

Lighting

QuickTime™ and a
decompressor
are needed to see this picture.

DEFINITIONS § 101

Permanently Installed Lighting

2005

2008

All luminaires attached to the inside or outside of a building or site, including:

- Track and flexible lighting system
- Attached to walls, ceilings, columns
- Inside or outside of permanently installed cabinets
- Internally illuminated case work
- Mounted on poles, in trees or in the ground
- Attached to ceiling fans
- Integral to exhaust fans that are other than exhaust hoods for cooking equipment

(continued on next page)

DEFINITIONS § 101

Permanently Installed Lighting (continued from previous page)

2005

2008

- **May have either plug-in or hardwired connections for electric power**
- Does not include
 - Portable lighting
 - Lighting installed by the manufacturer in refrigerators, stoves, microwave ovens, exhaust hoods for cooking equipment, refrigerated cases, vending machines, food preparation equipment, and scientific and industrial equipment.

DEFINITIONS § 101

Portable Lighting

2005

2008

- Lighting with plug-in connections for electric power that is
 - Table lamps
 - Freestanding floor lamps
 - Attached to modular furniture
 - Workstation task lights
 - Lights attached to workstation panels, movable displays
 - Other lighting that is not permanently installed lighting.

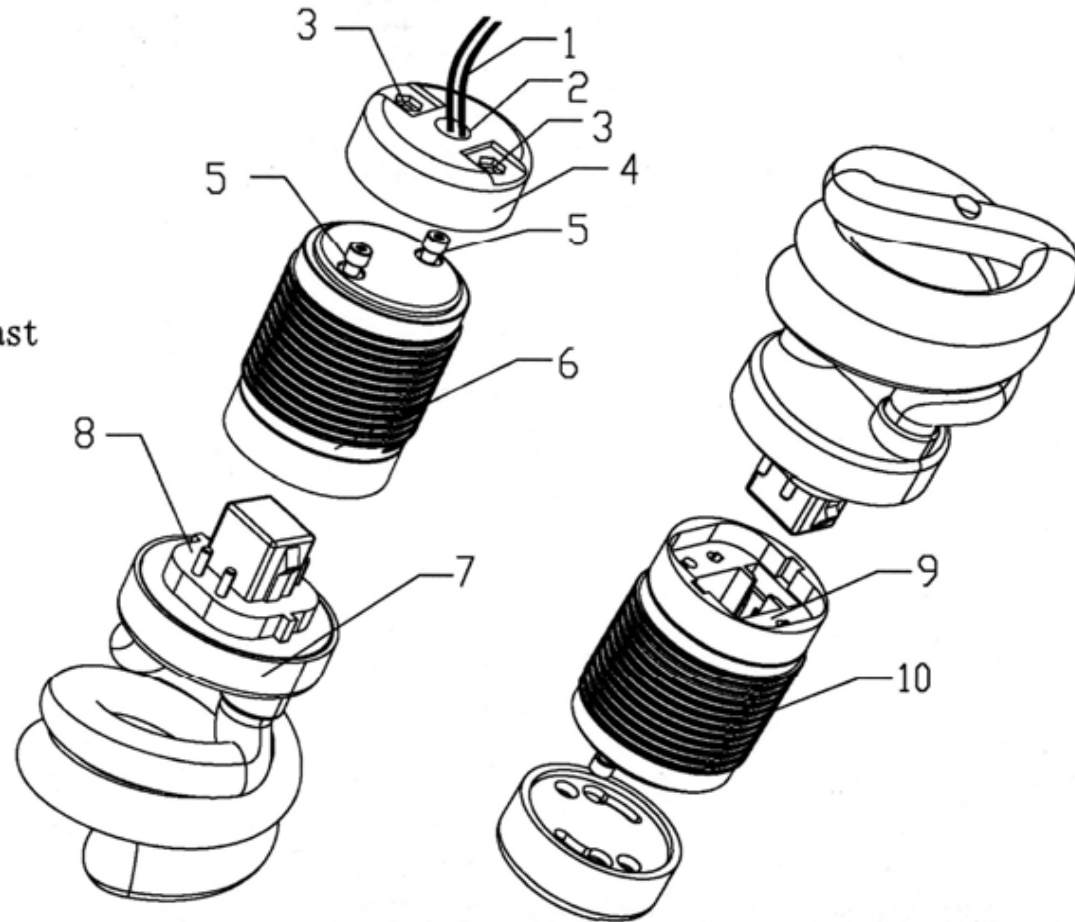
Luminaire Efficacy and Wattage is **NOT** based on the initial lamp installed

- Luminaire input wattage is based upon the type and rating of the luminaire, not the type of lamp initially installed in a luminaire.
- A high efficacy lamp screwed into a low efficacy luminaire is still considered to be a low efficacy lighting system for Title 24 projects.

