> spacescape

> objective(s):

Students will create a spacescape that includes a background starfield, nebula, planet and satellite (moon) using only selections and brush tools along with filters and effects.

> curricular focus:

This lesson emphasizes the effective use of Filters and Effects, Layer Blending Modes and creating organic patterns

> specifications:

save as: Space_LastnameF.psd
dimensions: 65-70 square inches (for example: 9.5"x7.25")
resolution: 300 dpi
mode: RGB
contents: Transparent

> instruction:

- slideshow of various actual starfields, nebula, planets
- slideshow of various professional and student project examples
- tutorials on creating various elements of project (stars, nebula, planet)

> procedure:

- set document size and specs (see Specifications above)
- follow the detailed tutorial that begins on page 2
  - all steps need approval from instructor

> requirements:

- file specifications are adhered to
- all elements are realistic
  - starfield
    - arrangement is organically random (no sense of pattern is evident)
    - varied brush sizes create strong depth of field (the larger the brush the fewer the stars)
    - created starfield is accurate to actual images of starfields
  - nebula
    - edges create a very organic shape and softly feather (no crisp edges)
    - thickness of shape varies throughout
    - different nebula colors mix and integrate smoothly
    - created nebula is accurate to actual images of nebulae
  - gaseous planet
    - color selections are monochromatic or analogous
    - color band interactions (both between and within) are accurate to actual images of Jupiter
    - shadow curve and density are realistic
  - Earth-like planet
    - realistic land mass shapes are utilized (continents, peninsulas, islands, lakes, rivers, etc.)
    - realistic terrain and transitions are evident (forest, plains, desert, mountains, ice, etc.)
    - includes accurate cloud cover
    - shadow curve and density are realistic
    - created Earth-like planet is accurate to actual images of Earth
  - moon(s)
    - realistic and creative
    - visually enhance overall composition and do not compete with main subject (planet)
    - shadow matches planet's precisely

>1: small stars

- **step 1:** set up your layer
  - rename your base Layer 1 as Small Stars
  - fill the layer with *pure* black
    - press D (Default) to return the Foreground and Background colors to black and white respectively
      - or click on the default black and white small squares above Foreground and Background colors
    - if your fill is not pure black, future steps with your starfield will not work properly
- **step 2:** select your brush
  - size should be 4-5 pixels
  - hardness must be 0% (very important)
- **step 3:** create small stars
  - make sure placement/distribution is organic and natural; do not evenly space stars!
    - method 1:
      - zoom out (Ctrl minus) a couple of times until your document is small enough that it makes seeing the stars you create difficult to see
    - method 2:
      - look away from the artwork so you cannot see where you are clicking (check back periodically to make sure you are still on the document)
  - click randomly throughout composition
    - *warning!* do not move the mouse as you click as it will create streaks
      - periodically check for errors
        - zoom in and look for all stars that are not perfectly round
        - select black Paint brush and paint over all errors
    - you will need *a lot* of small stars to create a foundation for the background
  - approve with instructor

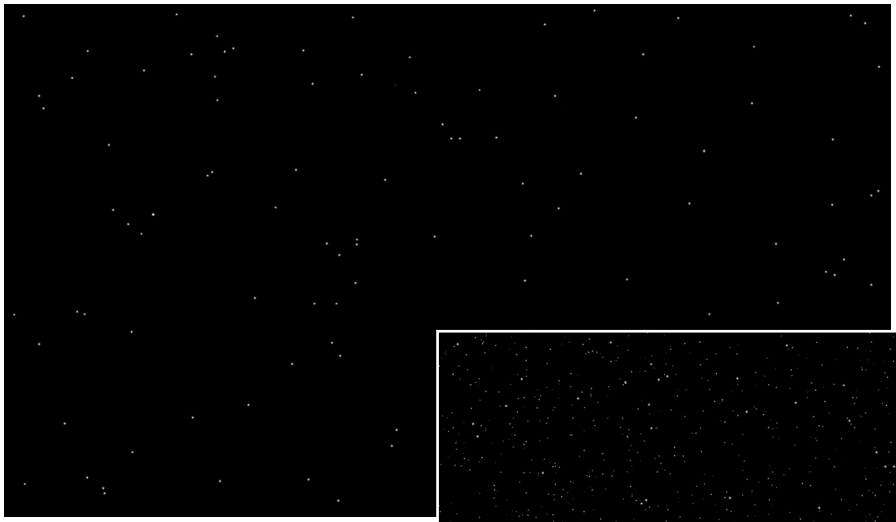
continued on next page

>1: small stars (cont.)

- **step 4:** perform audit for errors (streaks)
  IMPORTANT!
  - zoom in close and scroll throughout Small Stars layer to locate any and all streaks
    these are created by moving the mouse while clicking (you were warned earlier to be careful!)
  - use a black Paint brush to paint over all errors
    all errors must be removed before moving on to step 5 or you will only multiply all your mistakes
- **step 5:** duplicate small stars to increase number
  - go to Layer: Duplicate Layer
    or you may go to the Layer palette's sub-menu (located above Opacity) and select Duplicate Layer
  - go to Edit: Transform: Rotate and rotate to a very different angle
  - set the Layer Blend Mode to Screen
  - move the duplicated layer to another position
    this is an easy way to fill gaps that exist along the edges and in the corners
  - drop the opacity of this layer to create a sense of depth
    when we look at images of actual starfields, some of the smallest stars are more faint
- **step 6:** repeat duplicating small stars until desired composition is achieved
  - each duplicated layer should be at a significantly...
    ... different angle
    ... different location
    ... different opacity
- **step 7:** merge all Small Stars layers
  - have your Small Stars approved by instructor
  - select all Small Stars layers
  - go to the sub-menu inside the Layer palette/window and select Merge Layers
  - make sure layer is named Small Stars

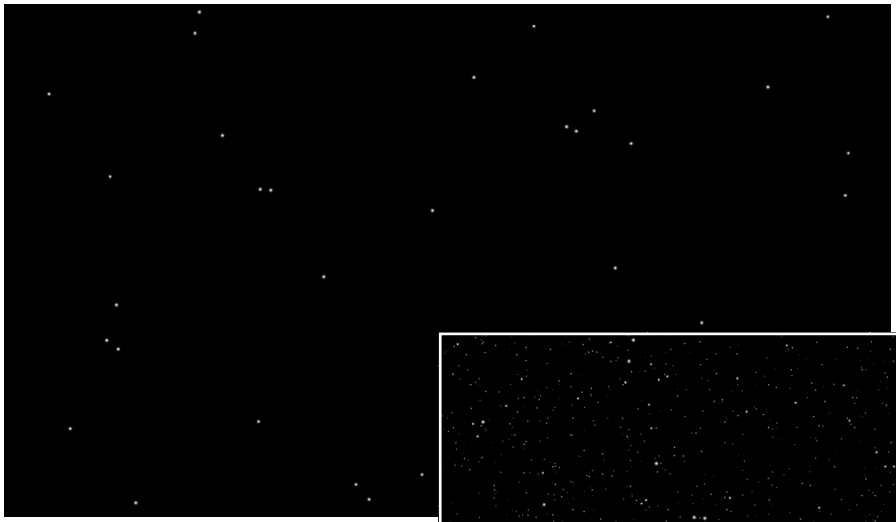
>2: medium stars

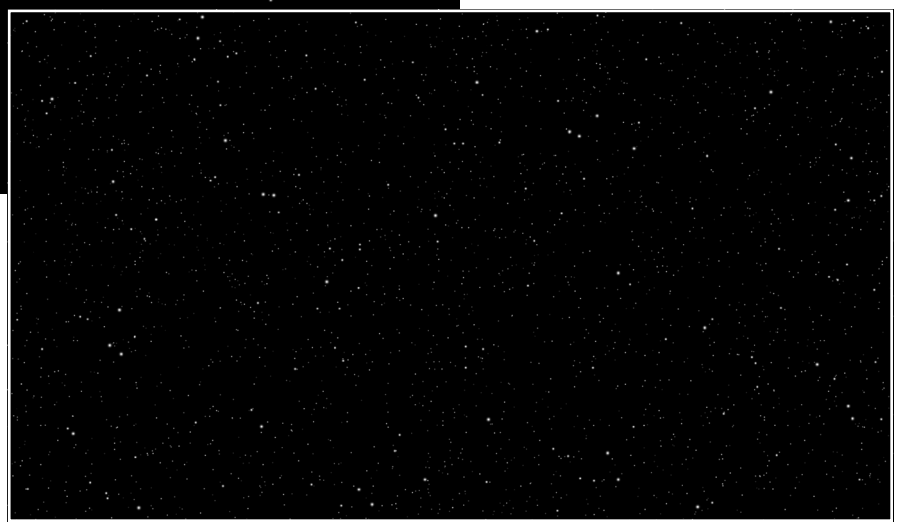
- **step 1:** set up your layer
  - create a new layer and name it Medium Stars
  - fill the layer with *pure* black (press D to return to black Foreground and white Background colors)
- **step 2:** select your brush
  - size should be 8-9 pixels
  - hardness must be 0% (very important)
- **step 3:** create medium stars
  - leave your Layer Blend Mode to Normal so you cannot see or be influenced by your Small Stars
    this will help your composition feel more organic and realistic
  - make sure placement/distribution is organic and natural; do not evenly space stars!
    method 1:
    zoom out (Ctrl minus) a couple of times until your document is small enough that it makes seeing the stars you create difficult to see
    method 2:
    look away from the artwork so you cannot see where you are clicking (check back periodically to make sure you are still on the document)
  - click randomly throughout composition
    warning! do not move the mouse as you click as it will create streaks
    you will need *a lot* of small stars to create a foundation for the background
  - create less than 1/2 the number of your original Small Stars layer
- **step 4:** perform an audit for errors
  - zoom in close and scroll throughout Medium Stars layer to locate any and all streaks
  - use a black Paint brush to paint over all errors
- **step 5:** set the Blend Mode to Screen
  - approve with instructor



>3: large stars

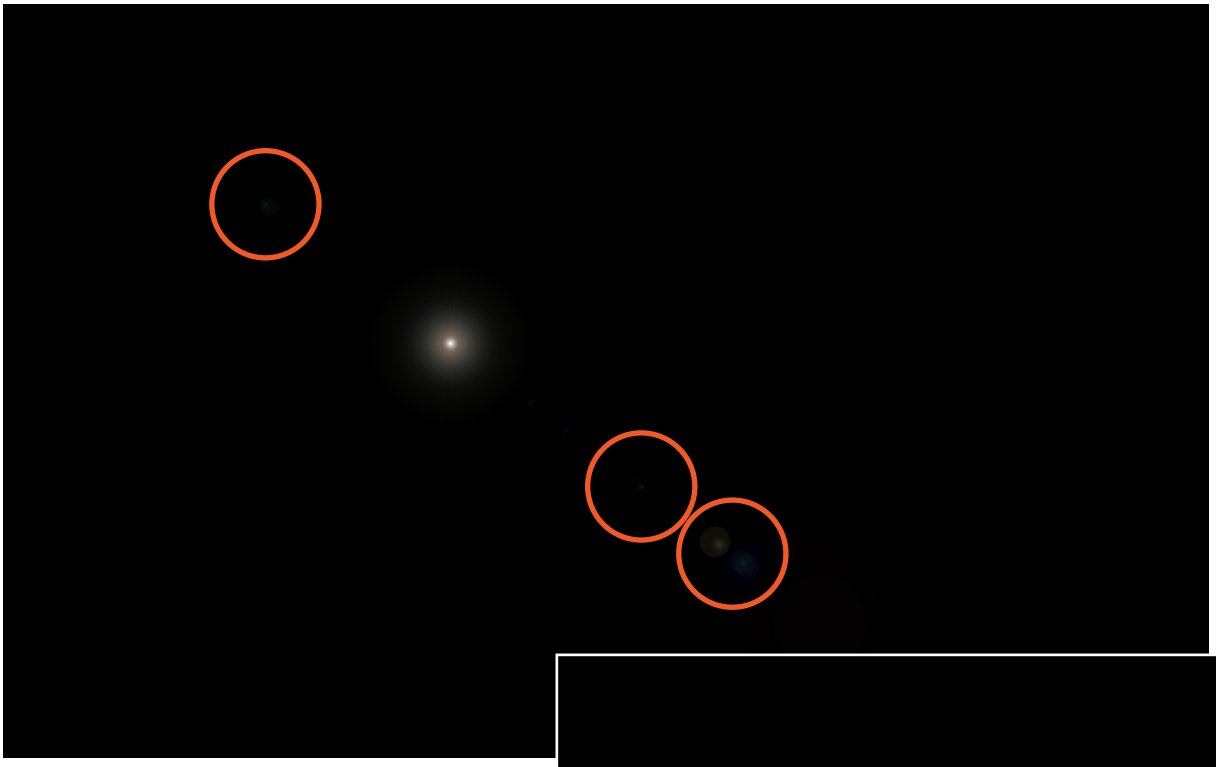
- **step 1:** set up your layer
  - create a new layer and name it Large Stars
  - fill the layer with *pure* black (press D to return to black Foreground and white Background colors)
- **step 2:** select your brush
  - size should be 12-13 pixels
  - hardness must be 0% (very important)
- **step 3:** create large stars
  - leave your Layer Blend Mode to Normal so you cannot see or be influenced by your Small and Medium Stars
    this will help your composition feel more organic and realistic
  - make sure placement/distribution is organic and natural; do not evenly space stars!
    method 1:
    zoom out (Ctrl minus) a couple of times until your document is small enough
    that it makes seeing the stars you create difficult to see
    method 2:
    look away from the artwork so you cannot see where you are clicking
    (check back periodically to make sure you are still on the document)
  - click randomly throughout composition
    warning! do not move the mouse as you click as it will create streaks
    you will need *a lot* of small stars to create a foundation for the background
  - create only (approximately) 25-35 large stars
  - set the Blend Mode to Screen
- **step 4:** perform an audit for errors
  - zoom in close and scroll throughout Large Stars layer to locate any and all streaks
  - use a black Paint brush to paint over all errors
  - approve with instructor

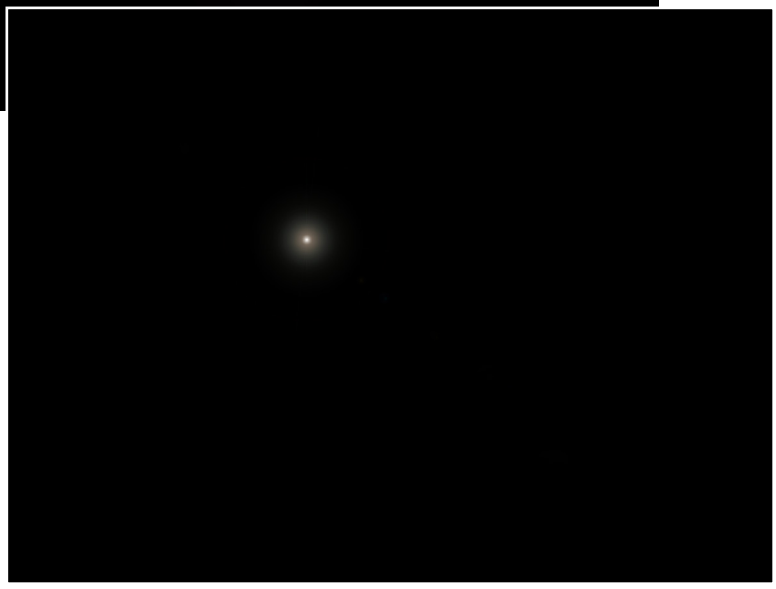




>4: nearby stars

- **step 1:** set up your layer
  - create a new layer and name it Lens Flare 1
  - fill the layer with *pure* black (press D to return to black Foreground and white Background colors)
- **step 2:** create Lens Flare
  - go to Filter: Render: Lens Flare
    select 105mm Prime
    set Brightness to 10
- **step 3:** remove residual lens flare circles to leave only the 'star'
  - select the Burn brush
    set the size to 300-400 and set the hardness to 0%
    you may need to set the mode to Shadows if Midtones doesn't work
  - burn away all residual circles created by the Lens Flare filter
    do not get too close to the star or you will warp the glow (making it asymmetrical)





note: you may also create one or two red nearby stars by selecting 50-300mm OR 35mm; make sure the brightness is only 10

