takes just over 14 days and the moon will rise during the day light.

After full moon, the moon begins waning. So it's a waning gibbous until it's half full at third quarter. It then continues to shrink and is called a waning crescent. At 29 days the moon reaches new again and cannot be seen.

Which moon phase is the best for star gazing? Well, that depends on what you're looking for.

If you want to take photographs by moonlight, then a moon from half full to full is pretty good.

If you want to see moon craters through your binoculars, then a first or last quarter moon is ideal. Look along the lunar terminator, or boundary between day and night for the greatest detail. At the terminator the sun is just beginning to rise so the shadow are long.

If you want to scan the Milky Way with your binoculars, then a new moon or waxing crescent is best. At new, the moon's light will not drown out the faint stars.

Slide 18
One of the things you'll notice about the crescent moon is that you can often faintly see features in the dark of the moon. This region of the moon is still in the might, but the light of the Earth faintly illuminates it. If you were an astronaut, visiting this part of the

moon, you would see an Earth four times larger than our moon and many times brighter still hanging in the sky.

Slide 19
There's a lot you can see on the moon with just a pair of binoculars. So let's learn the names of a few features that you can see on the moon.

Slide 20
First, you'll notice the moon is made up of two types of terrain, maria and highlands.

The highlands are a rocky scum that was created when the moon first formed. The highlands are made of a white mineral called feldspar. It has a lower density compared to the rest of the moon, so it floated to the top. Highlands are the oldest parts of the moon. We can tell they're old because they are heavily cratered. The highlands formed while the solar system was still being bombarded by the collision of planet building blocks called planetesimals. Some collisions were so large they produced craters hundreds of miles across. Craters that big are called impact basins.

Maria are lava flood plains that were created when lava came to the surface and filled the large impact basins. The lunar lava is basalt, the lava rock we see in much of Idaho. The lava erupted on the moon after most of the impacts occurred, so maria are devoid of the large, shoulder to shoulder craters you see in the older highlands. Maria is plural for mare and mare comes from the Latin word for sea.

Here are two rocks from Idaho that are similar to what astronauts find on the highlands and maria.

PASS AROUND THE MOON ROCK ANALOGS

These are the names of a few of the maria visible on the moon. Please mark your Lunar Maria sheet just like you see on this slide. Afterwards, we'll give you a quiz. The regions circled in your lunar map are named as follows.

Sea of Serenity
Lake of Dreams
Sea of Tranquility
Sea of Crises
Sea of Fertility
Sea of Nectar
Sea of Vapors
Central Bay
Sea of Clouds
Sea of Moisture
Seething Bay
Ocean of Storms
Sea of Rains

Bay of Rainbows
Sea of Cold

Slide 21
Now call out the name of the mare in the next three quiz questions. Don't worry if you get them wrong, we're not giving a grade. Oh, you can also use your notes. Ready?

Slide 22
This mare is named?
(Sea of Rains)

Slide 23
This mare is named?
(Sea of Serenity)

Slide 24
This mare is named?
(Ocean of Storms)

Slide 25
Now that you know a few lunar seas, let's try a few prominent craters. Young craters have ejecta blankets and rays. Tycho is a great example of this. Over time the rays will darken and fade due to solar radiation and cosmic rays. The craters Plato and Grimaldi are old craters and flooded with lava. Please mark your Lunar Craters sheet just like you see on this slide. Afterwards, we'll give you a quiz.

Slide 26
These three large craters are more prominent at first or last quarter.

Slide 27
Now call out the name of the crater in the next three quiz questions. Don't worry if you get them wrong, we're not giving a grade. Oh, you can also use your notes. Ready?

Slide 28
This crater is named?
(Tycho)

Slide 29
This crater is named?
(Grimaldi)

Slide 30
This crater is named?
(Copernicus)

Slide 31

Probably everyone has heard of the man on the moon. But how many have seen him or the rabbit on the moon? Here's how the maria on the moon create the images of a young woman, a man, and a rabbit.

Slide 32
As the moon traverses the sky, it appears to rotate. That happens because the moon keeps its poles pointing in the same direction with respect to the solar system. The moon's rotation emphasizes different aspects of the maria. As the moon rises the maria can appear in the shape of a woman who is dancing or reading.