Lighting

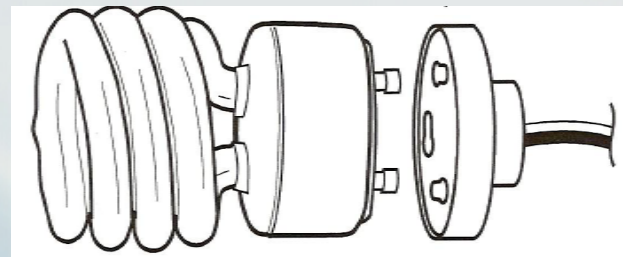
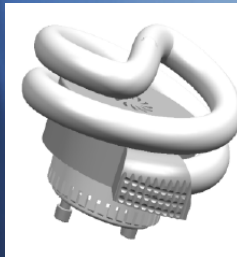
- GU 24 Base

1. Lead Wire
2. Fixing Hole I
3. Fixing Holes II
4. Base
5. Prongs
6. Replacement Ballast
7. Replacement Lamp
8. Lamp Base
9. Lamp Holder
10. Thread



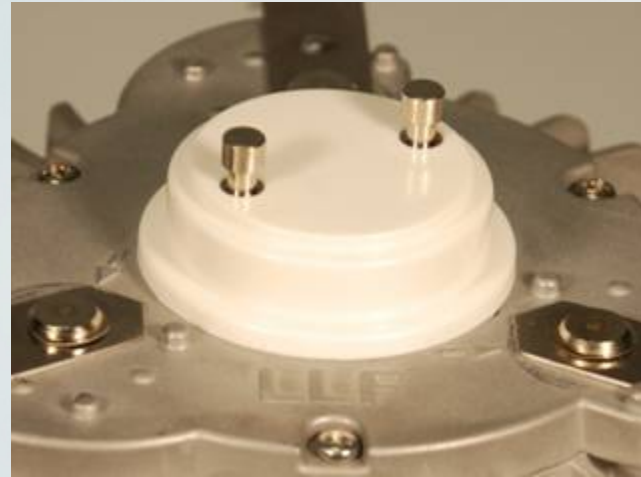
Lighting

- GU 24



Lighting

- GU 24



Lighting

- GU 24 Requirements

Title 24 Rules for Determining Luminaire Wattage §130(e)
GU-24 Lamps, Luminaires, and Adaptors Installed in California shall not be low efficacy as follows:
<ul style="list-style-type: none">• No GU-24 low efficacy lamps• No GU-24 low efficacy luminaires• No GU-24 modular adaptors or luminaire conversions



Lighting

Title 20 (Appliance Efficiency Regulations adopted December 3, 2008)

It is against the laws of the State of California to sell any of the following products in California

- **Incandescent lamps with GU-24 bases.**
- **GU-24 adaptors that adapt a GU-24 socket to any other line-voltage socket.**
- **Luminaires that are equipped with GU-24 sockets which are rated for incandescent lighting of any kind (including low-voltage or high-voltage.)**

Lighting

- GU 24

Nowhere in the Standards does Title 24 recognize any type of “permanent” screw-based adaptors

- High efficacy luminaires, for compliance with Title 24, shall not contain screw-base sockets according to §150(k).
- If a luminaire contains a screw-base socket it is not recognized as high efficacy by T24, regardless of manufacturer claims.
- Title 24 does not recognize any “permanent” line-voltage adaptors.



