

## Nebula

### A shader plugin for Cinema 4D

#### Introduction

This shader is designed to create formations that resemble a nebula in space. It has a wide variety of parameters you can set, which should enable some realistic nebulae for your space scenes.

Note: this is not a 3D nebula you can fly through. It is a 2D representation intended for use as a backdrop to a scene, probably in conjunction with a star field such as that generated by StarScape (also available from [Microbion](#)).

#### How to use it

Create an instance of the shader in the material luminance channel. This will give better results than using the material color channel, which should be disabled as should the reflectance channel.

This shader is designed to be added to a Plane object. The reason is that you are probably going to want to overlay it onto a star field of some kind, and it is simpler to use a separate object rather than in a Layer shader with the star field, although you can do that instead if desired. However, using a separate Plane object does require that you add an alpha channel to the material and also to ensure that the Plane would not cast shadows on the star field from any lights in the scene.

#### How it works

To use this shader most effectively, it is useful to understand how it works. The shader draws up to four concentric rings of different radii which fade into one another. These circles are then distorted using a Noise shader - you don't have to add this, it's created internally - and then coloured with a colour gradient. You can also put the shader in the alpha channel to hide the object the shader is on.

There are 'transform' controls to re-position or rotate the shaded result, and to alter the scale of the rings if necessary. The amount of distortion and the noise type can be set to vary the results.

#### User interface

The shader interface is shown in Figure 1 (with all sections collapsed).

#### Buttons

There are three buttons at the top of the interface. These are:

Copy to Alpha: copies the shader to the alpha channel and enables the alpha channel in the material (not used in Redshift).

About...: clicking this button shows the version number of the shader.

Open Manual: to view the manual, click this button. To work, the manual must be in the same folder as the plugin binary file (the one with .xdl64 or .xlib extension).