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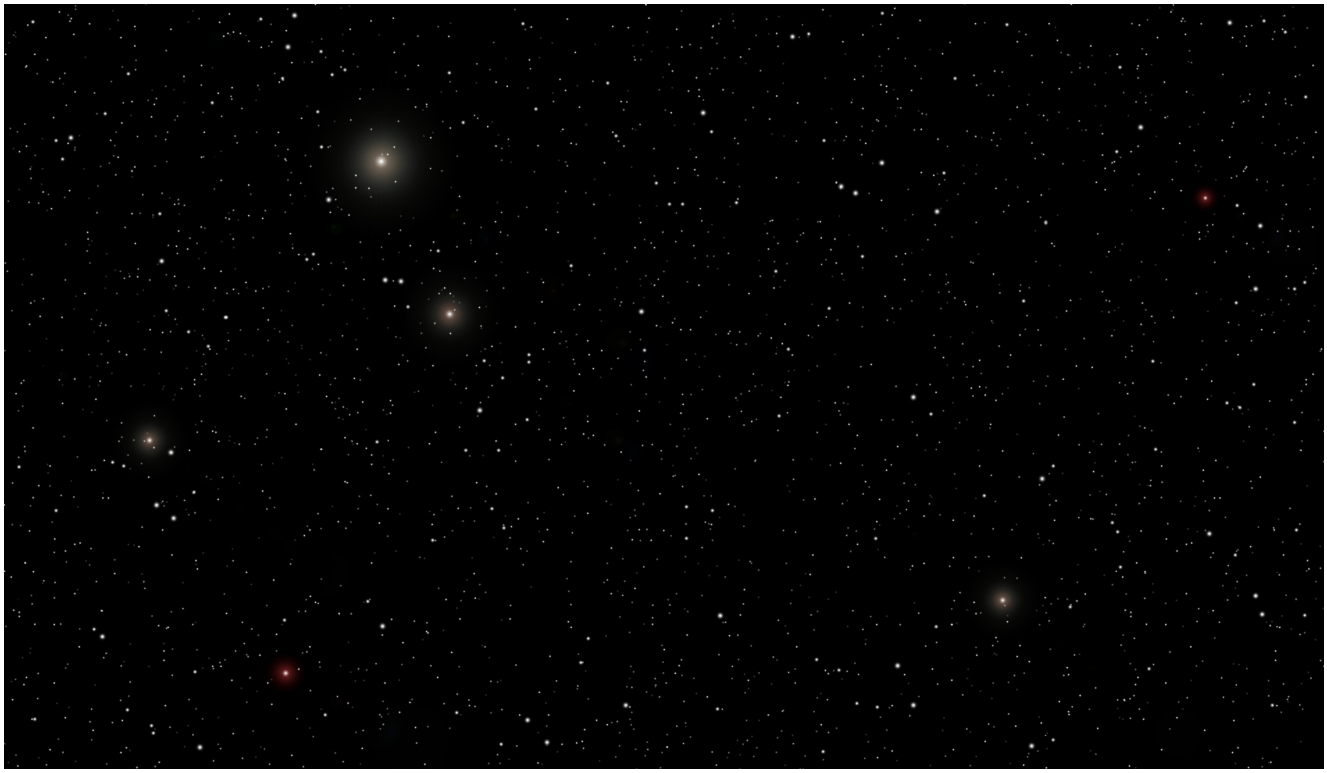
>4: nearby stars (cont.)

- **step 4:** set the Layer Blending Mode to Screen
- **step 5:** use the Move tool to aesthetically place the Lens Flare star
- **step 6:** scale the Lens Flare star
  - even at only Brightness setting 10 the star is too large
  - go to Edit:Transform:Scale and drag from a corner point to resize
- **step 7:** repeat steps 1-5 until you have the desired number (about 3-5 total)
  - each individual Lens Flare should be scaled differently from each other to create a sense of variety and depth
  - red stars tend to be distracting and will probably need to be scaled down more than white stars
  - approve with instructor

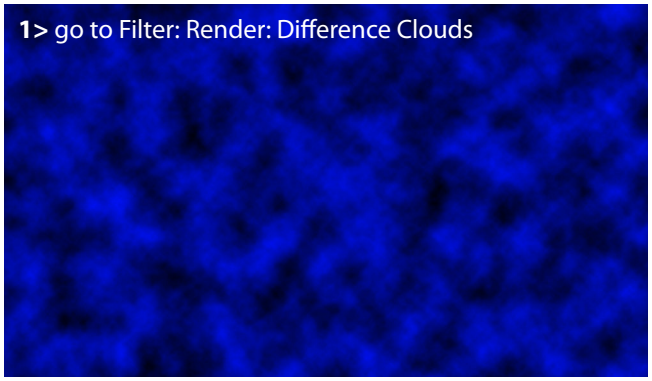


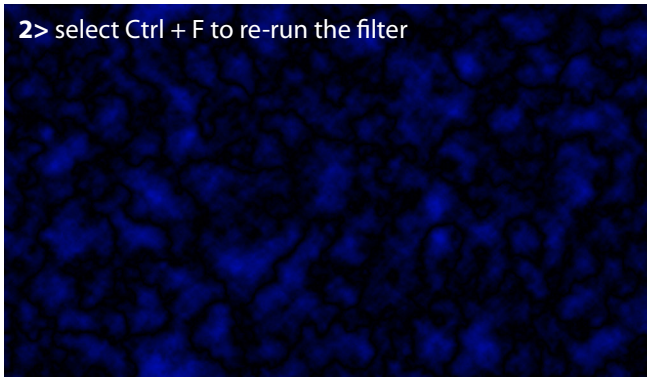
>5: organize starfield layers

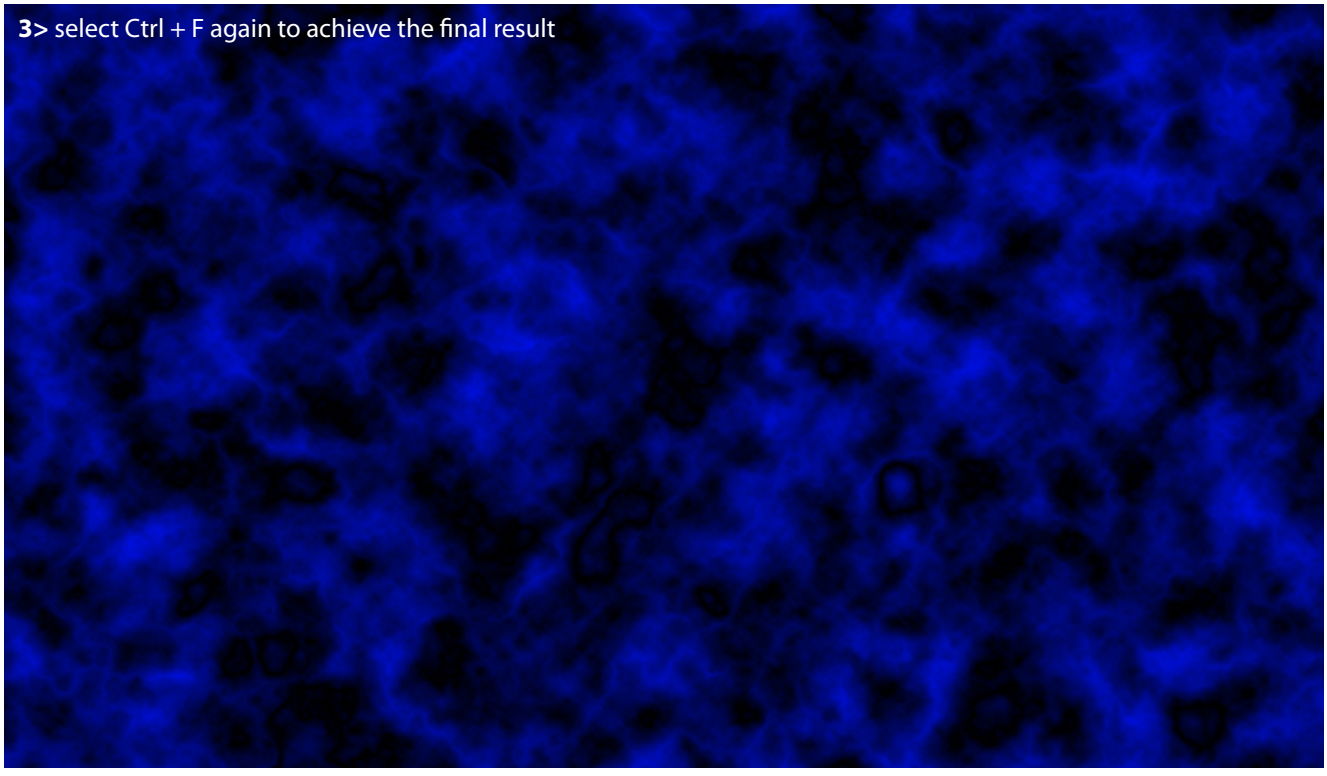
- **step 1:** select all starfield layers
  - click on your bottom most Small Stars layer, then hold down Shift and select your top most Lens Flare
    this will highlight all of your star layers in blue, making them active
- **step 2:** group layers into folder
  - go to the Layer palette pulldown menu (abover Opacity)
  - select New Group from Layers and rename layer group as Starfield
- **step 3:** have Starfield approved by instructor
- **step 4:** recrop document to its dimensions
  - go to Image: Image and verify width and height
  - select Crop tool and crop the full document
    Select W x H x Resolution preset and type in the document dimensions and 300 dpi
    make sure the crop selection box snaps to the eges of the document
    this will delete any portions of layers that extend beyond document bounds (thus saving file size)

>6: nebula

• create nebula color 1
- decide what color you are going to use for your initial nebula layer (red, magenta, blue, violet, etc.)
- create a new layer named for the color nebula cloud you plan to start with
for example: if you are starting with blue name the layer Blue Nebula
- fill the layer with pure black
press D (Default) to return the Foreground and Background colors to black and white respectively
or click on the default black and white small squares above Foreground and Background colors
- set foreground color to desired nebula color
click on the invert colors arrows (above Color Picker) so that foreground is white and background is black
open Color Picker (by selecting Foreground Color) and choose your color
selecting a high intensity color is fine since we will be lowering the opacity later
- run Difference Clouds 3 times
go to Filter: Render: Difference Clouds then press Ctrl + Alt + F two times to achieve desired result







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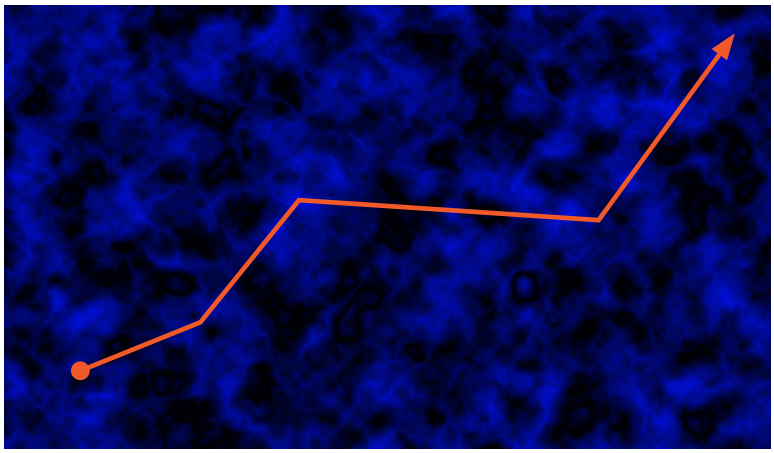
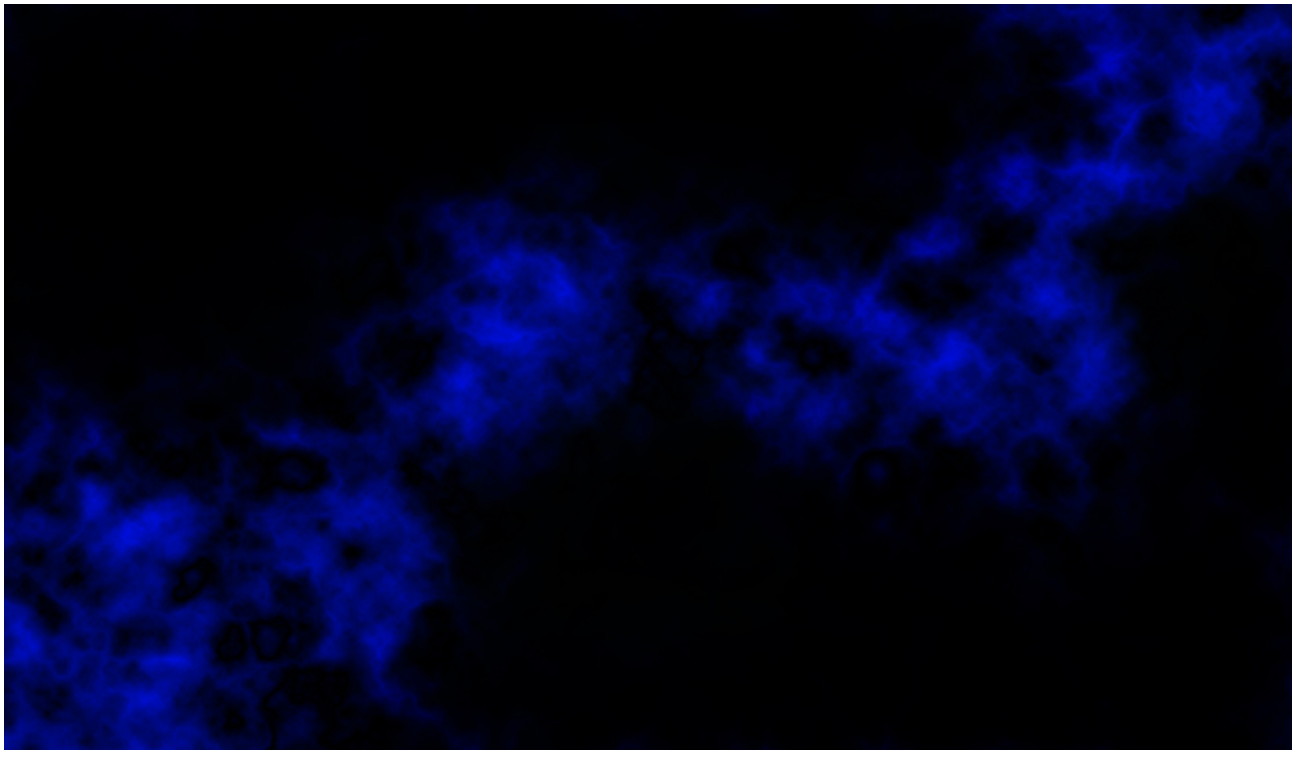
>6: nebula (cont.)

• burn away unwanted areas (do not let nebula cover entire canvas)
- select the Burn tool
size 400-600px
0% Hardness
100% Exposure
- analyze what you want to keep
look closely at your filter result
choose a path that follows a higher density of clouds
be artistic! (do *not* create a straight stripe!)
create a swash of clouds that ebbs and curves naturally and organically
your nebula shape should continuously vary in contour and thickness

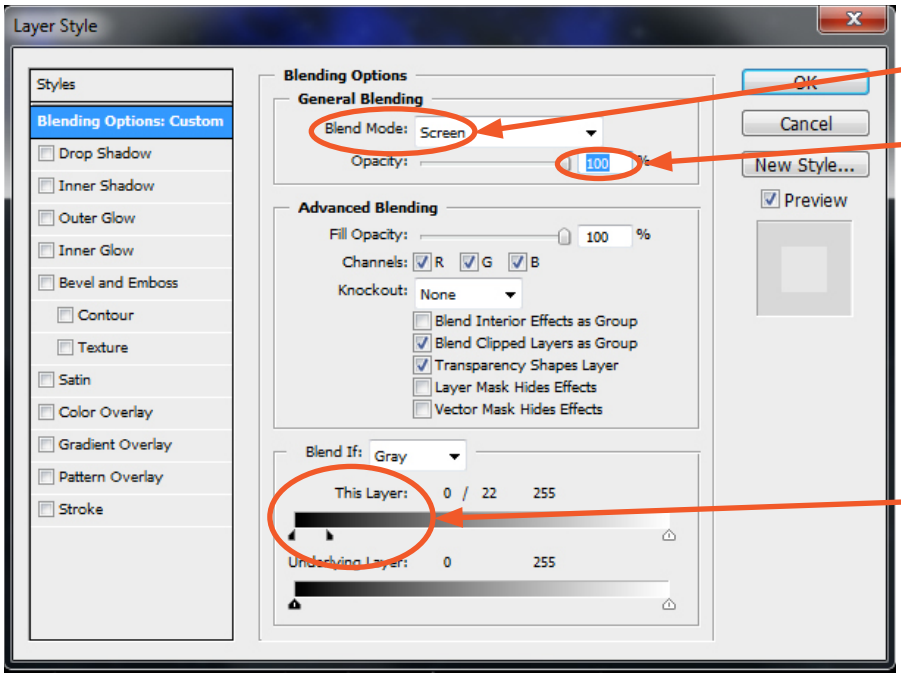


- burn away unwanted areas
- approve with instructor



>6: nebula (cont.)