Lighting

- GU 24

Nowhere in the Standards does Title 24 recognize any type of “permanent” screw-based adaptors

- **Adaptors are NOT recognized by Title 24 as converting a low efficacy luminaire to a high efficacy luminaire.**
- **A luminaire with a screw-based socket will always be classified as an incandescent luminaire, even if a “permanent” adaptor is installed in the luminaire.**



High Efficacy Luminaires § 150(k)

- Standards require ALL luminaires installed in RESIDENTIAL applications must be classified as high efficacy or low efficacy.
- Standards do not require luminaires installed in nonresidential applications to be classified as high efficacy or low efficacy.

Residential Lighting Standards § 150(k)

Definition of a High Efficacy Luminaire

- Contains only high efficacy lamps
- **Does not contain any medium screw base sockets**
- Is not a low efficacy luminaire as specified in §150(k)



Residential Lighting Standards § 150(k)



Definition of Low Efficacy Lighting	
2005	2008
	<ul style="list-style-type: none">• Any luminaire that does not qualify as high efficacy• Any luminaire containing a medium screw-base socket (E24/E26)• Any luminaire containing any type of line-voltage socket <p>Except GU-24 under certain conditions</p>



Residential Lighting Standards § 150(k)

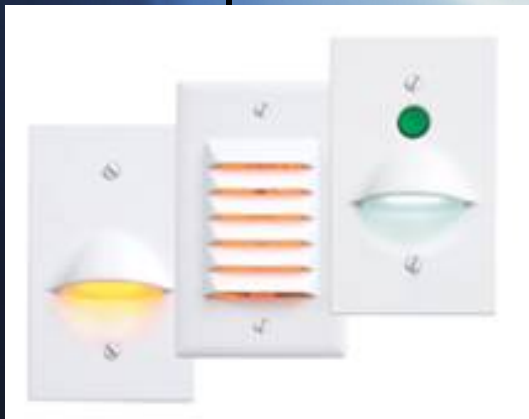
Permanently Installed Night Lights and Night Lights Integral to Permanently Installed Luminaire or Exhaust Fan

2005

2008

1. Shall contain only high efficacy lamps with no line voltage lamp holder
or
2. Shall consume no more than 5 watts with no screw-base lamp holder.

Indicator lights that are integral to lighting controls shall consume no more than 1 watt



Residential Lighting Standards § 150(k)

Recessed luminaires in insulated ceilings continued	
2005	2008
	<ul style="list-style-type: none">•To qualify as high efficacy ballasts shall be certified to comply with Section 119(n)•Must allow ballast maintenance and replacement readily accessible from below the ceiling without cutting holes in ceiling.

Lighting

How to Determine High Efficacy § 150(k) Use total system watts for LED lighting

From Table 150-C	
Wattage Range	Minimum Lumens/Watt
$\leq 5 \text{ W}$	30 L/W
$> 5 \text{ W to } 15 \text{ W}$	40 L/W
$> 15 \text{ W to } 40 \text{ W}$	50 L/W
$> 40 \text{ W}$	60 L/W



Lighting

- **An LED source system with a standardized base is an LED lamp.**
 - For purposes of the energy standards, an LED bulb which is a replacement for an incandescent bulb is not an LED light engine with integral heat sink.



Lighting

▪ **LED Lighting**

Background:

- There will continue to be both high efficacy and low efficacy LED lighting, as defined by Title 24, for the foreseeable future
- Two most common formats for LED lighting systems available today are:
 - Dedicated LED luminaires
 - LED “trims”

An LED trim is a one-piece integral unit containing the power supply, transformer, heat sink, and LED circuit board, and is designed to be installed into a recessed luminaire housing.

Lighting

LED Lighting

Background continued:

- Many manufacturers of LED trims currently install their LED trims into someone else's luminaire. They do not manufacture their own luminaire housing
- These third-party luminaire housings are typically classified as low efficacy according to Title 24
- So as to not impede high efficacy LED lighting systems from the market, the Energy Commission has options in the 2008 Residential Compliance Manual to address conditions high efficacy LED trims, when installed into low efficacy luminaires, may be classified as high efficacy
- These issues are unique to LED trims. Therefore, the solution must apply only to LED trims, and not to any other lighting technology. For example, it shall not apply to CFL trims.

Lighting

- **LED Lighting**

Background continued:

Field modified luminaires may lose their UL listing

Lighting

- Following is language in the 2008 Residential Compliance Manual:
 - The UL listing of the luminaire housing must be addressed with UL
 - The LED trim must be certified to the Energy Commission as high efficacy according to Table 150-C, or it shall be considered low efficacy.
 - The LED trim must be hardwired directly into the luminaire housing. The wiring assembly may include some kind of mid-line connection, like a GU-24, or other such connector between the LED trim and the wire ends used to hardwire the assembly to the housing.