Slide 33
A little later, the rotation makes the maria appear as the Man on the Moon.

Slide 34
Closer to morning, the moon has rotated so much that we can see a rabbit on the moon. In Japan this rabbit is called the Shogun of the Moon.

Slide 35
The moon makes a great guide to the night skies. You have a summer lunar guide. Take a quick look at it and you'll see that it lists the days of the moon phases and when the moon is near an object of interest.

Slide 36
Four planets are prominent this summer. You'll notice the planets Venus, Mars, Jupiter, and Saturn don't twinkle like the other stars.

Slide 37
By the end of summer the Zodiacal Light becomes visible again. The light is really sunlight being reflected off dust inside the solar system. It's major source is the dust of comet tails.

Slide 38
The first planets visible are Venus, Mars, and Saturn. Begin looking for them even before it gets dark. Venus is brilliant and visible even in daylight if you know where to look. Mars passes close to the lucida of Leo the Lion, Regulus.

Slide 39
Beginning in August, Venus passes through Mars and Saturn. They form a small triangle on August 10th. Watch every night as their changing positions is noticeable.

Slide 40
Jupiter, the king of the planets, is so bright that you can't miss it in the late night sky. This summer Jupiter is located below the Great Square of Pegasus. Jupiter is the only planet that benefits from the use of binoculars. That's because you'll see its four largest satellites. Watch them over several days and you'll see that they orbit around the planet.

On average, the satellites are roughly the size of our moon. From closest to most distant, the satellites are named Io, Europa, Ganymede, and Callisto.

Slide 41
Along with planets and stars, you'll see meteors while you star gaze. So let's take a minute to discuss them.

Slide 42
Most meteors you see are bits of comet dust. When a comet enters the inner solar system, sunlight warms the comet until it forms a tail of dust and gas. The dust follows the comet in its orbit around the sun and when the earth passes through the orbit of a comet, the dust will slam into the atmosphere. The dust and sand grains can have speeds approaching 70 miles per second and would be able to cross Idaho in less than five seconds. We call rocks and dust in space meteoroids.

Slide 43
When meteoroids enter the atmosphere that fast, they create a shockwave that compresses the air ahead of it. The shocked air gets very hot; so hot that its heat will melt the grain of comet dust. The meteoroid creates a channel of hot glowing air that appears as a luminous streak in the night sky. That streak is called a meteor, or falling star. Most meteors you see are 60 to 80 miles above the ground and will melt and vaporize long before they can reach the ground. Sometimes the air is left glowing like the gas inside a fluorescent light. When this happens, a faint trail is left hanging in the sky after the meteor burns up. The trail can persist for several seconds to more than several minutes. Normally a meteor flashes across the sky in just a few seconds.

EVERYONE BEGINS METEOR WATCHING

So normally when some one says…..

POINTS TO WHERE NO ONE ELSE IS LOOKING

"Oh, there's a good one!"

EVERYONE ELSE TURNS TO LOOK

……it's usually over before anyone else can see it.

Occasionally though, you'll see a slow one that takes 5 seconds or longer to travel. Larger and faster meteoroids create the brightest meteors. Some times they can be as bright as the moon. Really bright ones are called bolides and they can end in a terminal burst of light. The burst of light can be followed by fainter colored sparks.

If a meteoroid is large, several inches or larger across, it can survive its passage through the atmosphere and land on earth. A meteoroid that makes it to the ground is called a meteorite. Here are two examples of meteorites. One is a nickel-iron that came from the

core of a forming planet and the other is a stony that came from the outer crust of a forming planet. Please don't drop them.

PASS AROUND METEORITES

Slide 44
Because comets follow the same orbit around the sun, earth will run into their dusty orbits the same time each year. When this happens, we see an increase in the number of meteors per hour which we call a meteor shower. Meteors from the same shower enter the atmosphere from the same location. This makes them appear to radiate from one point in the sky. Perspective makes them appear to fan out like this slide shows.

Typically, on any given night, there are seven meteors per hour. During a meteor shower the number can go up to over 60 meters per hour, or one per minute.

There are four two good meteor showers in the summer, the Delta Aquarids, Alpha Capricornids, Iota Aquarids, and the Perseids. The first three are weak showers with radiants that are low in the sky. The best shower and probably the best meteor shower of the year is the Perseids. Moonlight will interfere with the Perseids this year. But there's enough shower activity this summer for many nights of meteor watching.