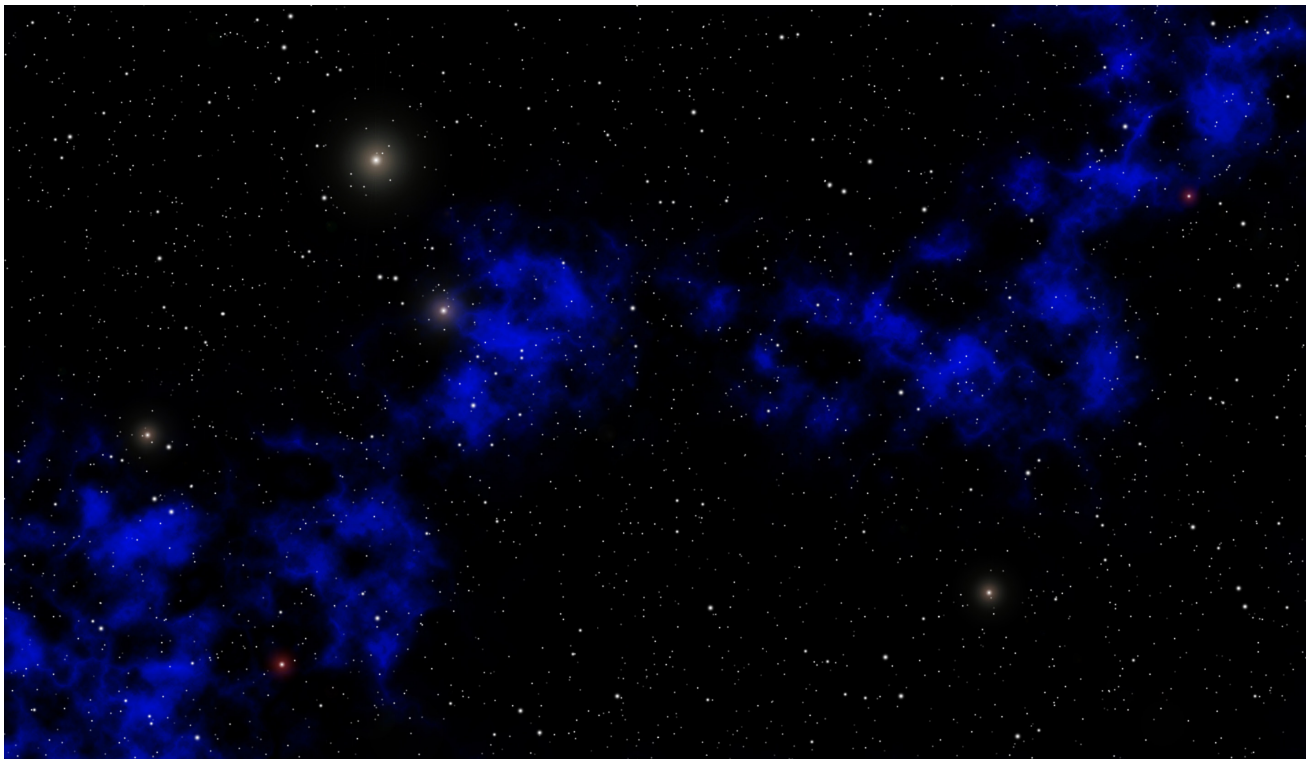
• remove black from layer
- go to Blending Options (double click on layer)
- increase Blend If: This Layer's right bracket to remove black
(Alt+Click on right part of pyramid only) until desired elimination of black is achieved
- set layer Blend Mode to Screen
- approve with instructor



set Blend Mode to Screen

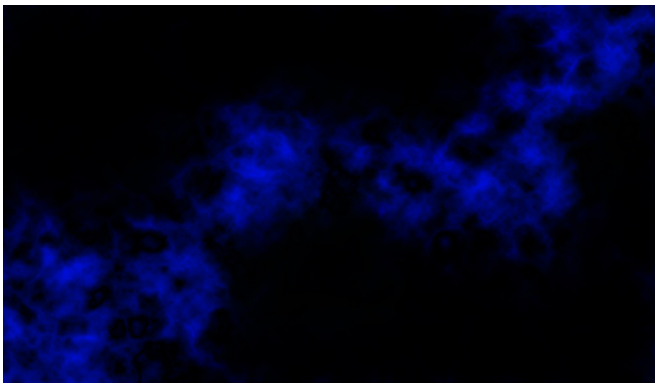
set Opacity to taste

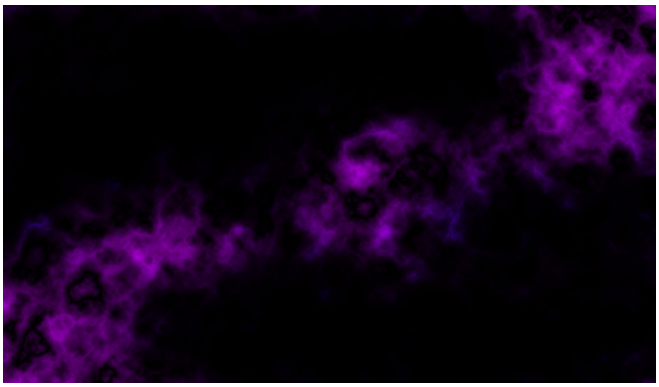
press Alt and click on the right half of the pyramid to split it; adjust the right half (only) to eliminate the blacks



>6: nebula (cont.)

• create second nebula color
- follow steps given previously for your first color
- when burning away unwanted areas you want to have something *similar*, but unique to first nebula layer

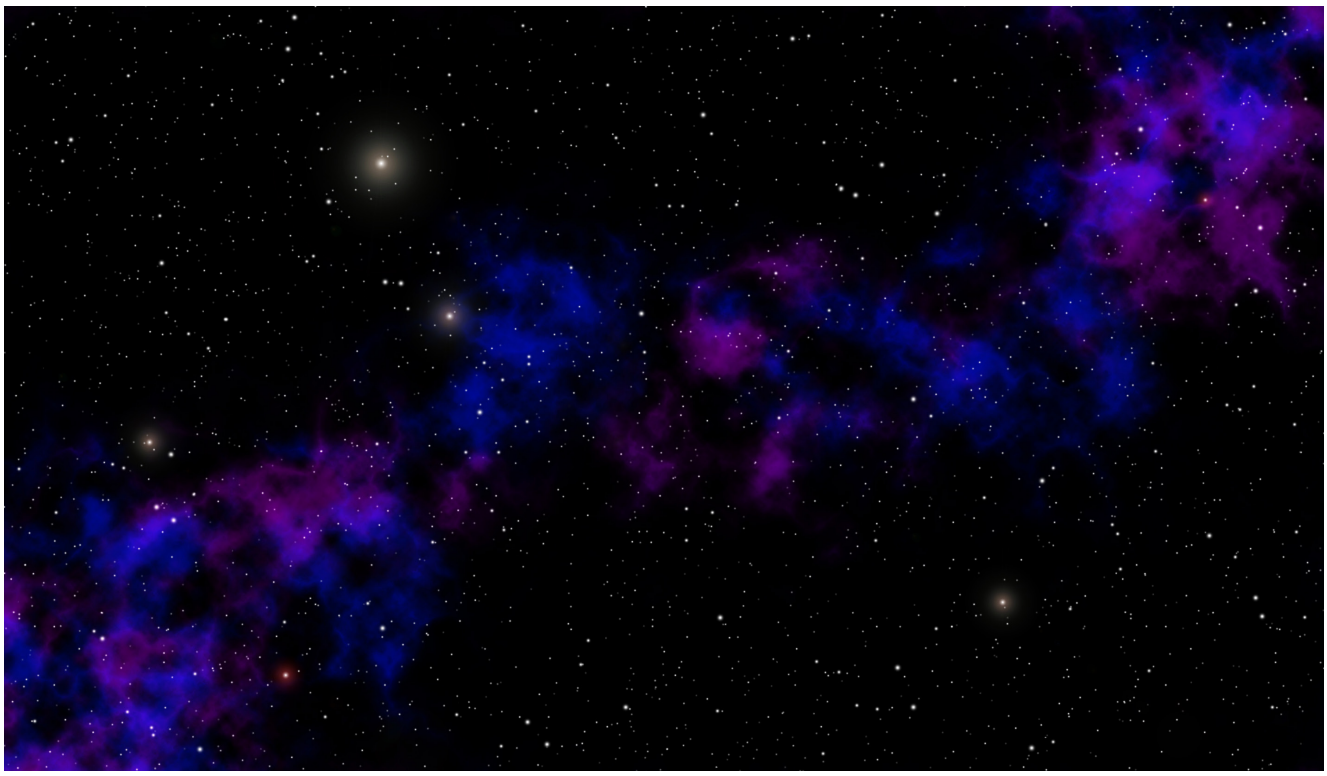




- remove black from layer
go to Blending Options (double click on layer)
increase Blend If: This Layer's right bracket to remove black
(Alt+Click on right part of pyramid only) until desired elimination of black is achieved
- set Layer Blend mode
start with Hue (this mode usually provides the best results)
explore the entire list of modes to see if anything great happens that you prefer instead

• lower the Opacity of the nebula layer(s)
- the nebula is only a middleground visual enhancement and must not compete with your planet and moons

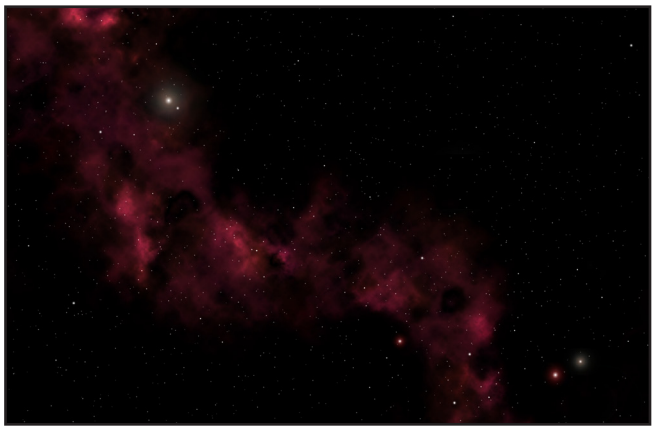
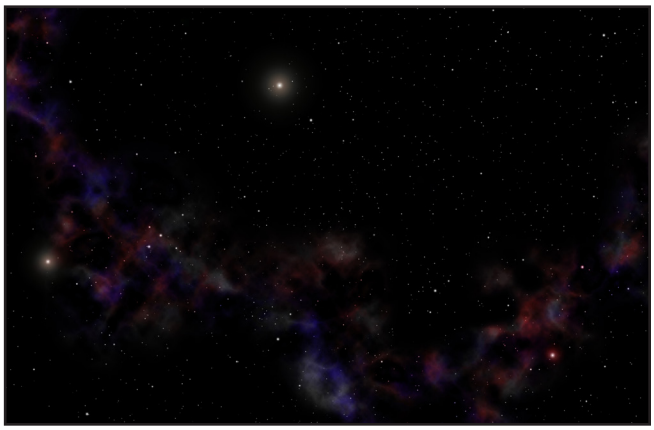
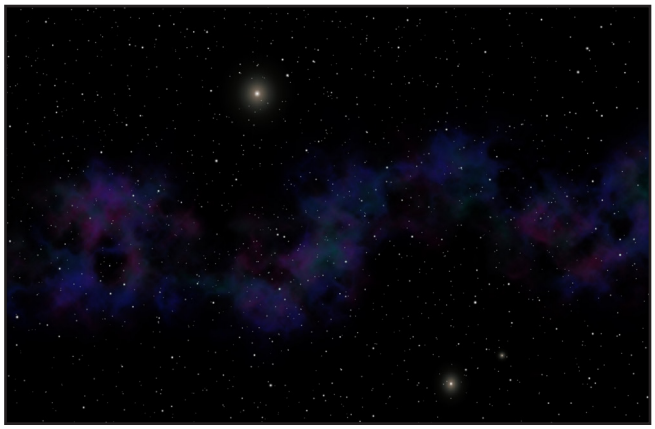
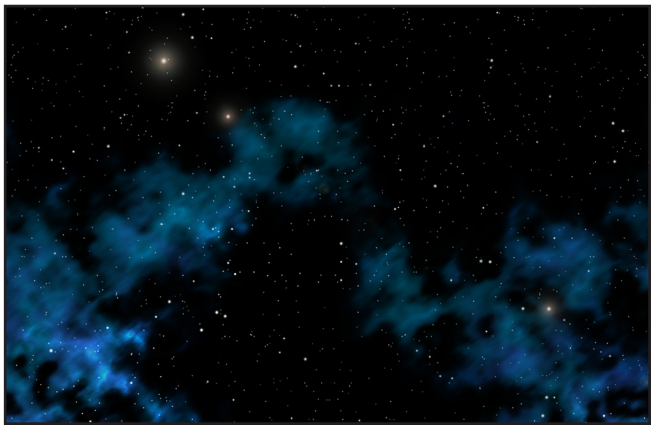
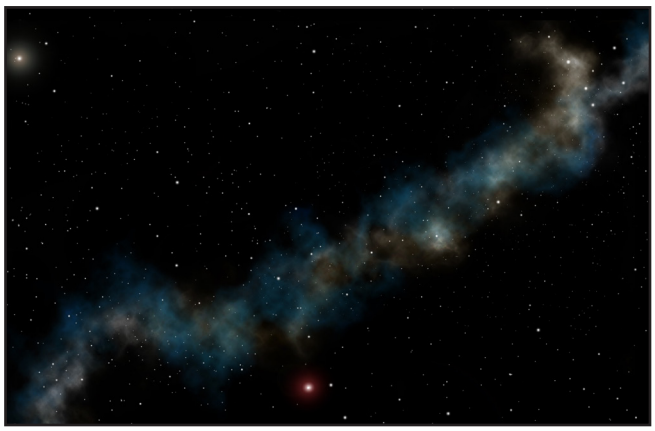
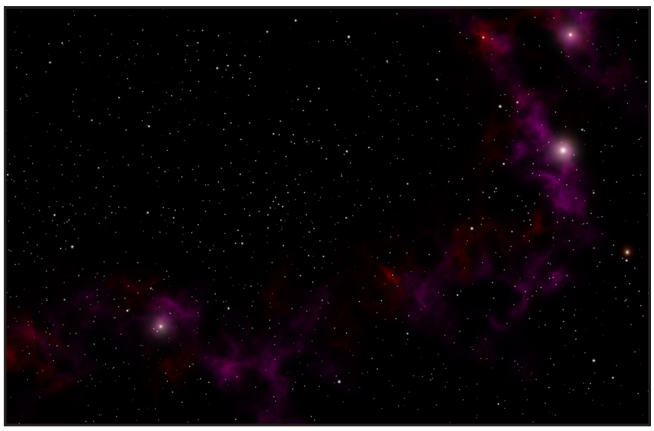
• approve with instructor



>6: nebula (cont.)