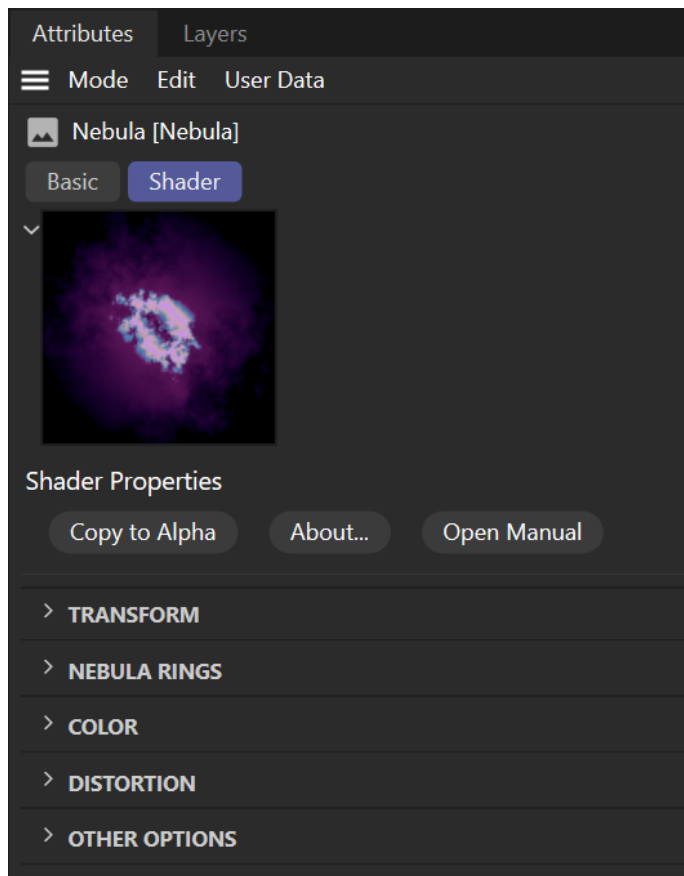


Figure 1. Shader interface

## Transform section

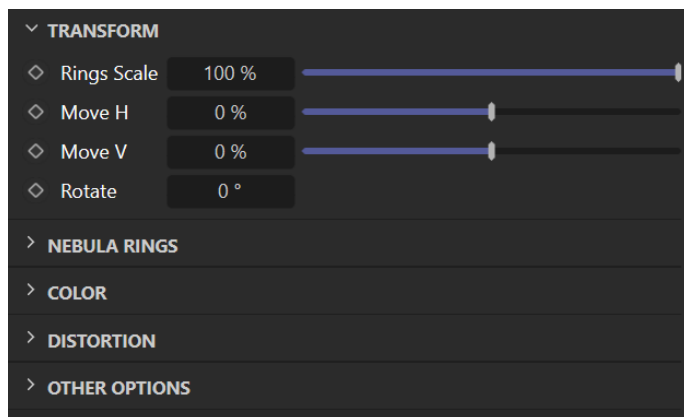


Figure 2. Transform section

These controls let you move, rotate and resize the shaded nebula.

### 1. Rings Scale

This control will decrease the overall size of the concentric rings. There is a reason for this control. If the amount of distortion is high, then depending on the noise type the shaded result may extend beyond the edge of the object the shader is on. This leads to a sharp cutoff at the edge, which looks poor. If this happens, reduce the value in this control until the shaded result is no longer cut off by the edge of the object. If your nebula is now too small in the scene, simply increase the size of the Plane object it is on. You can also increase the rings scale to enlarge the shaded area.

### 2. Move H, Move V

These controls move the shaded result horizontally and/or vertically across the shaded surface, so you can use

them to position the nebula exactly where you want it.

### 3. Rotate

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Rotates the shaded result by the specified number of degrees.

### Nebula Rings section

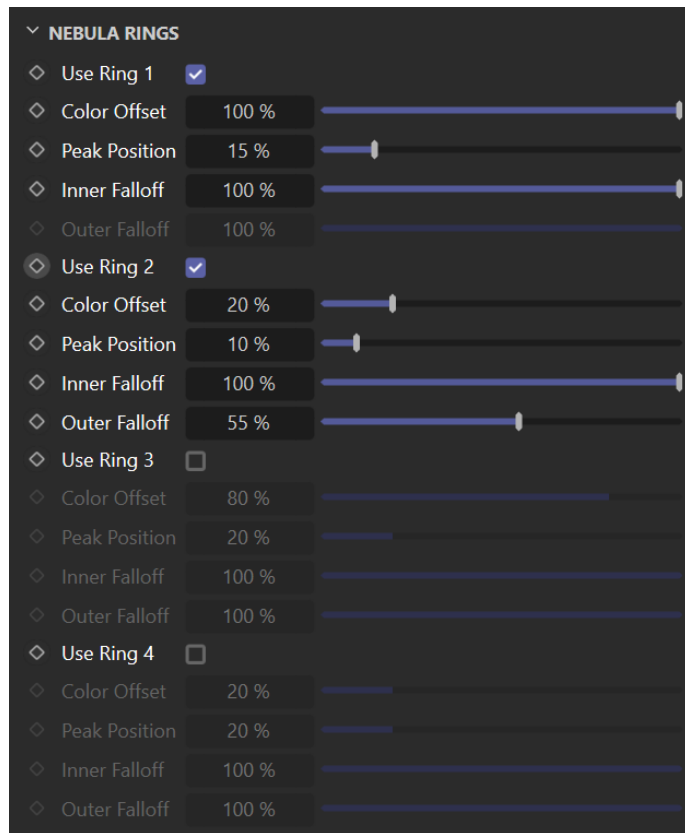


Figure 3. Nebula Rings section

### 4. Use Ring

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There are four rings you can use here. Each one has a ‘Use Ring’ switch; if it is checked, the ring will be created by the shader but if it is unchecked that ring won’t be used. You can use any or all of the rings, they don’t have to be turned on in sequence; unused rings are simply ignored.

Each ring has a peak position at which it has a maximum ‘strength’ which then fades away towards the centre and towards the outer edge. The rings are shaded in sequence, with the topmost ring in the stack being rendered first. The colour from each succeeding ring will blend with that from the underlying rings. You can use anywhere between one and four rings, depending on the effect you want.