However, under no circumstances shall the connection include a screw-base.

Continued on next page

Lighting

- Following is language in the 2008 Residential Compliance Manual:
 - The luminaire housing cannot contain any type of screw-base socket.
 - Screw-base adaptors shall not be used, even if the manufacturer considers them to be “permanent”.
 - An LED trim, provided by the manufacturer with a screw-base “pig-tail,” shall NOT be installed unless the base is cut off and discarded prior to installation, and the trim must be permanently hardwired into the luminaire.

Lighting

Electronic ballasts required for lamps rated 13 watts or greater

2005

- To qualify as a high efficacy luminaire

2008

- For all luminaires



Lighting



Blank Electrical Boxes in Kitchen

2008

- Shall be calculated and treated as 180 watts of low efficacy lighting

Lighting

Switching Requirements

2005

2008

- High efficacy / low efficacy lighting systems must be separately switched
- Controls must be installed according to manufacturer instructions

- Exhaust fans switched separately from lighting. Exception: light switched manually on/off in conjunction with an auto time-out switch on fan.
- All controls permit manual on and off
- No override of dimmer or vacancy sensor installed to comply with § 150(k)
- Controls are certified per § 119

Lighting

Lighting Internal to Cabinets

2005

- IS considered part of the kitchen lighting for calculating 50%

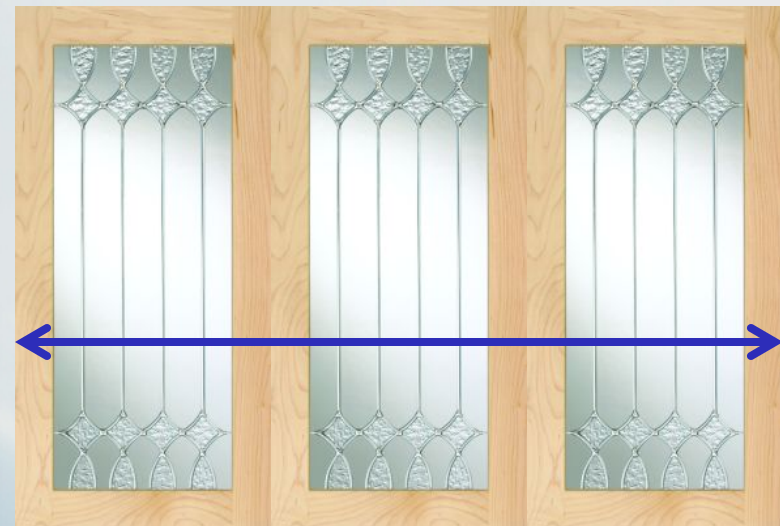
2008

- NOT considered part of the kitchen lighting for calculating 50%
- Shall use no more than 20 W/ linear foot of illuminated cabinet



Lighting

You may use either the width of the cabinet section or the height of the glazing per cabinet section, regardless of the number of shelves or doors on the cabinet.



Lighting

**Additional Low Efficacy Kitchen Lighting Wattage Exempt
from 50% High Efficacy Requirement
Only When All Conditions Have Been Met**

2005

2008

- Up to 50 watts per dwelling units $\leq 2,500$ ft²

- Up to 100 watts per dwelling units $> 2,500$ ft²

Lighting

All Conditions Required to qualify for Additional Kitchen Low Efficacy Lighting Wattage

2005

2008

1. All low efficacy luminaires in Kitchen controlled by vacancy sensor, dimmer, EMCS, or multi-scene programmable control, and
2. All luminaires in garages, laundry, closets > 70 ft², utility rooms must be high efficacy AND also must be controlled by a vacancy sensor



Lighting

Bathrooms, Garages, Closets Laundry Rooms, and Utility Rooms

2005

- bathrooms, garages, closets, laundry rooms, and utility rooms

2008

- bathrooms, **attached and detached** garages, closets, laundry rooms, and utility rooms

All installed lighting must be

- high efficacy, or
- controlled by a vacancy sensor certified to CEC

Low efficacy luminaires allowed in closets less than 70 ft²

Lighting

Outdoor lighting attached to a building

2005

2008

- All outdoor lighting attached to buildings must be high efficacy, or

controlled by both a motion sensor and an integral photocontrol

controlled by a motion sensor in addition to one of the following methods:

- Photocontrol not having an override or bypass switch, or
- Astronomical time clock not having an override or bypass switch, or
- Energy management control system (EMCS) not having an override or bypass switch that allows the luminaire to be always on.