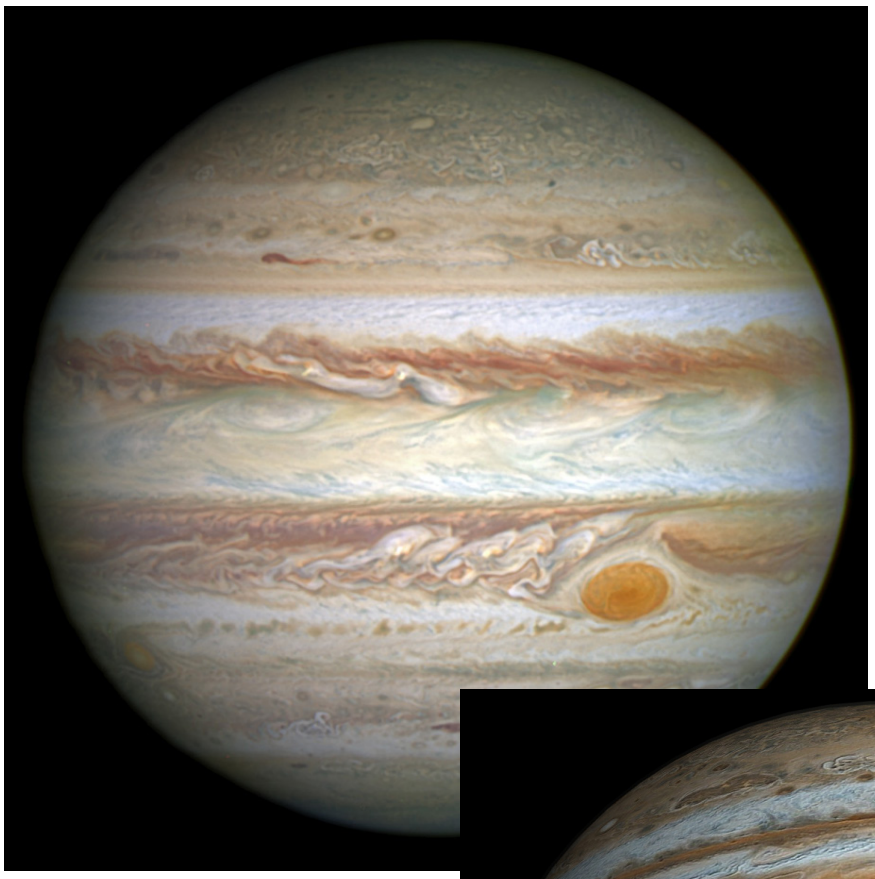
- explore nebula layer combinations
  - try lowering the Opacity of the nebula layers to soften the blending
  - try shuffling nebula layers to see if they interact more effectively in a different order
    make sure the bottom Layer Blend Mode is Screen
  - try experimenting with other Layer Blend Modes for top colors
    remember: bottom color layer must always be set to Screen- (or you won't see stars)
  - if your nebulae are interfering with your lens flares, you may need to move the nebula layers below lens flares
- approve final nebula with instructor

- student examples:

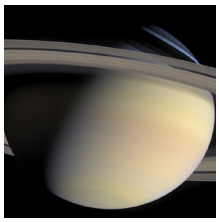







>7a: gas giant

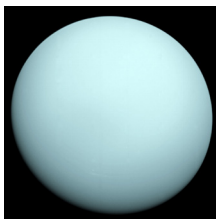
- study images of Jupiter
  - Jupiter is the only gas giant in our solar system with enough visual details to be worth being an exemplar
    Saturn, Uranus and Neptune are essentially just a fuzzy ball of a single color



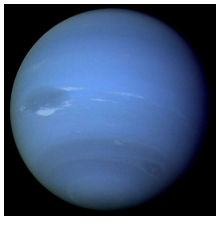
Jupiter is essentially made of analogous colored bands that chaotically interact along their edges, but also within the bands themselves



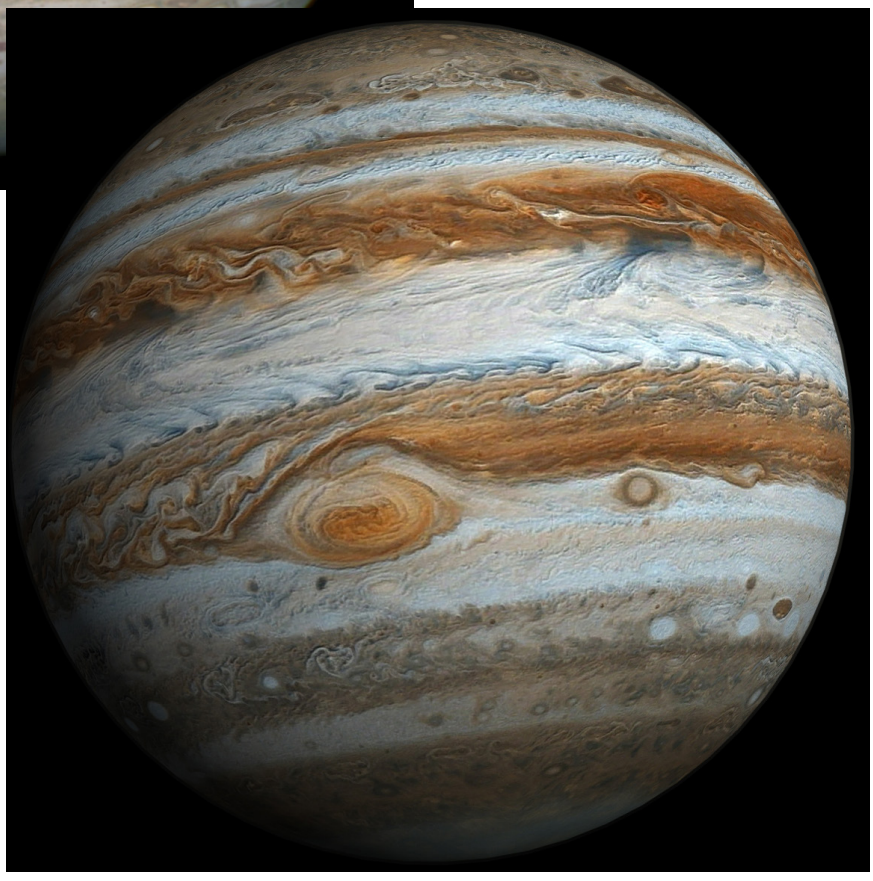
Saturn



Uranus

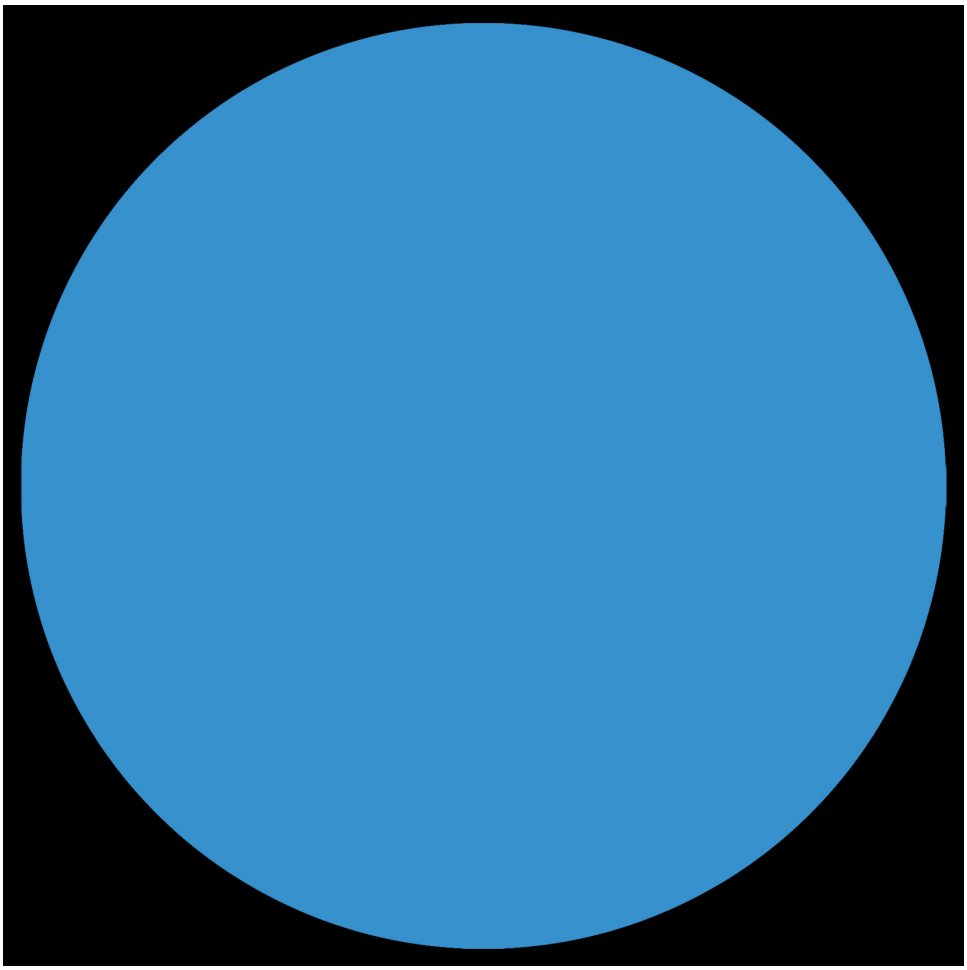


Neptune



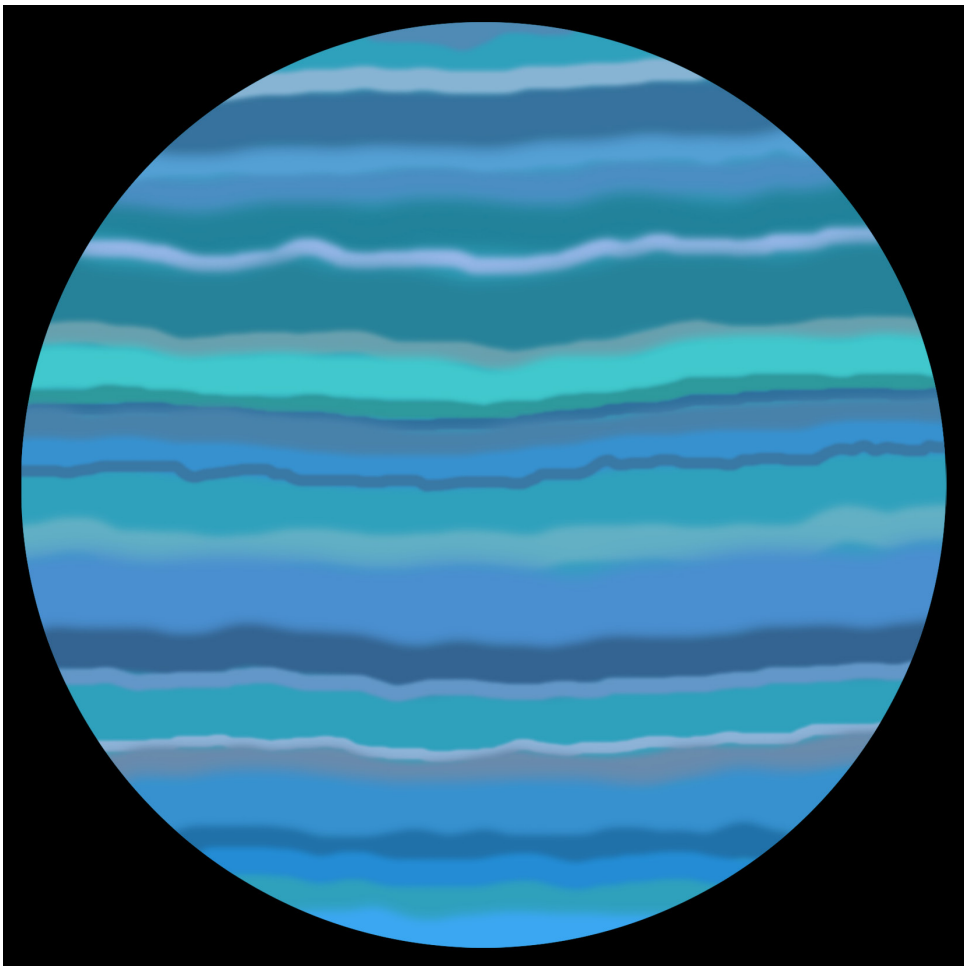
>7a: gas giant (cont.)

- create a new layer and name it Planet Base
- create your planet base
    - make a circular marquee (near the center) as large as it will fit without touching any side
        remember to hold down shift to maintain a perfect circle
        we want this as big as possible to make it easier to create details
    - decide on your base color
        must be a lighter, more desaturated color
            selection will be near the top-middle in the Color Picker
            for example: Jupiter's base color is beige (light yellow-orange)
    - select Paint Bucket from the toolbox and fill marquee
- approve with instructor



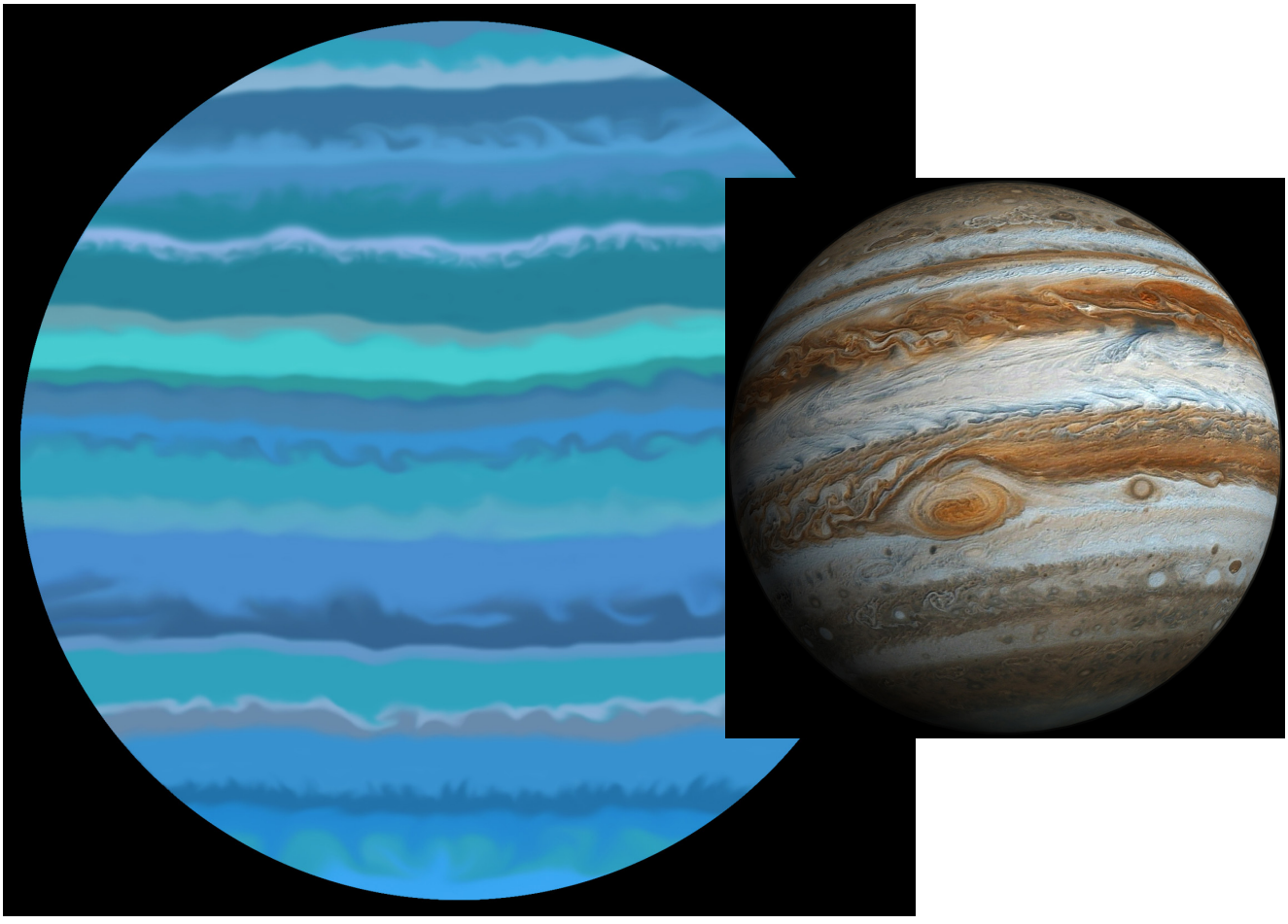
>7a: gas giant (cont.)