### 5. Color Offset

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Each ring has a ‘Color Offset’ setting. This determines which colour will be selected from the gradient depending on the falloff of the ring (except in ‘Distance’ mode, when it is renamed ‘Brightness’).

At the ring’s peak position, the falloff is zero, and if the colour offset is set to 100% the colour at the right of the gradient will be used. However, if the offset is set to (for example) 50%, then at the peak position the colour chosen comes from 50% along the gradient. As the falloff increases (either inwards to the centre or outwards to the edge) the colour chosen moves to the left of the gradient. At maximum falloff the colour returned is always black.

In most cases you will probably want the outer edge of the nebula to fade into the background colour, so at

that point of near-maximum falloff the colour selected should be similar to whatever background colour is used - which in the case of a space scene, might be black or a very dark blue or purple. In that case, at the left end of the gradient should be a dark colour close to the background, so that as the falloff approaches maximum the colour becomes progressively darker and blends with the background.

Note that setting this value to zero is not the same as turning off the 'Use Ring' switch. Compare these three images - on the left is the default nebula; in the centre, 'Use Ring 1' is turned off with 'Color Offset' for ring 1 set to 100%; on the right, 'Use Ring 1' is on, but 'Color Offset' is zero. You can see the clear difference between the two.

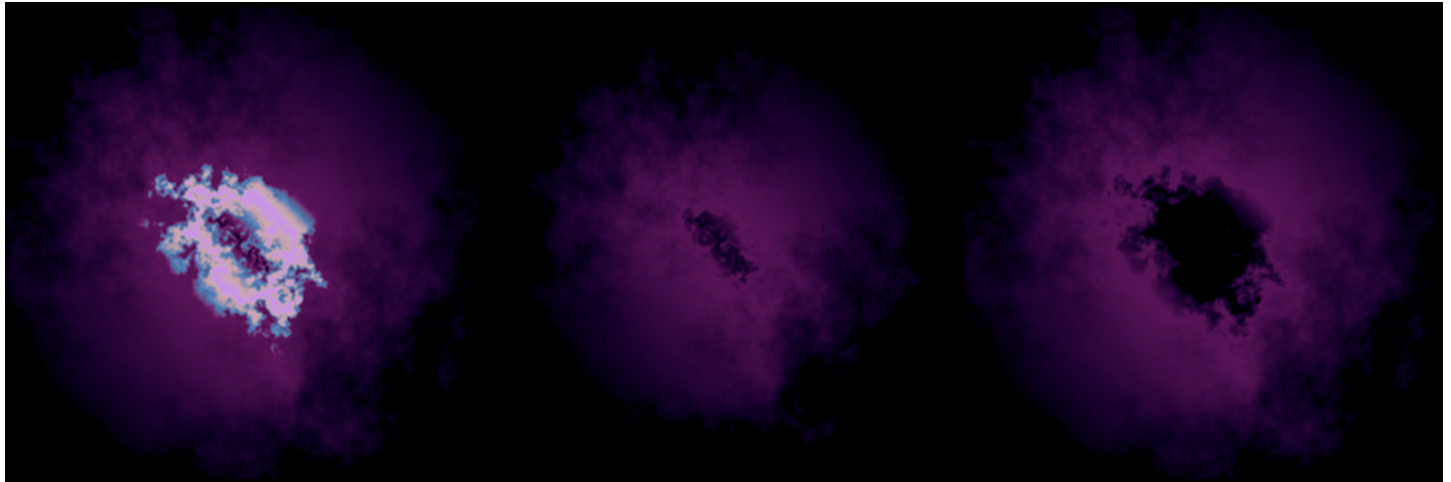


Figure 4. Ring not used (centre) compared to colour offset of zero (right)

**Important: when the colour mode (see below) is set to 'Distance' this setting changes to read 'Brightness' and then directly controls the brightness of the ring. It has no effect on the colour selected.**

### 6. Peak Position

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Each ring has a peak position which is the distance from the object centre\* at which the ring is rendered at its maximum strength. From that position the ring strength falls off inwards towards the centre, blending its colour with the ring 'above' it in the stack of rings. The ring also loses strength outwards to the edge of the object\*. As the falloff in either direction increases, the colour chosen from the gradient moves towards the left end of the gradient. Figure 5 shows one ring, distortion set to zero, peak position at 50%, outer falloff at 50% and a black-to-white gradient. You can see the narrow brightest area which is the peak position fading inwards and outwards.