Lighting

Outdoor lighting attached to a building

2005

2008

•Exception to high efficacy: Outdoor luminaires in or around swimming pools, water features, or other locations subject to Article 680 of the California Electric Code

Summary of Article 680 is in the Residential Compliance Manual

Low efficacy outdoor luminaires may have temporary override switch which bypasses the motion sensing function for up to six hours provided that the override switch automatically reactivates the motion sensor.

The background features a gradient from light blue to white on the right side, and a dark blue area on the left side with several bright, diagonal white streaks that create a sense of motion and light.

Non-Residential

Indoor
Lighting

QuickTime™ and a
decompressor
are needed to see this picture.

- Lighting accounts for about 1/3 of electrical usage in Non-Residential buildings.

Rules for Determining Wattage §130(d)

Line-Voltage Incandescent Luminaires - continued

For **RECESSED** luminaires with screw-base line-voltage lamp holders shall be the larger of

- Relamping rated wattage, or
- 50 watts per socket for $< 5''$ aperture diameter regardless of mounting height
- 50 watts per socket for $\geq 5''$ aperture diameter and mounting height ≤ 11 feet
- 60 watts per socket for $\geq 5''$ aperture diameter and mounting height > 11 and < 15 feet
- 75 watts per socket for $\geq 5''$ aperture diameter and mounting height ≥ 15 feet



Rules for Determining Wattage §130(d)

Modular Luminaires

- Luminaires designed to accommodate a variety of trims without changing wiring shall be highest wattage designated by the correlated marking
- Line voltage: Label shall not consist of peel-off or peel-down layers



Rules for Determining Wattage §130(d)

Ballasts

- Permanently / remotely installed ballasts = operating input wattage of the rated lamp/ballast combination published in manufacturer's catalogs based on independent testing lab reports as specified by UL 1598
- CFL or HID luminaires that accommodate a range of wattages without changing the luminaire housing, ballast, or wiring shall be the larger of the installed lamp/ballast combination, or the average lamp/ballast combination for which the luminaire is rated.

Rules for Determining Wattage §130(d)

EXAMPLE: Multi-Wattage CFL Ballasts

Use higher of:

- Installed wattage, or
- Average wattage

Lamp Wattage

- 26
- 32
- 42

If 26 or 32 Watt lamps installed:

- Use average = 33.3 Watts

If 42 watt lamp installed:

- Use 42 Watts

§ 131 Indoor Lighting Controls

Exceptions to Section 131(a) [Area Controls]	
2005	2008
<ul style="list-style-type: none">Up to 0.5 W/ft²...for reasons of building security or emergency egress, if:	<ul style="list-style-type: none">Up to 0.3 W/ft²...for reasons of building security or emergency egress, if:
<ul style="list-style-type: none">The area is controlled by switches accessible only to authorized personnel	<ul style="list-style-type: none">The security or egress lighting is controlled by switches accessible only to authorized personnel

§ 131 Indoor Lighting Controls

(b) Multi-Level Lighting Controls	
2005	2008
<ul style="list-style-type: none">• ...shall have at least one control step that is between 50% and 70%	<ul style="list-style-type: none">• ...shall have at least one control step that is between 30% and 70%
<ul style="list-style-type: none">• ...at least one step... <35% full rated lighting system power	<ul style="list-style-type: none">• ...allow the power of all lights to be manually turned off.

§ 131 Indoor Lighting Controls

(d) Shut-off Controls	
2005	2008
	<ul style="list-style-type: none">• Occupancy sensor required:<ul style="list-style-type: none">✓ Offices ≤ 250 ft²✓ Multipurpose room < 1000 ft²✓ Classrooms any size✓ Conference rooms any size• Shall allow lights to be manually shut off regardless of sensor status.