- duplicate your Planet Base layer and rename it Bands
  - this will protect your original circle shape for future work or corrections
    go to Layer: Duplicate Layer or select Duplicate Layer from the menu inside the Layer window/palette
  - hide your original Planet Base layer
- create horizontal color bands
  - ***constantly refer to Jupiter images as reference!***
  - use a variety of soft Brushes (0-50% Hardness values)
  - use a *strong* variety of band thickness and value
    you want bands that are **thick** and thin as well as light and dark
    do not create a regular pattern!
    for example: several in a row of the same thickness or alternating thicknesses
    variety! variety! variety!
  - use a strong variety of *subtle* color shifts
    incorporate a limited number of bands that have a slight hue shift from your base
    slightly adjust the slider in Color Picker to move to an analogous color to your base
    do not move more than one color on the color wheel away from your base
    for example: a blue base may also incorporate a few blue-green and blue-violet bands
  - do *not* paint it curved
    we will use the Spherize filter to make it look 3D
- approve with instructor



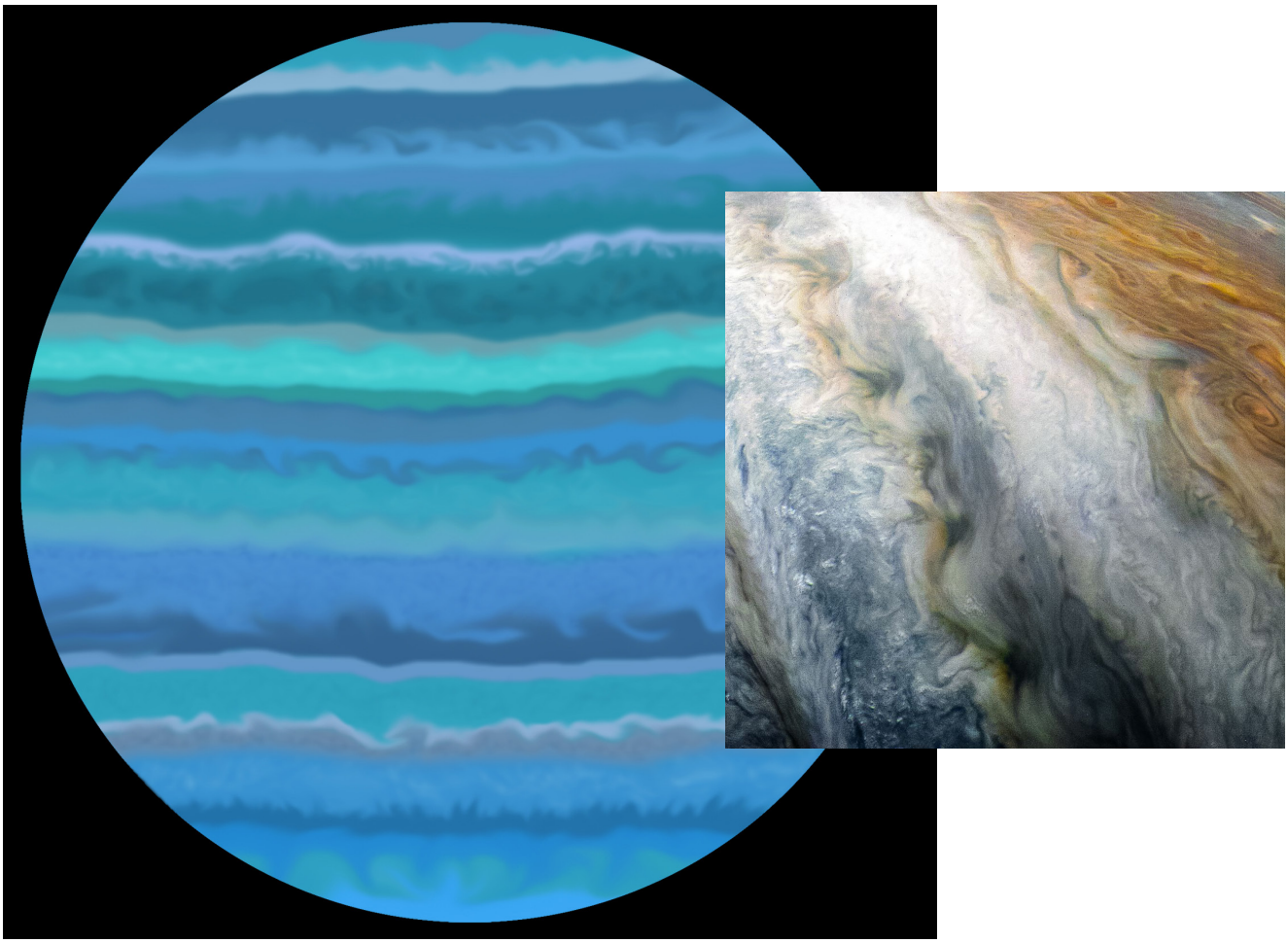
>7a: gas giant (cont.)

- duplicate your Bands layer and rename it Between
  - hide your Bands layer
- create interactions between bands
  - ***constantly refer to Jupiter images as reference!***
    - notice all the various ways bands mix with other bands along their edges
  - use Smudge tool to create a strong variety of interesting edges between color bands
    - some ripple, some swirl, some wave, some just simply fade
      - try to make each interaction between edges of bands different
    - avoid excessively vertical spikes
      - they are distracting and inaccurate
        - the centrifugal force created by rotation flattens bands out
  - be careful around marquis edge!
    - do not accidentally pull in empty pixels from outside of the selection
      - this will create dents in your planet
    - always push towards the Marquee when you get close to the edge
- repair planet edge
  - check the edges of your planet for dents
    - hide previous planet layers to isolate Between layer result
  - to correct errors...
    - Ctrl + click on the Planet Base layer thubmnail to recreate the perfectly circular marquee
    - use Smudge to push pant back to the edge of the marquee
- approve with instructor



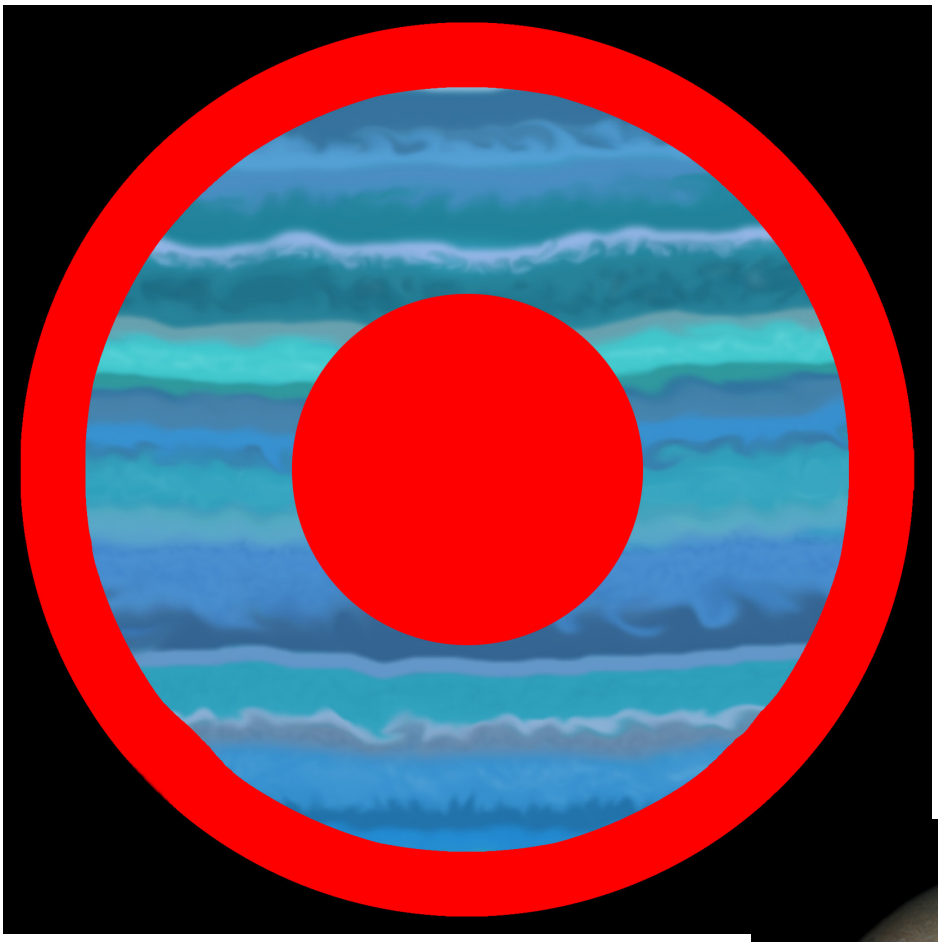
>7a: gas giant (cont.)

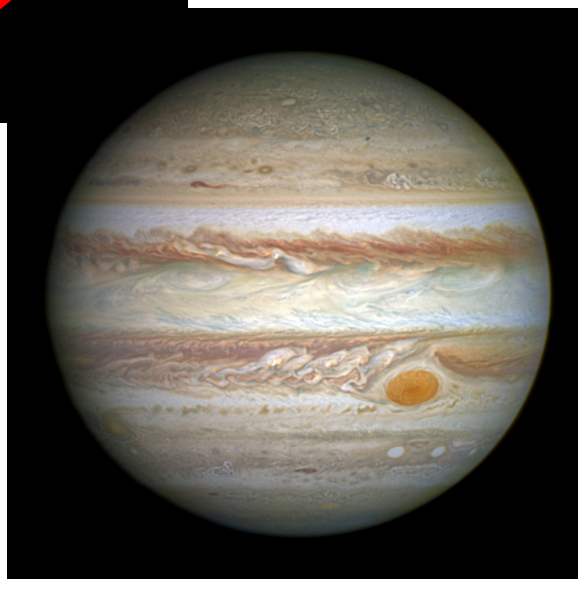
- duplicate your Between layer and rename it Within
  - hide your Between layer
- create interactions within bands
  - ***constantly refer to Jupiter images as reference!***
    notice all the various details within the bands themselves
  - use Burn and Dodge brushes along with Smudge to create a wide variety of subtle variations within color bands
    use a small brush set to 0% Hardness
    set Exposure for Burn and Dodge to a low value (start at approximately 10%-15%)
    use Smudge and/or Blur brushes to mix and blend the brushwork in interesting and different ways
    create low contrast variations! (high contrast variations will be distracting)
- repair planet edge
  - check the edges of your planet for dents
    hide previous planet layers to isolate Between layer result
  - to correct errors...
    Ctrl + click on the Planet Base layer thubmnail to recreate the perfectly circular marquee
    use Smudge to push pant back to the edge of the marquee
- approve with instructor



>7a: gas giant (cont.)

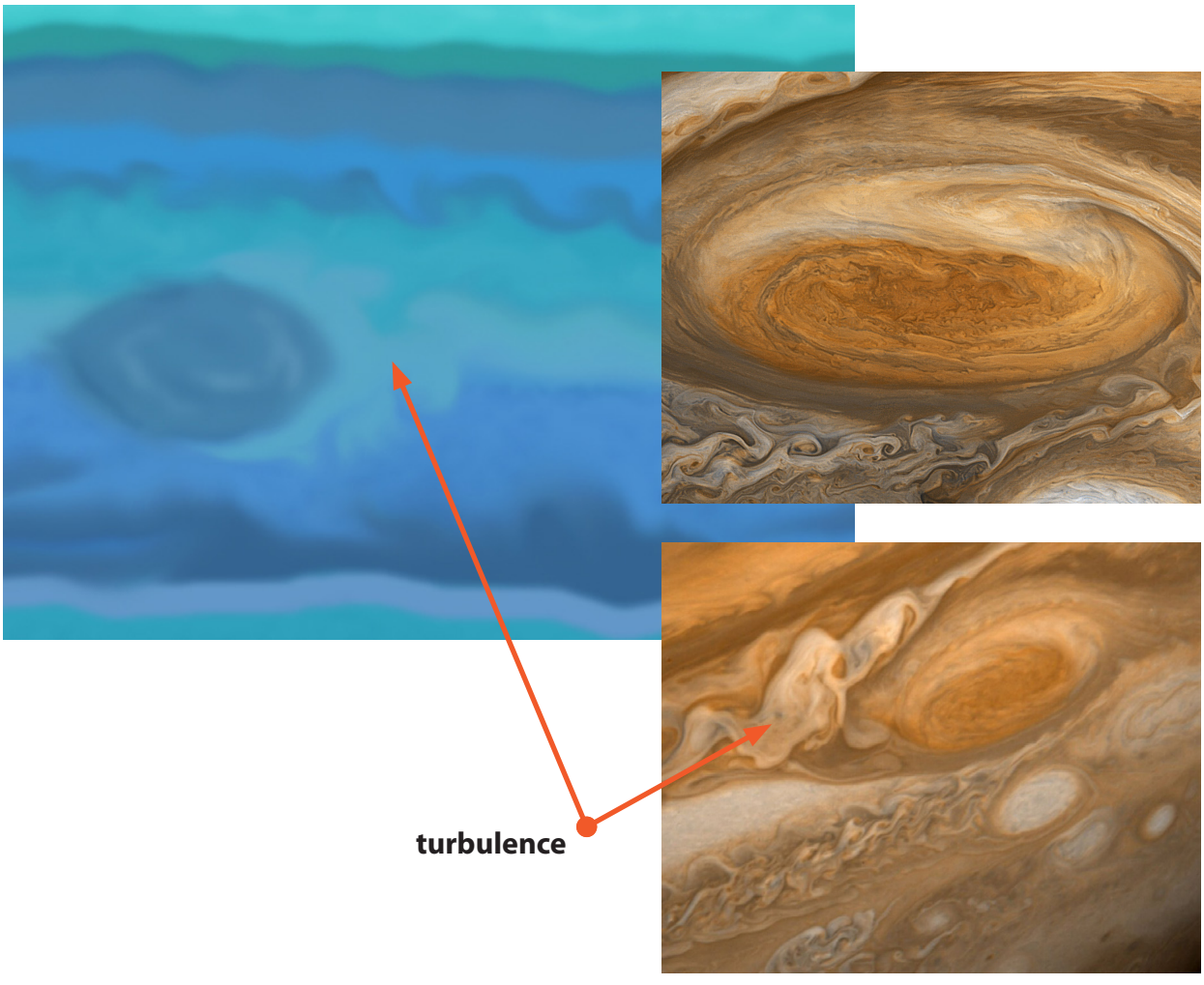
- determine location of your giant storm
  - refer to target image below
    - do not place giant spot in red areas
      - too close to the middle will over-stretch it when you Spherize
      - too close to the edge and it will vanish when you Spherize
        - Spherize works by stretching pixels in the middle and compressing them along the edge
    - place your giant storm between two bands
      - this will make it much easier to create turbulence in the next step





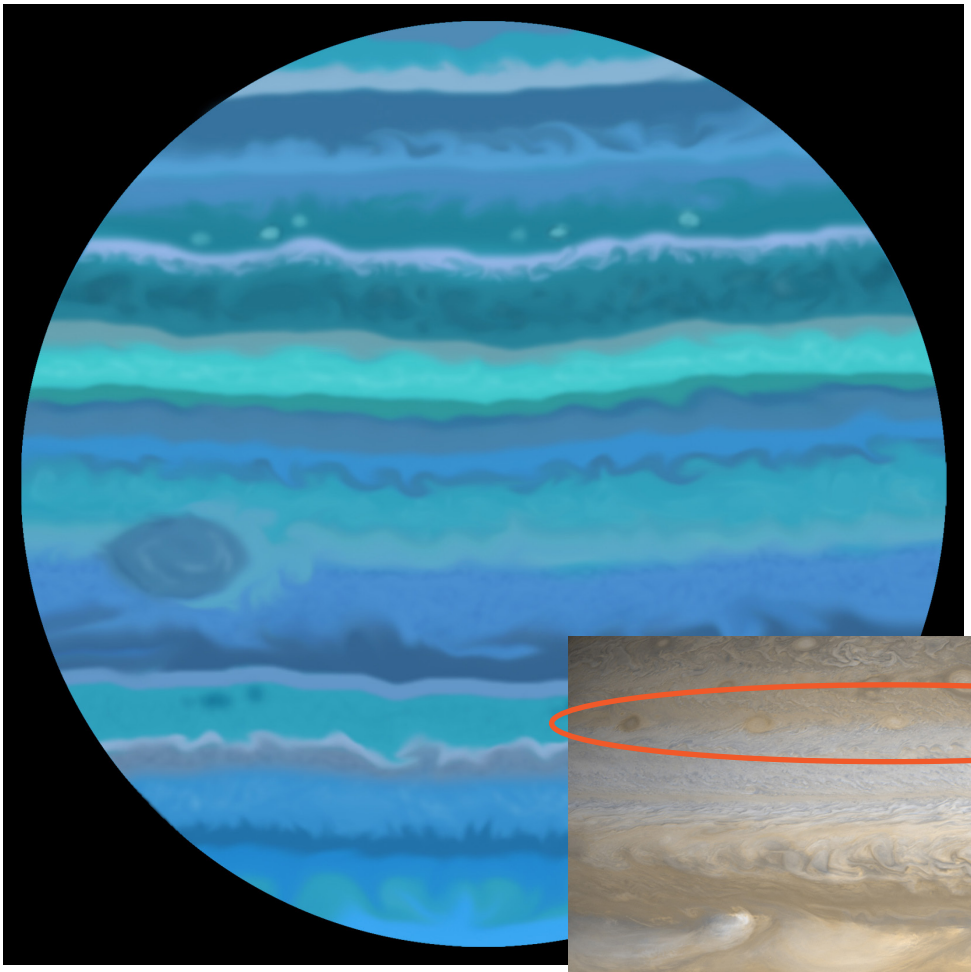
>7a: gas giant (cont.)