*\*Technically, the centre of the object is really the centre of the UV map and the edge of the object is the edge of the map, but in a Plane object these are the same. In other objects that might be very far from the case and the shaded results are unpredictable - try it on a Figure primitive, for example!*

Very importantly, note that the rings are evaluated from the top of the list to the bottom. If all rings are used, for example, ring 1 would be drawn first. Then ring 2 is drawn, and it will blend with and probably partially overwrite ring 1. Then ring 3 is drawn and finally ring 4.

But where are the rings drawn? The 'Peak Position' value is used to determine this. These values are cumulative, not absolute. Suppose the first ring has a position setting of 20%. The ring is then drawn at its peak strength 20% out from the centre of the object then falls off inwards and outwards. If the second ring has a peak position of 10%, that ring is at its brightest 30% from the object centre (that's 20% for the first ring plus its own 10% value to give 30%). This means that if the peak position is greater than zero each ring is always drawn at some distance outwards from its predecessor. Don't make the mistake of thinking that the peak position setting is an absolute position on the object.

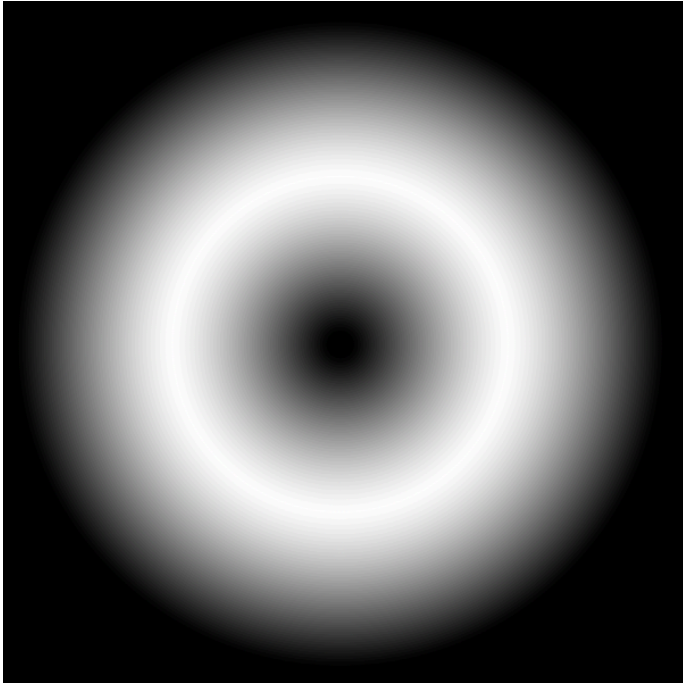


Figure 5. Falloff from peak position inwards and outwards

What happens if the cumulative peak position exceeds 100%? All that happens is that the ring will become brighter and its outer edge will become sharper with an abrupt delineation from the background. If you see that happening, your cumulative position values are probably greater than 100%.

### 7. Inner Falloff

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The next ring setting is 'Inner Falloff'. This is the distance over which the ring fades inwards towards the centre. As this value decreases, the colour change is compressed into a smaller distance, so the border between the ring and its immediate predecessor will become sharper. In these examples, there is one ring; its peak position value is 50% so it is at its maximum halfway between the centre and the outer edge. The inner falloff values range from 10% (with a large black centre hole) to 50% and then 100%, where the ring fades slowly getting darker and darker until it is black only at the very centre.