Slide 45
Along with meteors, you also see satellites drifting across the sky.

Slide 46
Satellites are visible when the sky is dark but before the sun is too far below the horizon. That's when sunlight can still illuminate satellites and we see that reflected sunlight in a dark sky. In dark skies you can expect to see at least half a dozen satellites. They will appear as stars slowly drifting across the sky. A satellite can take as long as fifteen minutes to travel from one horizon to another. Often the satellite will fade out long before reaching the horizon. That's because the satellite has traveled out of the sun's light and into the earth's shadow. Some satellites slowly pulsate in brightness. These satellites are usually rocket boosters left in earth orbit. As the long cylindrical booster tumbles end for end, its size and therefore brightness appears to fluctuate. Satellites will not blink, nor will they have lights right next to them. Those are airplanes.

The most enjoyable satellites to look for are the International Space Station and Iridium satellites.

Slide 47
To find when ISS will be visible or an Iridium satellite will flare, go the Heavens Above website. Then under configuration, select the option to pick a location from their database.

Slide 48

In the Name field, type your city. As long as it's not a tiny little town, Heavens Above will have one or more entries for the town's name. Select your town and state. Then save the website under your favorites so you can select it anytime you want to know what satellites are visible. Alternately, go to my website, NearSys.com and look under Easy Star Gazing – you'll find the link there.

Slide 49
Now that you're looking at the right page, select either, ISS passes for the next ten days or Iridium flares for the next seven days for the town closest to where you live.

Slide 50
The report will look like this. In your packet you have the same reports for Boise.

Note: Briefly describe what's on the listing. Is there one tonight?

If no town listed is close to where you're camping, or if you want a really accurate report, then click on the Heavens Above link and follow the direction to select reports based on the GPS coordinates you type.

Slide 51
How many people own binoculars? Did you know binoculars are a great astronomical tool? They're easy to point and you can use both eyes. Briefly, let's describe binoculars and what you can see with them.

Slide 52
First, you'll notice that there's two popular numbers associated with binoculars. For example, 7 by 50. The first number is the magnification of the binoculars. The larger this number, the larger objects appear magnified in your binoculars. You really don't need high magnification in your binoculars. A magnification between 7 and 10 is plenty. Too much magnification usually means the binoculars are large, heavy, and difficult to hold steady. You can't see nearly as much detail in binoculars if they shake in your hands.

HOLD UP MASSIVE BINOCULARS AND SHAKE

The second number is the diameter of the objective lens in millimeters. 50 millimeter lens are two inches in diameter. The larger the diameter, the more light they gather and the brighter objects appear. But also the larger the objective, the heavier the binoculars and the more difficult it is to hold them steady.

A pair of 7 by 50 or 10 by 50 binoculars are perfect for camping.

HOLD UP A PAIR OF BINOCULARS

Here are two important things to check on binoculars before buying them.

Alignment: First check that they are properly aligned. If the binoculars aren't aligned, the images in your eyes aren't aligned either. That means you'll see double images rather than a single object.

Focusing: Check that the binoculars focus properly when you aren't wearing glasses. Most binoculars focus with a ring in their center. Take off your glasses and try focusing a binocular at something on the horizon. If you can't twist the focuser enough to remove the blurriness of the horizon, then look for a different pair of binoculars.

Binoculars views are best when the binoculars are held steady. So try propping them on stationary objects like a tree. Alternatively, you can now purchase a pair of image stabilized binoculars. These binoculars use a prism that bends the path of light. The prisms moves around to compensate for the movement of your hands.

Slide 53
Here's a list of easy to find objects for your binoculars this summer. One of your hand outs has maps to these objects.

Slide 54
First is MEL-111, part of Coma Berenices. Look for the old tuft of Leo's tail. It's just above the pointy end of Leo's triangle of stars, which represent his hind quarters. In dark skies you'll see a triangular scattering of stars that nearly fill the entire field of view.

Slide 55
Now turn your binoculars to the bend in the handle of Big Dipper. That star will appear as two very close stars to good eyes in dark skies. In binoculars, they're easy to separate. In small telescope, you can split the brightest star, Mizar into two stars.