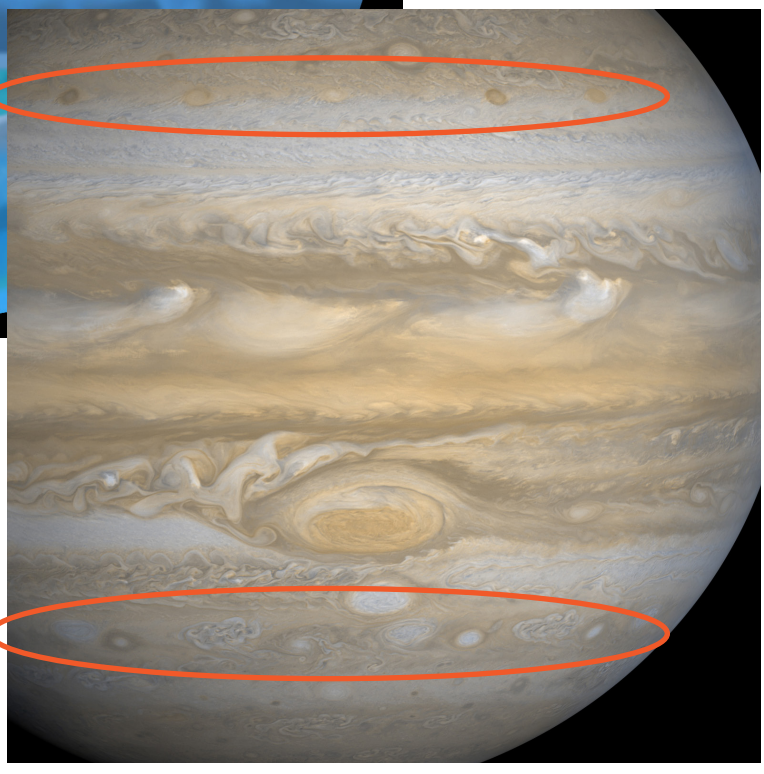
- duplicate your Within layer and rename it Giant Storm
  - -hide your Within layer
- create giant storm
  - - ***constantly refer to images of Jupiter's Great Red Spot as reference!***
  - - use a large, soft Brush to create a horizontal oval
    - do not make your spot too round as centrifugal force from rotation flattens things out
    - remember to place your storm between two bands to make creating turbulence later easier
  - - use Burn and Dodge brushes on low Exposure to create lines with slight variations in values
    - lines should follow the contour of the storm oval
  - - use Smudge to create interesting swirls inside the storm (you may also need to Blur it)
  - - approve giant storm with instructor
- duplicate your Giant Storm layer and rename it Turbulence
  - - hide your Giant Storm layer
- create storm turbulence
  - - refer to images of Jupiter's Giant Red Spot
    - think of your storm like a boat going through water
    - water pushes around the front of the boat is disrupted behind
  - - use Smudge to start to wrap the band around the front of the storm
  - - use Smudge to create turbulence behind the storm
  - - approve turbulence with instructor



>7a: gas giant (cont.)

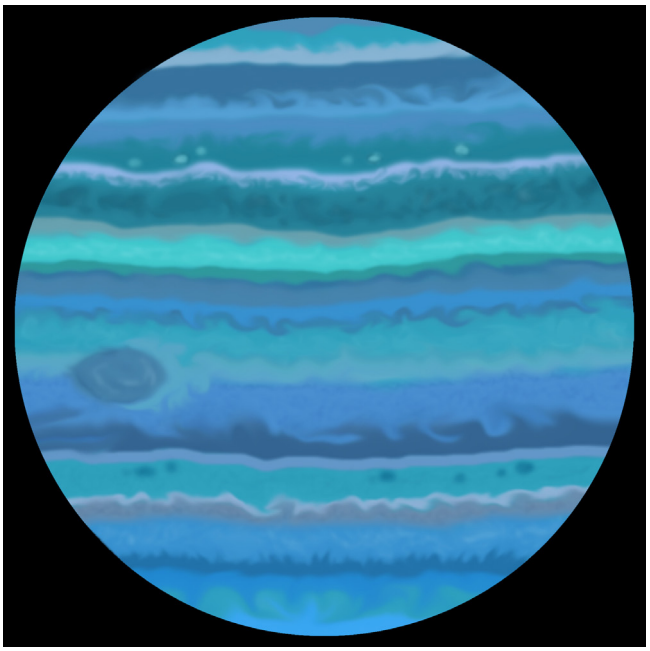
- duplicate your Turbulence layer and rename it Small Storms
  - hide your Turbulence layer
- create small storms
  - ***constantly refer to Jupiter images as reference!***
    use Burn and Dodge brushes (set to a low exposure) to create small storms within bands
  - avoid too high of a contrast or it may become distracting
    for example: do not create white spots in a very dark band
  - small storms have a tendency to appear in rows but not evenly spaced (check Jupiter images)

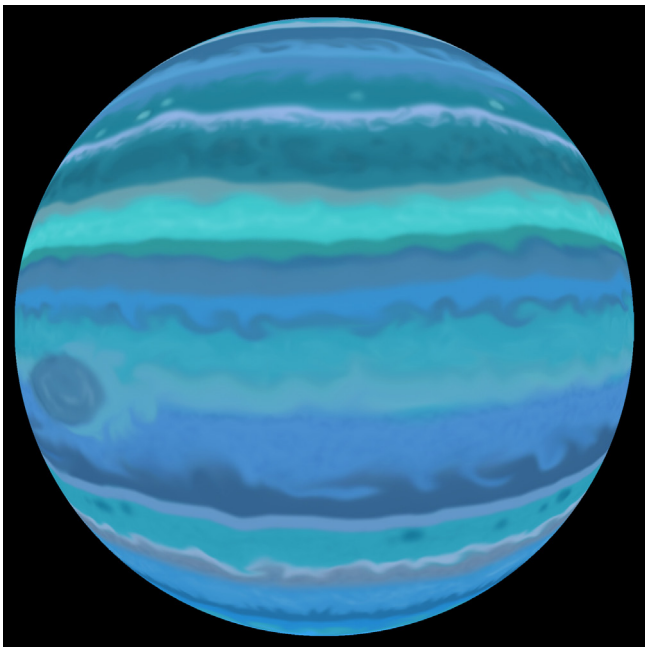




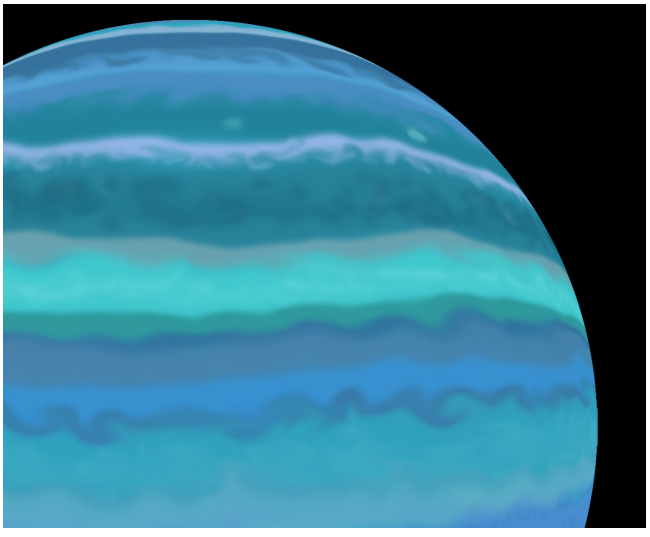
>7a: gas giant (cont.)

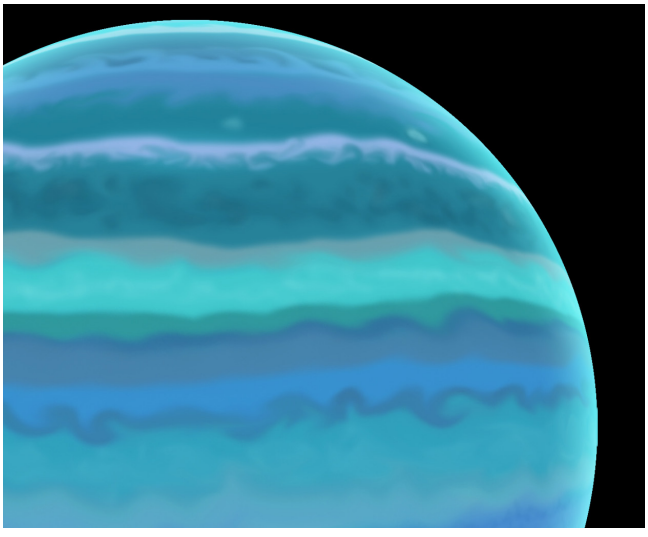
- duplicate Small Storms layer and rename it Spherize
  - hide your Small Storms
- create a marquee around your planet
  - Ctrl + click on your Planet Base layer thumbnail
- spherize your planet
  - go to Filter: Distort: Spherize
  - set to 100% and press Okay





- create inner glow
  - go to Layer: Layer Style and select Inner Glow
  - select your Inner Glow color
    - click on the color box to open the Color Picker
    - use the Eyedropper to select the color of one of your lighter bands of gas
  - change the Size of your Inner Glow between 50-100
  - adjust Opacity to taste



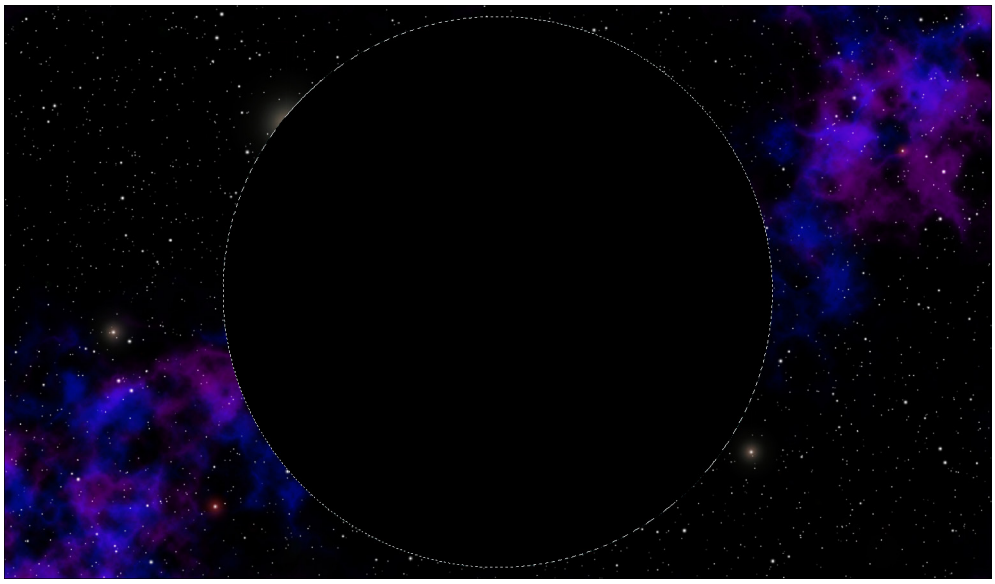


>8: shadow

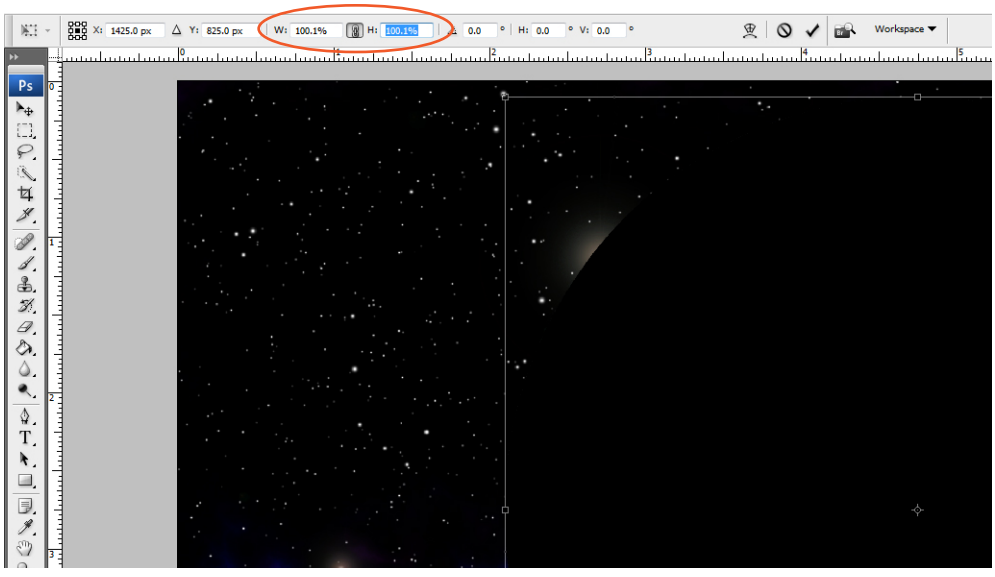
• organize layers
once your planet is finalized and approved by instructor, delete all planet layers except Planet Base and Spherize
• detemine the type of shadow you want
- orange circles indicate appropriate choices
- a gibbous planet has a shadow that is less than half
this allows you to show more of your planet artwork
- a crescent planet has a shadow that is more than half
if you choose this you may only be slightly more than
- no half planets
a shadow covering exactly half of the planet will be visually boring
- your giant storm must be showing (shadow will go on opposite side)

>8: shadow (cont.)

- create a new layer and name it Shadow
- create Marquis of planet shape by pressing Ctrl and clicking on the Planet Base layer thumbnail
- fill the Marquis selection Black (in the Shadow layer)

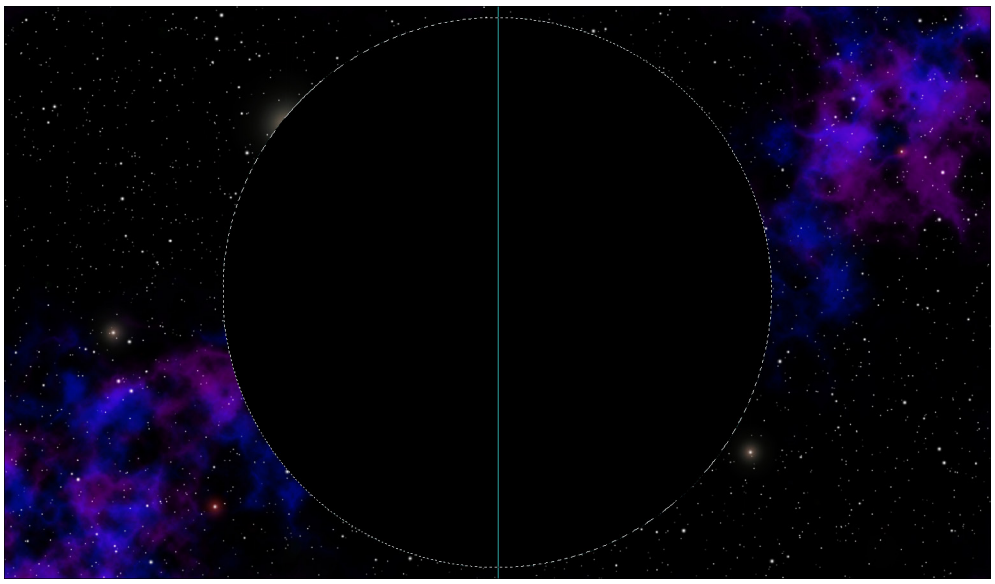


- check the shadow edge for errors
  - you may see a slight edge of your planet still showing around your shadow
  - zoom in to actual pixels
    Ctrl + Alt + 0 or pressing Ctrl + plus until bottom left zoom number is 100%
  - if any of your planet edge is still visible, you need to make a correction (see next step)
- correct any shadow error
  - deselect any marquee by pressing Ctrl + D
  - open Free Transform by pressing Ctrl + T
  - in the Control bar at the top change both the width and the height to 100.1% then hit Enter to apply
  - check edge again to see if the problem is rectified
    zoom in to actual pixels (Ctrl + Alt + 0 or pressing Ctrl + plus until bottom left zoom number is 100%)
    if problem remains, repeat previous step at 100.1% until planet is covered

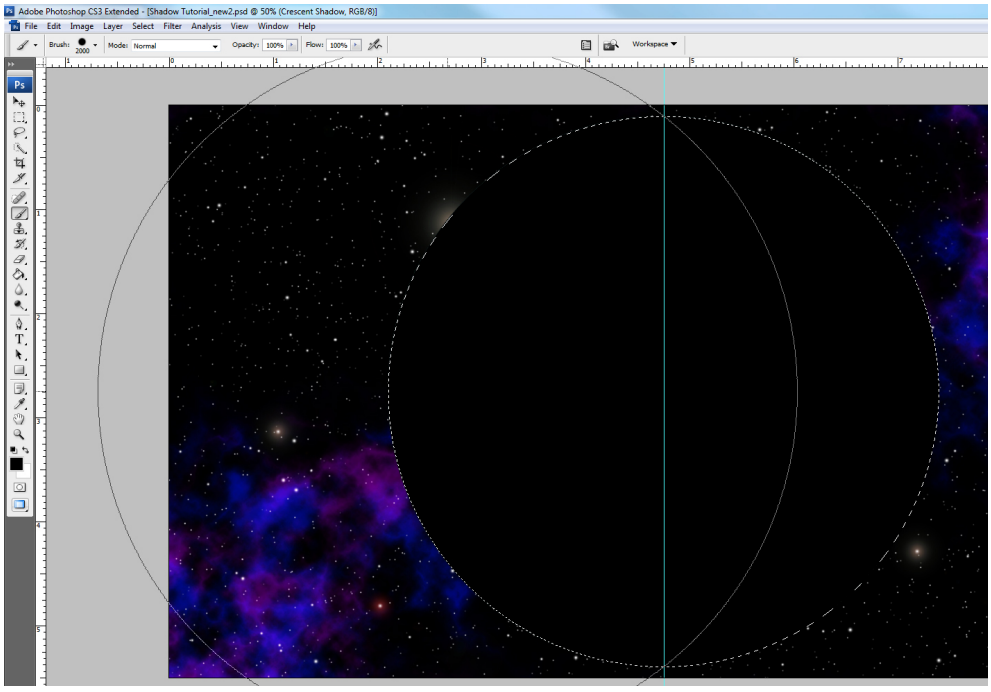


>8: shadow (cont.)