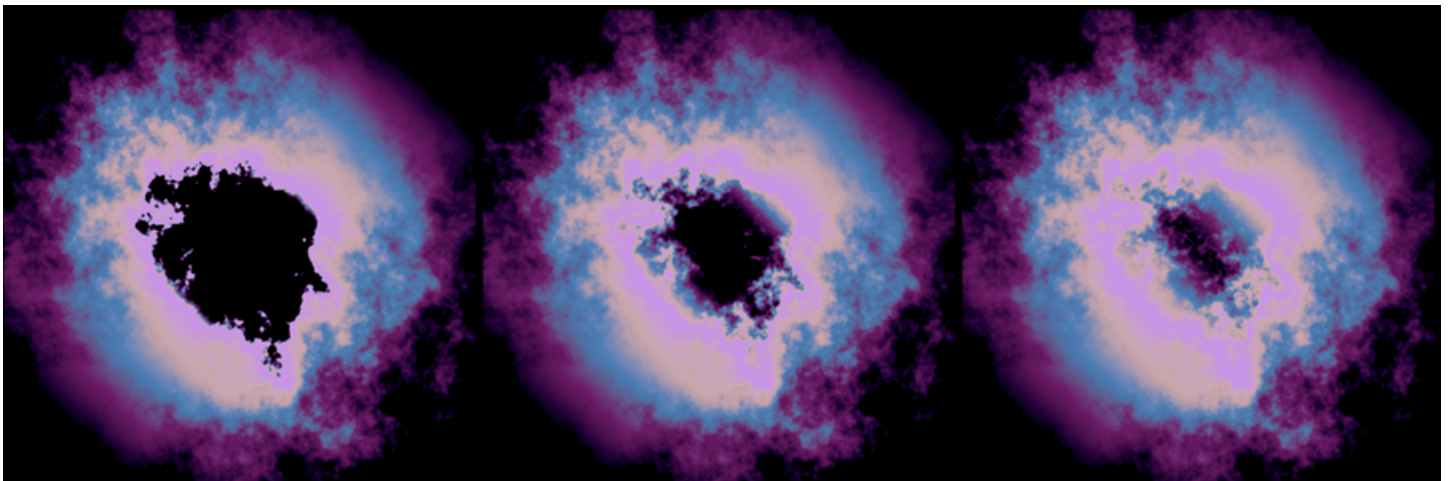


Figure 6. Different values of Inner Falloff

### 8. Outer Falloff

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Finally, the last ring in the stack to be rendered, and only that ring, has an 'Outer Falloff' setting. This is the same as 'Inner Falloff' but for fading the outermost ring outwards to the object's UV map boundary. You can use it to reduce the spread of the outermost ring if it's too wide, which it can be, especially with high distortion values. If you make this value too small though, you may see a hard cutoff between the nebula and



the background, so you could consider reducing the rings scale (see above) to remove the cutoff. These three images show values of 10%, 50% and 100% outer falloff (no alpha channel used):

