

**LUMA Entertainment LLC**  
**650 Town Center**  
**Suite 2030**  
**Las Vegas, NV 89144**  
**702 386 5862**  
[www.lumatheater.com](http://www.lumatheater.com)

**STUDY GUIDE: LUMA**

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The following is an overview of material, available for teachers, in conjunction with theatrical performances by Luma, produced by First Light Company.

BACKGROUND:

Luma is a show about light, performed 80% or more in the dark. It is presented in three suites: Natural, Artificial, and Metaphysical Light. Luma's creator, Marlin, was inspired to create the show after seeing natural wonders such as the lava flow on Hawaii's Big Island, and the night sky.

THE NIGHT SKY AS INSPIRATION:

Our **Sun** is perhaps the most prominent of all sources of natural light. Our eyes see the kind of radiation the sun is best at producing--visible light--but the sun also produces radiation our eyes can't see, such as ultraviolet rays.

Our **Moon** is closest to Earth--at 240,000 miles away. It's a source of **reflected** light and is represented in Luma's first suite, Natural Light. The moon has no atmosphere, water, weather, nor life forms, and its cratered surface changes very slowly.

We've all grown up being familiar with pictures of Earth, first available in the 1960's. Since then, our spacecrafts have managed to capture images of 8 of the 9 planets in our solar system. You may have created a model of our solar system in a science class, revealing what you know of Earth's size compared to the other planets.

The surface of **Venus** is so masked by perpetual clouds that radar beams had to be used to see what was below the dense layer of clouds.

**Mars** is visible as a "red planet" with only 38% of Earth's gravity and consequently, a very thin atmosphere.

**Jupiter** has a giant red spot--referred to as the "mother of all storms."

**Saturn**, which consists of the two lightest elements--hydrogen and helium, has rings which are not solid but are made up of icy particles.

For thousands of years on Earth, the dark has evoked fear and awe into the hearts of humans. The night brought the danger of wild animals and the wonder of the sky. Before technology and hard science, countless stories of the stars were passed down throughout many cultures to explain what people saw. We in the West are most familiar with myths from Greek culture. For example, **Orion** [who recognizes his belt?] was a mortal who bragged about being the best hunter there ever was. He was punished by a god from Mount Olympus who sent a scorpion to bite him. To keep the peace, as the story goes, Orion and Scorpio were placed on either side of the heavens. This story offered an explanation of why we never see Orion, a winter constellation, and Scorpio, a summer constellation, in the sky at the same time.

From the Hubble Space Telescope, the **Orion Nebula** has been captured on film. The nebula is visible to the naked eye in a dark sky, but with our modern cameras, we're able to learn more about how this star system--1,500 light years away--is being formed. Our technology allows us to begin to understand what we see without reliance on myth.

The death of stars is as spectacular as their formation. **Eta Carinae** is a star more than a hundred times the mass of our Sun and four billion times more luminous. This star was first observed in 1677, but in 1860 it was barely visible to the naked eye.

**Supernova** are massive natural sources of light likened to the artificial light of fireworks. Supernova refer to stars that become unstable at the end of their lives and explode, becoming extremely bright for a short period and producing new elements. [The Big Bang when it exploded created the two elements, hydrogen and helium.]

**Comets** are chunks of dirty snow and ice. The icy bodies of comets cannot melt because there is no pressure in space to allow for the existence of liquids, so the ice evaporates directly from solid to gas, forming a vapor cloud and tail.

Open clusters and globular clusters of stars are other inspirational images, as is our own Milky Way within galaxies such as **Andromeda**.

Most of the images we've ever seen rely on advanced technology. Yet much more than we think is visible to the naked eye in a sky free of **light pollution**. The U.S. alone is losing \$2 billion annually on wasted light.

And it's been getting worse. The satellite image of Los Angeles in 1908 and Los Angeles in 1988 are dramatically different. Much of the light one sees in the 1988 image is wasted: street lights, for example, light up the sky and actually reduce visibility at ground level.

It's unfortunate that, because of light pollution, many of you will never see the Milky Way's gas, dust clouds and stars as you can under a dark sky.

**Mercury lighting** creates the glare and splatter of light that you see around typical houses for "security." **Low-pressure sodium lights** offer a more efficient light with less glare and more useful light.

#### KINDS OF LIGHT:

**Fire** is a source of natural light. Can you name others?

[The moon...]

[Meteorites, when they come into our atmosphere...]

Some of Luma's props use natural sources of light, such as **flash paper**, sparkers (**magnesium against steel**), and **lighter fluid** on swinging torches.

Some animals make light naturally. Can you name any? Their light is used to attract mates and is called **bioluminescent**.

Science has imitated bioluminescence artificially. The space program designed “**cyalumes**” which contain two chemicals. When the cyalume is cracked, the chemicals mix and light is created. This kind of artificial light produces very little heat, but unlike jellyfish and lightning bugs, the light from cyalumes only lasts up to 12 hours or so.

**Gas lamps** provided light at night for many decades until Thomas Edison created the first electric light bulb. Does anyone know how the light bulb works? The invention of the light bulb meant that we could easily create “synthetic day” and has forever changed our relationship with the dark. **Incandescent bulbs** produce a lot of heat and are not very efficient because they require a lot of energy.

Can you think of other kinds of artificial light? Luma uses all of the following types of light:

**LED’s**...(light emitting diodes, used in common household items such as stereos, alarm clocks, microwaves, bicycle lights, what else...?)

**Fiber optic light**...(light bounces off the interior of a tube until it reaches the end.)

**Electroluminescent** wire...(screened phosphor carries the electrical charge through the entire wire *unlike* fiber optics where the light source is only at the base.) Electroluminescent light is also used in panels, such as in Indiglo Watches and camcorder mini-screens.

**Diffused light**...(incandescent light that is filtered through water, for example.)

**Neon light**...(an example of light from gas; the gas is stimulated by an electrical charge; when the electrons within the gas jump to a higher orbit, they throw off photons, thus creating light.) Neon is one of the Noble Gases, but “neon lighting” is misleading as Neon is often not the gas used for this kind of light. Do you know which gases are used instead?

**Fluorescent light**...(another example of light from gas.) Do you know which of the Noble Gases are used to create fluorescent lighting?

**Black light**...(a light which uses filters to highlight nothing but ultraviolet, or UV, light.) Luma colors objects with UV paint which contains artificial phosphors. Under black light, these painted object “pop.” Tide detergent is a common household example of something with artificial phosphors.

What other kinds of artificial light are you aware of?

How about **Metaphysical Light**? Do you know what this means? Meta is the Greek word for “above” or “beyond.” How many of you have seen Star Wars? Do you remember when Obi Won Kenobi told Luke Skywalker about the Force? This is an example of Metaphysical Light, and the territory that Luma is pioneering.

There is a light or energy that represents the animating force within every living being. We sometimes call it the “twinkle” in your eye, or the “radiance” of your spirit. There is about 1.9 volts of energy generated within the human body. This is an electrical field that is measurable. When a person is sick, his or her energy is “low.” When healthy, the energy is “vibrant.”

How else has Metaphysical Light been represented or made visible?

Halos...

Auras...

Sixth Sense...