• place a vertical guide over the center of the planet
  - go to View: Rulers (Ctrl + R)
  - move mouse into left ruler, click, hold down and drag a ruler until it 'snaps' to the center of the circle

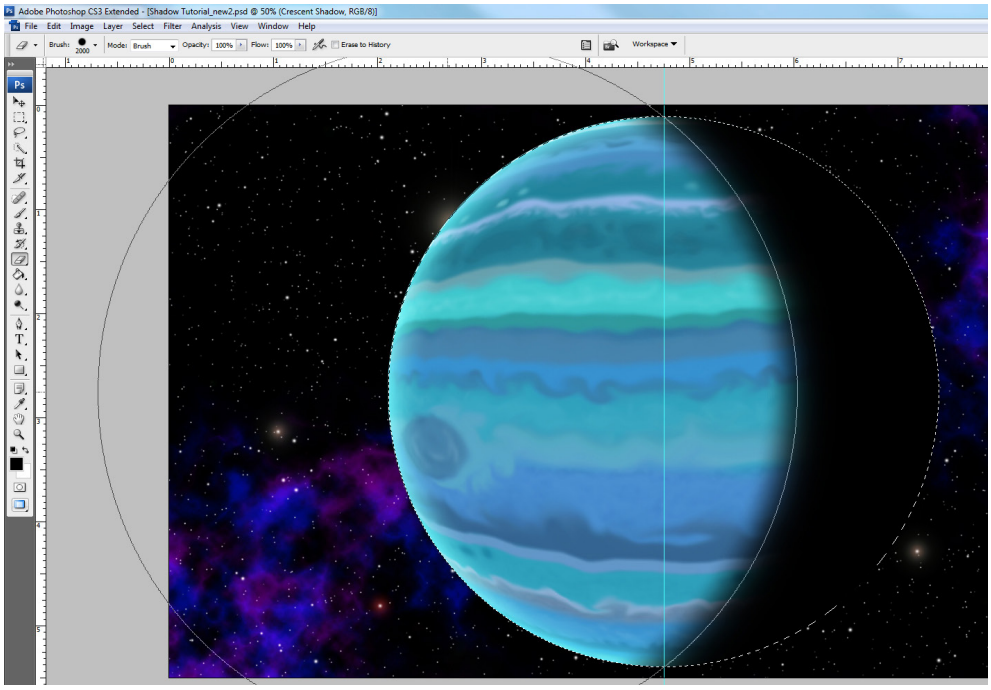


• set up your Eraser brush
  - select a Brush that is larger than the planet to create the proper curve
    the bigger shadow you want the bigger brush you will need
    set hardness to 75%-80% to create feathered edge between light and dark (known as the terminator)
• erase the part of the planet you want visible
  - overlap Brush so it intersects with the north and south poles created by your ruler guide and click mouse
    remember- the shadow will be on the opposite side of your giant storm

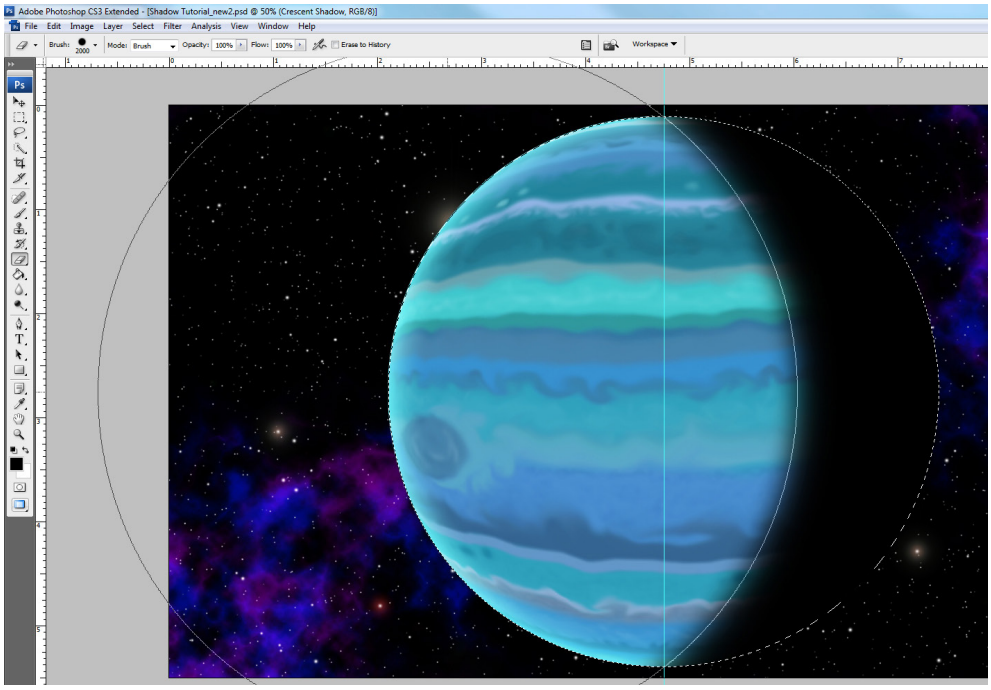


>8: shadow (cont.)

- click to erase the part of the shadow you don't want
  be very careful not to move the mouse

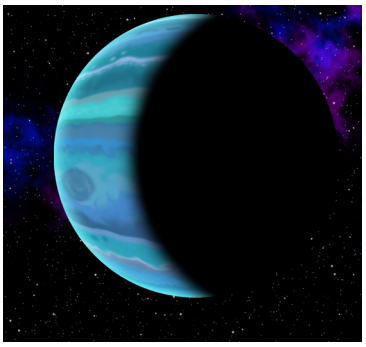
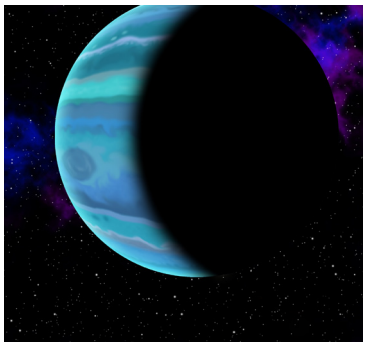
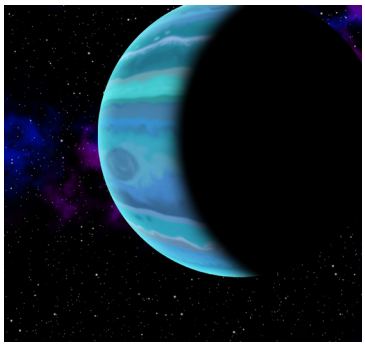


- you may need to click a second time to get the terminator to line up better with the poles
  be careful not to move the mouse

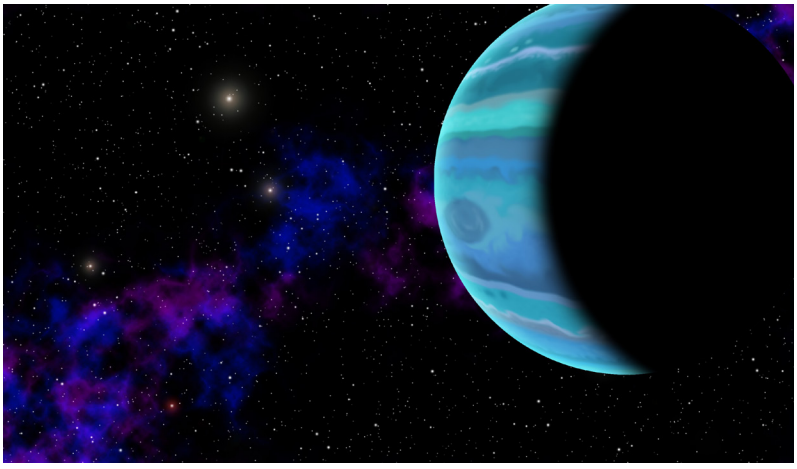


>9: scale and locate planet

• approve your final Spherize planet layer with instructor
  - delete all previous planet layers ***except Planet Base*** (you need this as a template for your moons!)
• duplicate Spherize and Shadow layers
  - select both layers then go to Layer: Duplicate Layer or select Duplicate Layer from the menu inside the Layer window
• merge and rename duplicated layers
  - select both Spherize copy and Shadow copy layers
  - go to Layer: Merger Layers or select Merge Layers from the menu inside the Layer window/palette
  - rename as Planet and Shadow
• decide where you want place your planet
  - review *Final Composition* on page 30 as well as artwork in the Spacescape Projects folder for examples)
  - hide Planet and Shadow layer (so all you see is Starfield and Nebula)
  - remember! this is the centerpiece of your composition
    you need the planet LARGE but create enough room for your moons
  - you have three options in terms of placement
    1. let it float completely within the frame but definitely off-center
    2. let it bleed off one edge of the frame
    3. let it bleed off two edges of the frame

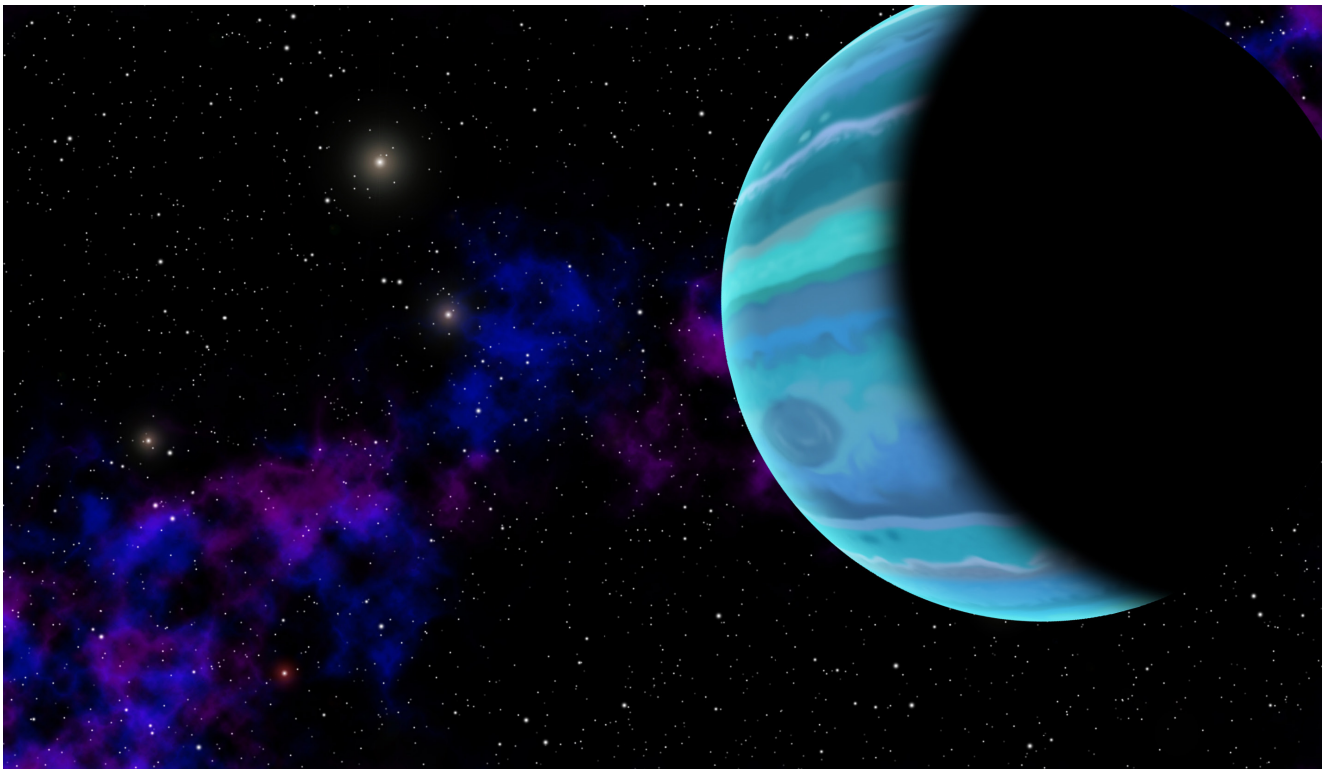




  - do not keep it in the center!
  - do not worry about covering your lens flare stars (relocate them later if you wish)
• scale and locate planet
  IMPORTANT!- deselect any Marquee
    having a Marquee on while you scale down will leave a ghost ring behind
  - go to Edit: Transform: Scale or press Ctrl + T to open Free Transform
    hold down Shift while you pull from a corner to alter to desired size
  - select the Move tool and locate your planet



>10: rotate planet

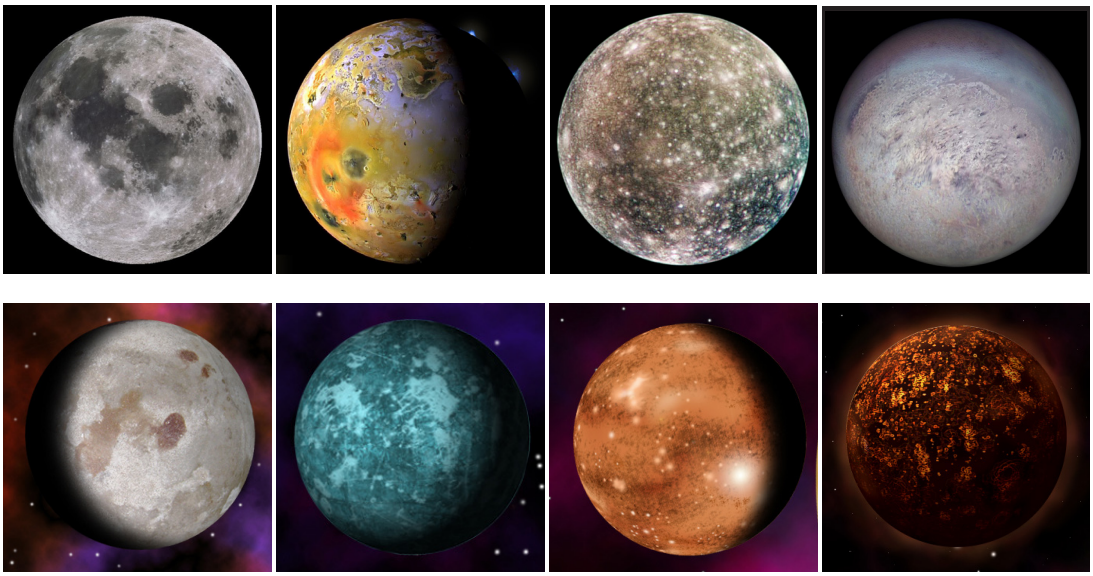
- rotate planet
  - go to Edit: Transform: Rotate or press Ctrl + T to open Free Transform
  - in the Options bar at the top, enter an angle amount
    positive numbers rotate clockwise, negative numbers rotate counterclockwise
    make sure you remember this amount for we'll be using the same for your moons!