Nonresidential Indoor Lighting §146

Calculation of Actual Indoor Lighting Power Density - §146(a)

2005

2008

- Includes total watts of all planned permanent and planned portable lighting systems (for all applications)

- Offices $\geq 250 \text{ ft}^2$
minimum 0.2 W/ft^2
assumed portable lighting

- EXCEPTION: $\leq 0.2 \text{ W/ft}^2$ portable lighting for all office areas not added to LPD

Alterations – Prescriptive Approach § 149

Existing Nonresidential indoor lighting systems § 149(b)(H)

2005

2008

- Alterations that increase lighting load, replace, or remove and re-install $\geq 50\%$ luminaires in enclosed space
- Where new or moved wiring is being installed to serve added or moved luminaires; or
- Where conductor wiring from the panel or from a light switch to the luminaires is being replaced, or
- Where a lighting panel is installed or moved.
- Where an existing enclosed space is subdivided into two or more spaces
- Alterations that increase existing LPD > 0.5 W/ft²

Non-Residential

Building
Envelope

Envelope

A new section **§143(c)** reduces the prescriptive area threshold for skylights in large enclosed spaces in lowrise non-residential buildings from 25,000 square feet to 8,000 square feet.

The building plans must show all skylit and primary sidelit areas that total more than 2,500 square feet in an enclosed space (room) **§131(c)**.

Envelope

- New prescriptive requirement for steep sloped roofing products (cool roof).
- Alteration requirements for roofing products have been altered to allow for current insulation values to be installed as an exception to cool roofing.

Alterations - Prescriptive Roofing Requirements

When more than 2,000 square feet or more than 50 percent of a roof, whichever is less, is being replaced on a conditioned building, the roofing shall meet the cool roofing requirements *and* when low-sloped roofs are exposed to the roof deck or to the recover boards, the exposed area shall be insulated to the levels specified in Table 149-A. (Some exceptions)

- Non-Res (CZ 3 & 4 = R-8/0.081), (CZ 12 = R-14/0.055)
- High-Rise Res = R-14 or 0.055 U-factor.

Envelope

Standards no longer reflect the R-value of the cavity or continuous insulation to demonstrate compliance. U-factors are used to demonstrate compliance.

2005 Standards

QuickTime™ and a
decompressor
are needed to see this picture.


2008 Standards

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Reference Appendices

REFERENCE APPENDICES

CALIFORNIA ENERGY COMMISSION




REGULATIONS / STANDARDS

for the **2008 BUILDING ENERGY EFFICIENCY STANDARDS FOR RESIDENTIAL AND NONRESIDENTIAL BUILDINGS**

JOINT APPENDICES
RESIDENTIAL APPENDICES
NONRESIDENTIAL APPENDICES

December 2008
CEC-400-2008-004-CMF

Arnold Schwarzenegger
Governor



Reference Appendices

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Envelope

New to the Standards for Non-Residential are U-factor requirements for swinging and non-swinging exterior doors.

- A maximum U-factor of 0.70 is allowed for swinging doors.
- For non-swinging doors the criteria depends on the climate zone. Typically a maximum of 1.45.
- If glazing exceeds one-half of the entire door area, it is then defined as a fenestration product and the entire door area is modeled as a fenestration product.

Exterior Doors

QuickTime™ and a
decompressor
are needed to see this picture.

Envelope - Alterations

When less than **150** square feet of an entire building's fenestration is replaced then only the U-factor requirement needs to be met. The SHGC or Relative Solar Heat Gain Coefficient requirements need not be met.

The same requirements and exceptions apply if **50** square feet or less of fenestration area is added.

Compliance Documentation

QuickTime™ and a
decompressor
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- Demo version of EP 5.0 available at
www.energysoft.com

Acceptance Requirements

- Building Envelope Acceptance Test for Fenestration (ENV-2A)
- Seven new Mechanical Acceptance Test Requirements (MECH-9A through MECH-15A)
- New Outdoor Lighting Acceptance Test (OLTG-2A)

Acceptance Forms

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The background of the slide is an abstract composition of diagonal lines in various shades of blue and white, creating a sense of movement and depth. The lines are soft and blurred, with some appearing as bright white streaks against a darker blue background on the left side, which transitions to a lighter, almost white background on the right.

Questions?