Slide 56
Wait until late June nights to see the Milky Way and Jupiter. In July and August they'll be visible earlier in the night.

A large and bright cluster of stars called M-7. It was recorded by Ptolemy 1,800 years ago and named after him. In binoculars, it appears as a cloud of stars in a haze.

Slide 57
There are all kinds of stuff in Sagittarius that in binoculars appear as fuzzy spots. Some of them are globes of 100,000 stars, some are loose groupings of stars, while others are clouds of gas and dust where stars are being born.

Slide 58
It you're going to stay up late watching the Perseid meteor shower in August, then you have an opportunity to see a neighboring galaxy, the Andromeda Galaxy. Andromeda is 2.5 million light years away, but it's still visible to the unaided eye in dark skies. In binoculars it will appear as a large fuzzy cloud. Look carefully and you'll notice it's longer in one direction that the other. You'll be looking at the combined light of over

100 billion stars. Perhaps, there will be someone in Andromeda Galaxy looking back at you in their binoculars.

Slide 59
Jupiter's four largest satellites are visible in your binoculars as fainter stars close to the planet. You'll need to prop up your binoculars to hold them steady, so use a car, fence post, or tree. The steadier you hold the binoculars the easier it is to see the Galilean Satellites.

Slide 60
Let's talk about using your camera to take astronomical photographs while camping.

POINT OUT CAMERA ON TRIPOD

To take astronomical photographs you'll need a camera with bulb setting. This lets the camera shutter remain open for as long as you wish.

Then you need a tripod to hold the camera steady. Exposures at night are from several seconds to several minutes or even hours. Without a tripod you'll have to rely on propping your camera up against a stationary object like a rock. Here are two examples of tripods. Both are light weight, but one is a lot smaller than the other.

HOLD UP MINI TRIPOD

Then you need a cable release. The cable release does two things. First it lets you open the camera shutter without jiggling the camera. It also lets you lock the camera shutter open.

Be sure your camera lens is focused for infinity. If it's not, the stars become fuzzy circles in your pictures.

Here are some examples of what you can record.

PASS AROUND FRAMED PICTURES

Star Trails: If you leave the camera pointed at the sky and the lens opened for several minutes to several hours, you'll record the paths of stars as they travel across the sky. Typically you want to place an interesting landscape in the foreground. If you want the trails long, you need to leave the shutter open for a long time. During long exposures the film becomes less sensitive to light and it can overexpose and fog the image. One way to get around this is to increase your lens' f-ratio. Instead of leaving the lens wide open, you can slow it down to f-8.

At the end of your star trail photograph you may want to flash the foreground. Since the flash is so brief, the sky above the terrain remains dark. Flashing brings out foreground features while retaining the already recorded star trails.

Aurora: Auroras are pretty bright, so an exposure of 15 seconds is plenty long enough. For an aurora photograph, leave the lens wide open.

Satellites: If you know when a bright satellite, like ISS or an Iridium flare will occur, you can position your camera in advance and let the satellite drift through. Since this normally takes less than 10 minutes, you can leave the camera lens wide open.

Meteor Showers: Recording meteors usually takes a lot of film unless you're lucky or there is a significant meteor storm. To record the faintest meteors, leave the lens wide open and keep the exposures to less than an hour. The darker the sky, the longer the exposure can be.

Landscapes: Just because the moon is out doesn't mean you can't photograph at night. Moonlight adds an ethereal feel to a landscape. So set your camera up and leave the shutter open for several minutes.

Slide 61
Now we'd like to leave you with additional sources of information.

Slide 62
In your hand outs you'll find this information.

First, Topeka has an astronomy club, the Northeast Kansas Amateur Astronomer's League. They meet at the library on the fourth Thursday of the month at 7:00 PM. They have an observatory west of Topeka that's opened to the public monthly, so check them out. This is a great opportunity to see Saturn's rings.

Also in Topeka, Washburn has an observatory and planetarium. However, they don't give shows regularly.

KU in Lawrence has an observatory on their campus.

Powell Observatory is south of Kansas City.

You can get monthly star maps from Sky Maps.com. If you use them, you'll learn your way around the sky in less than a year.

Slide 63
A planisphere is an adjustable version of the star map and they're available from some bookstores and museum gift shops. Here's how you use one.

Thank you for coming to this presentation.