>11: moon tutorial

• study images of moons (actual and artist renditions)
- go to the Images Resources folder and select Moons to see actual images of moons in our solar system
there are a myriad of colors and surface textures
- go to the Spacescape Projects folder to see artist renditions of moons

• actual examples of moons with student-created moons underneath

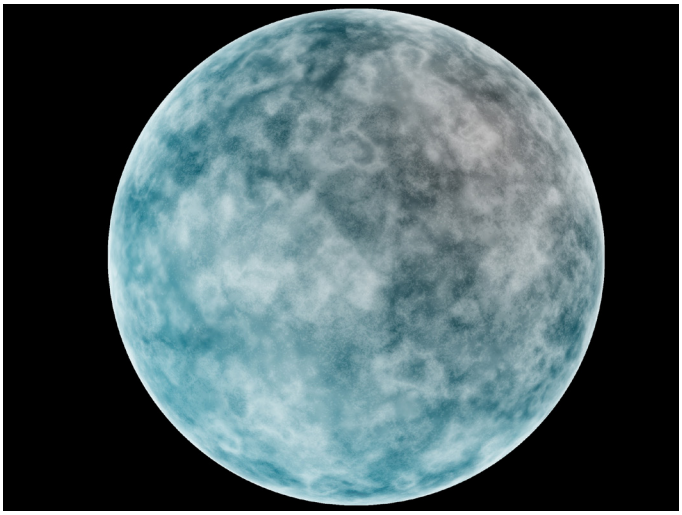


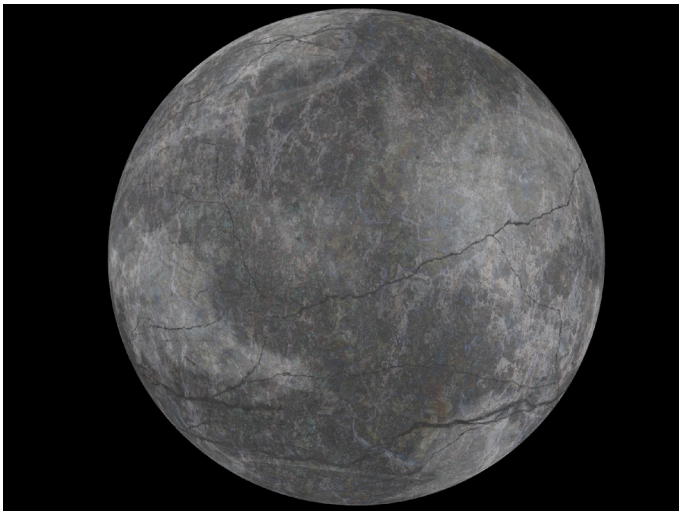
• review moons requirements and tips
- gas giants must have a minimum of two; earth-like planets must have a minimum of one
- each moon should have a distinctly different surface quality/texture from each other
use a completely unique design approach/brush set for each moon
this does not include color
(for example: all of your moons can be gray as long as each has a different construction)
- important: remember that your planet is the center of interest so do not overpower it
keep color palette monchromatic or analogous
avoid high contrast in color temperature and value
for example: red and blue is distracting; red and red-orange is okay
use various brushes (or even effects) to create your surface
experiment with texture brushes like grunge, splatters, clouds, cracks, etc.
constantly change brushes/sizes so you do not create any noticeable patterns
use several different brushes in combination
do not be afraid to work in multiple layers and experiment with Layer Blending Modes
just remember to Merge Layers when you are finished
the most successful and realistic moons have used many different and subtle texture blends
• create your first moon (Moon 1)
- create moon marquee
go to original Planet layer (you must unhide it) and Ctrl + click to create your Marquee
re-hide your original Planet layer then create a new layer and name it Moon 1
- be creative!- we have an extremely wide array of moon surfaces in our own solar system
browse the Image Resources and Spacescape Projects folders for great examples of different types
see the gallery below for cool images of real and student created moons
the possibilities are endless but make sure we are still being realistic

> moon tutorial

create your first moon's shadow
- use your original planet's shadow (you already have an approved shadow- just use it again!)
  - unhide your planet's Shadow layer then go to the pull down menu and select Duplicate Layer
  - rename layer as Moon 1 Shadow and move it above your Moon 1 layer
- duplicate and merge your Moon1 and Moon 1 Shadow layers (just like you did with Planet and Shadow)
  - rename it Moon 1 and Shadow
- rotate Moon 1 and Shadow the exact same angle you did your Planet and Shadow
- scale and locate Moon 1 and Shadow
  - ***IMPORTANT!***- deselect and marquee before scaling (Ctrl + D)
  - moon must be significantly smaller than Planet (no bigger than 1/4 size of planet)
    - refer to Spacescape Projects folder for references
  - a moon can overlap the planet, but the planet must not overlap a moon

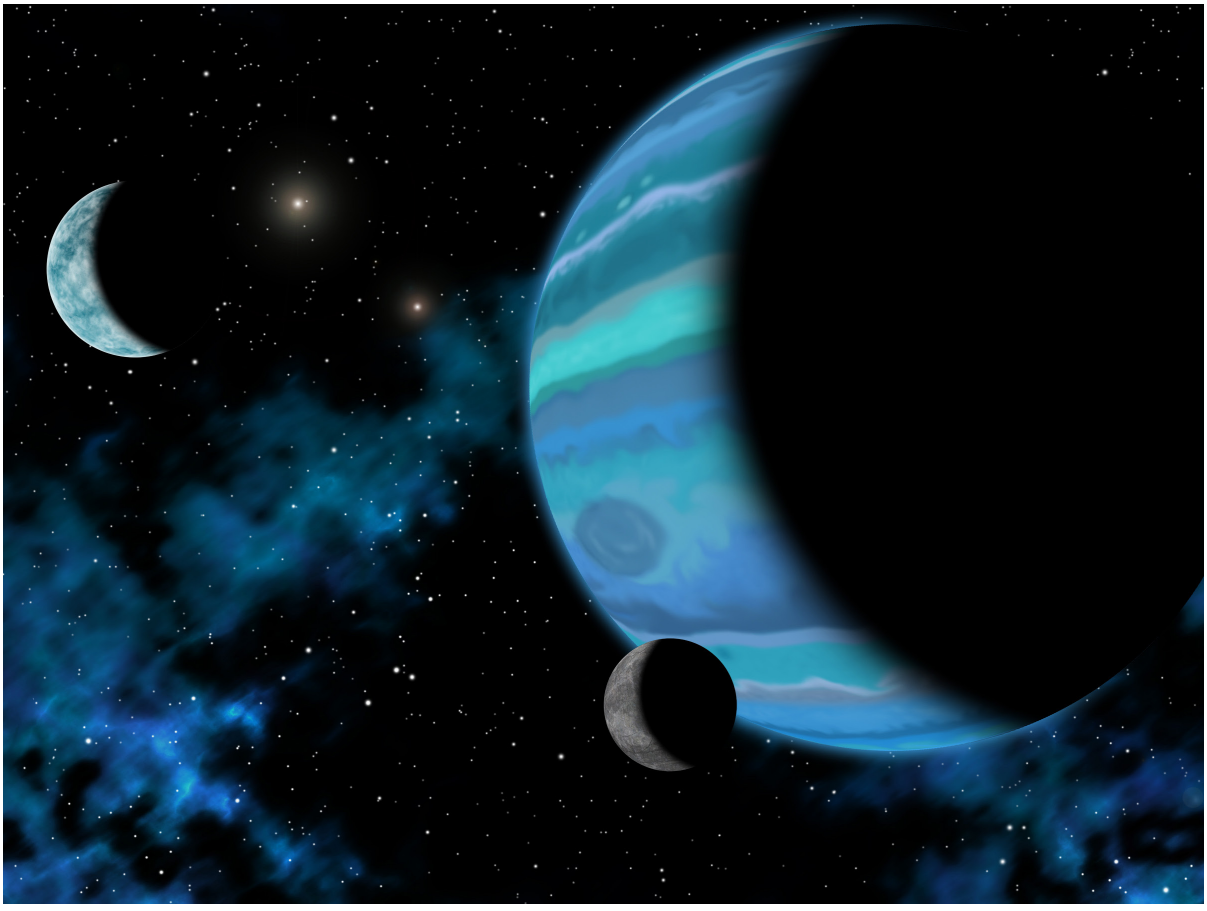
create your second moon (Moon 2)
- precisely follow the steps you performed for your first moon
- ***IMPORTANT!***- make sure your second moon has a completely different architecture than the first
  - see the moon examples below- each were built with a completely different approach
    - variety is not about being a different color- it is about being a different surface
  - do not use the same approach and same brushes as you did Moon 1
- rotate Moon 2 and Shadow the precise angle you did your panet and first moon
- scale Moon 2 and Shadow
  - make sure it is a *noticeably* different size
- locate Moon 2 and Shadow
  - place it away from your first moon; do not have them too close together
  - see *Final Composition* on page 13





> final composition

- planet
  - your planet must be the most noticeable element in your spacescape
    - this is most easily done with scaling
      - keep it large (remember it must be vastly bigger than your moons)
  - you have several options with location
    1. let it float completely within the frame but definitely off-center
    2. let it bleed off one edge of the frame
    3. let it bleed off two edges of the frame
  - do not worry about covering your lens flare stars
    - you can easily relocate them after you place your planet if you wish
- moons
  - your moons must be much, much smaller than your planet
  - your moons must be distinctly different sizes from each other
  - you have several options with location
    1. both moons float completely within the frame
       - note- your moons are too small to effectively bleed off an edge
    2. perhaps one moon partially overlaps the planet
    3. perhaps one is close to the planet and the other is much further away
  - do not overlap your moon with the planet (this implies your moon is gigantic, which is not possible)
- color
  - the brightness/intensity of your nebula and/or your moons may compete too much with your planet
    - if your nebula is too bright lower the opacity of the layers to fade more
    - if your moon is too bright go to Image: Adjustments: Hue and Saturation and lower the saturation



> common mistakes

Below is a list of the three most frequent deductions in regards to each individual element as well as the overall composition. Read these carefully and double check your project for these issues before submitting.

- starfield
    1. Brushes not set to 0% Hardness (stars glow so the edges must fade ad not be crisp)
    2. not enough/too many stars along the edge of the document (creates a frame around composition)
    3. too many large stars

- nebula
    1. edges of nebula are too crisp; do not fade smoothly
    2. nebula colors are too bright and saturated; compete with foreground
    3. nebula colors do not blend effectively

- gas giant
    1. colors are too intense
    2. bands of gas lack variety in width
    3. bands of gas lack variety in how they blend with adjacent bands (same technique is used throughout)

- earth-like planet
    1. land masses lack realistic contours
    2. land masses lack terrain details (forest, vegetation, desert, snow)
    3. clouds simply look like a spherized Photoshop cloud filter or too bright/colorful

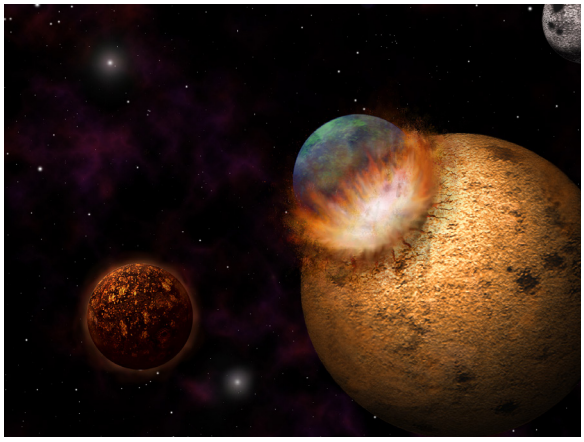
- moons
    1. moons too big in comparison to planet (also, planet should never overlap a moon)
    2. moon colors are too intense and distract from the planet
    3. shadows do not match the planet precisely (amount of shadow, opacity, feathered edge)

- miscellaneous
    1. scaling down planet and/or moons left behind a sliver of pixels (must be erased)
    2. all layers are not named
    3. location and scale of planet and moons creates ineffective balance of visual weight

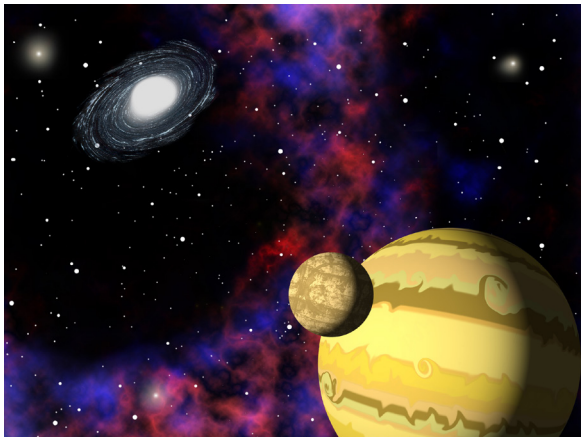
> extra credit elements

- create extra credit elements (not required)
  - additional elements include:
    - galaxy
    - comet
    - asteroids
    - planet rings
    - planet or moon collision
    - supernova
    - black hole
    - other (approve with instructor in advance)
  - use an image resource as a guide on what your extra credit element should look like
    - remember- realism is paramount
  - online tutorials are permitted for extra credit elements only
  - warning! these still must look realistic- regardless of what you choose make sure you refer to image resources
    - do not submit your project without checking your extra credit elements with instructor
      - just because you have an extra credit element does not mean it is going to help your grade; remember, this project is about *realism* so if your extra credit element does not look highly realistic compared to resource images either provided or found online, then it can *hurt* your grade

- strong student example of extra credit element (collision is highly realistic)



- weak student example of extra credit element (galaxy is not realistic)



> fun astronomy facts

- **our sun**
  - Light from the sun takes over eight minutes to reach us, traveling at 186,000 miles per second (671,000,000 mph)
  - 1,000,000 Earths would fit in the Sun
  - Our Sun will fuse 600,000,000 tons of hydrogen per second for another 5 billion years before becoming a white dwarf

- **stars**
  - Most stars (approximately 3/5) in the sky are binary stars, two stars orbiting each other
  - The star Betelgeuse is 1000 times larger than the sun; VY Canis Major is one billion times larger than the Sun
  - Supernovae can be so bright you could read by them at night
  - There are conservatively 1,000,000,000,000,000,000,000,000 stars in the known universe ($1x\ 10^{24}$)

- **planets**
  - Due to virtually no atmosphere, Mercury's lit side can reach 800 degrees while the dark side can drop to -300 degrees
  - Venus revolves around the sun faster than it rotates- thus, it's year is shorter than it's day; it also rotates backwards
  - If the Earth were a basketball, then the Moon would be a tennis ball 24 feet away; If the Sun was a basketball, then the Earth would be a pebble 86 feet away
  - Mars appears red due to the rusting of iron found in rocks and soil on the surface
  - Jupiter is bigger than the rest of the planets combined; 1000 Earths can fit inside Jupiter
  - Saturn's density is so low, it would actually float in water; Saturn is not the only planet with rings- Jupiter, Uranus and Neptune all have ring systems as well
  - Uranus, the first planet discovered by telescope, rotates on an axis of 97 degrees, meaning it spins sideways
  - Neptune was discovered through mathematics- scientists noticed an irregularity in Uranus's orbit and hypothesized it must be another planet's gravity affecting it
  - Astronomers have found 3700 exoplanets by detecting the wobble a star exhibits by an object orbiting it, or seeing the star dim when a planet passes in front of it; There are an estimated 9 billion Earth-like planets in our galaxy.

- **black holes**
  - The gravity of black holes is nearly infinite, so strong that even light cannot escape, hence the name "black" hole
  - Black holes are created when enormous stars die in a violent supernova; there is so much mass left over that gravity crushes it down to the size of a single point in space
  - Super-massive black holes are found in the center of nearly every galaxy
  - Black holes were theorized through mathematics decades before their actual discovery

- **nebulae**
  - Nebulae are enormous clouds of gas (mostly hydrogen and helium) and dust; some nebulae are regions where stars are born while others are the remnants of a dead star being propelled into space
  - The far left cloud column in the Pillars of Creation (in the Eagle Nebula) is four light years tall (24 trillion miles); our solar system would fit over 6000 times end to end within it

- **moons**
  - Iapetus was an equatorial ridge 12 miles high with two distinct sides, one dark and one light
  - Enceladus is the brightest object in our solar system; it's ice reflects nearly 100% of the sunlight
  - Triton, Neptune's largest moon, orbits in the opposite direction
  - Ganymede is the largest moon in the solar system and is even bigger than the planet Mercury
  - Titan is the only moon to have a thick atmosphere and actually has flowing liquid methane
  - Europa has a water ocean covered by a thick layer of ice; astronomers believe it is our best chance of finding life

> the universe in numbers

- **-370:** The surface temperature of Pluto.
- **0:** The number of Nobel Prizes Einstein won for his Theory of Relativity.
- **0.5%:** The percentage of funding for NASA compared with that of the U.S. military.
- **26%:** The percentage of American people who believe the Sun revolves around the Earth.
- **38%:** The percentage of atoms in the human body that are heavier than Hydrogen, and thus produced in stars.
- **66%:** The percentage of people who can no longer see the Milky Way due to light pollution.
- **8:** The number of minutes it takes for the Sun's light to reach the Earth. (8:18 to be precise)
- **9:** The number of years it would take for someone to walk to the Moon.
- **50:** The number of miles Hubble can still determine the color of your eyes.
- **171:** The approximate number of moons in our solar system.
- **177:** The number of years it would take to drive to the Sun at 60mph.
- **3536:** The number of years it would take to walk to the Sun.
- **5000:** The number of exoplanets discovered as of 2022.
- **10,000:** The temperature of the Sun's surface in Fahrenheit.
- **300 million:** The estimated number of *habitable* Earth-like planets in the Milky Way.
- **600 million:** The number of tons of matter the Sun converts into energy every second.
- **4.6 billion:** The age of our solar system.
- **13.8 billion:** The age of the universe.
- **28.2 million:** The temperature of the Sun's core in Fahrenheit.
- **49 million:** The number of years it would take to drive to the next closest star at 60mph.
- **8.8 billion:** The estimated number of Earth-like planets in the Milky Way.
- **9.2 billion:** The number of years our Universe existed before the Earth was formed.
- **100-200 billion:** The estimated number of planets in our own Milky Way.
- **100-200 billion:** Many astronomers calculate this is the total number of galaxies in the universe.
- **7,500,000,000,000,000,000:** Number of grains of sand on Earth.
- **100,000,000,000,000,000,000,000:** Conseervative estimate for the number of stars in the universe.