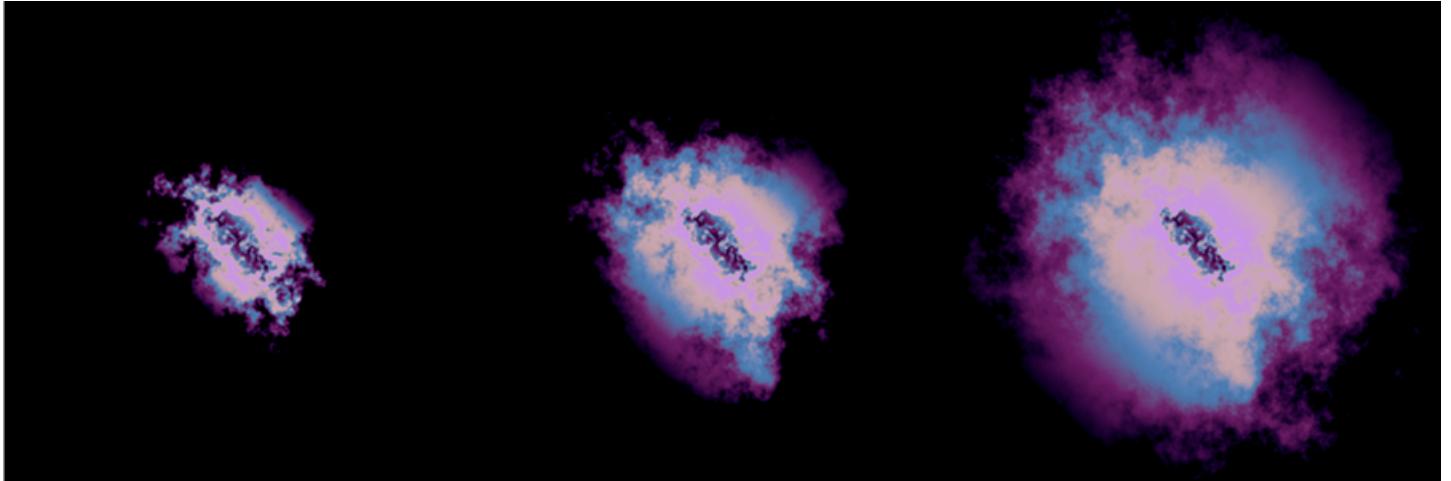


Figure 7. Different values of Outer Falloff

Remember that only the last ring can use this value. If ring 1 and ring 3 are enabled but rings 2 and 4 are not, the outer falloff would be set in ring 3, which is the last ring to be rendered.

### Analysis

Let's try to make sense of what these parameters are all doing. In the following images, the C4D preset gradient 'Heat 2' is used for the colours, with a distortion of 20%. For clarity, only one ring is used. This is the gradient:



Figure 8. Heat 2 gradient preset

### Image 1

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Both falloff values are set to 100%, colour offset 100%, peak position 50%. This is what we get:

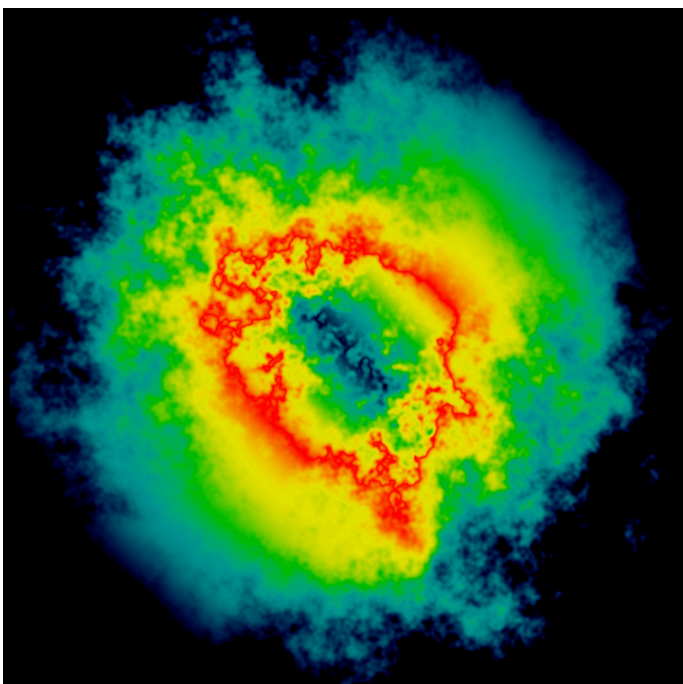


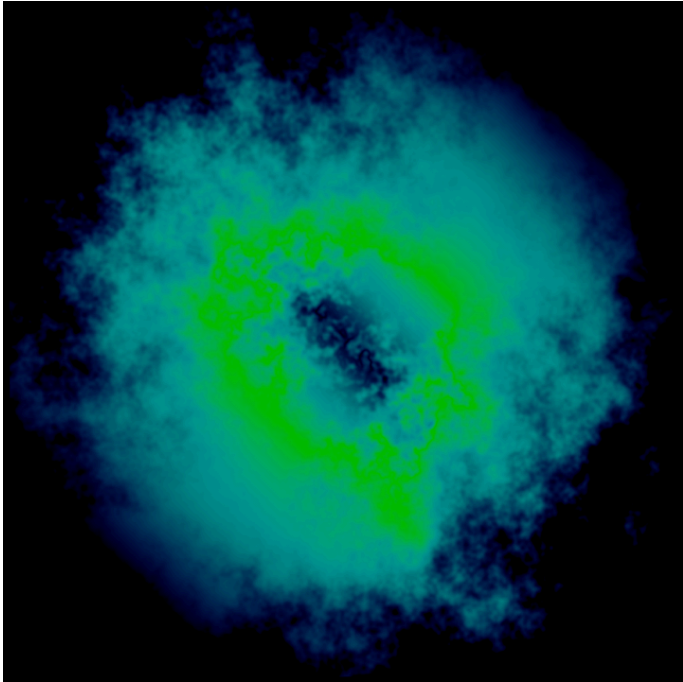
Figure 9. Analysis - image 1

As you see, with a peak position of 50% the maximum strength of the ring is at 50% from the object centre. This then selects the colour from the right of the gradient - in this case, red. The ring strength then falls off towards the centre and towards the outer border, so the colour changes to those from the left of the gradient - yellow, green, cyan and blue, in that order.

### *Image 2*

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Now, if the colour offset value is reduced, we would expect that the colours will be increasingly selected from the left of the gradient. In this image, the colour offset is set to 50%:



*Figure 10. Analysis - image 2, colour offset = 50%*

The maximum strength is still at 50% from the centre, since the peak position value is unchanged, but the selected colour now is green. This is because the colour offset is 50%, so the colour selected is 50% along the gradient - which is green. As the strength falls off only the cyan and blue colours are used. Note that with maximum falloff only black is returned.

### *Image 3*

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Now, let's return the colour offset to 100% and set the peak position value to 75%. What this will do is move the point of maximum strength outwards, but the falloff to the centre and the border will still take place, so the nebula increases in size and may be cut off at the edge of the Plane object. You will, however, see more detail because the area rendered is larger. See Figure 11 on the next page for the result.

We can fix this in one of two ways. The first is to reduce the outer falloff; this will work, but the outer part of the nebula will disappear, so that the red area would eventually become the outer border of the nebula. The other way is to reduce the rings scale in the 'Transform' section.

### *Image 4*

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With the peak position returned to 50%, let's set the inner falloff to 35%. You can see the result in Figure 12 on the next page.

What has happened here is that when the inner falloff is set to 100% the falloff in strength takes place over the whole distance from the peak position to the centre, so there is only a very small central 'hole' which is rendered black. Reducing the inner falloff to 35% forces the falloff to take place over a much shorter distance,

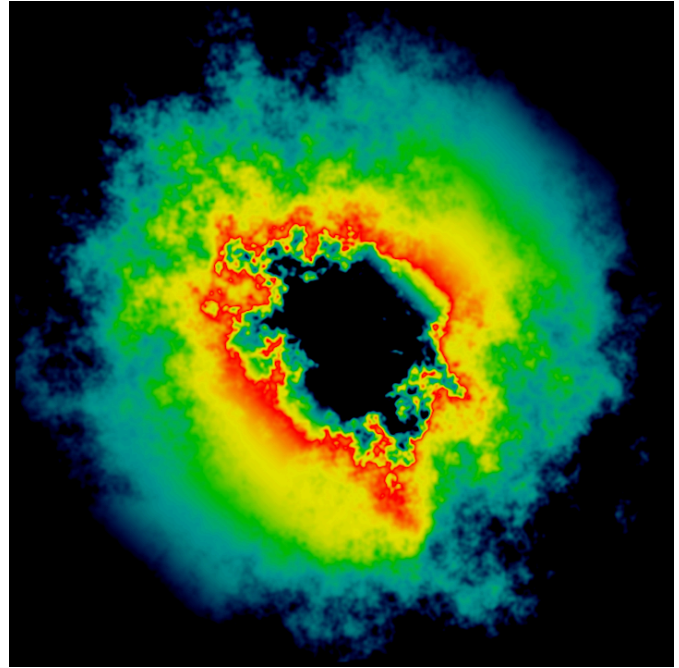
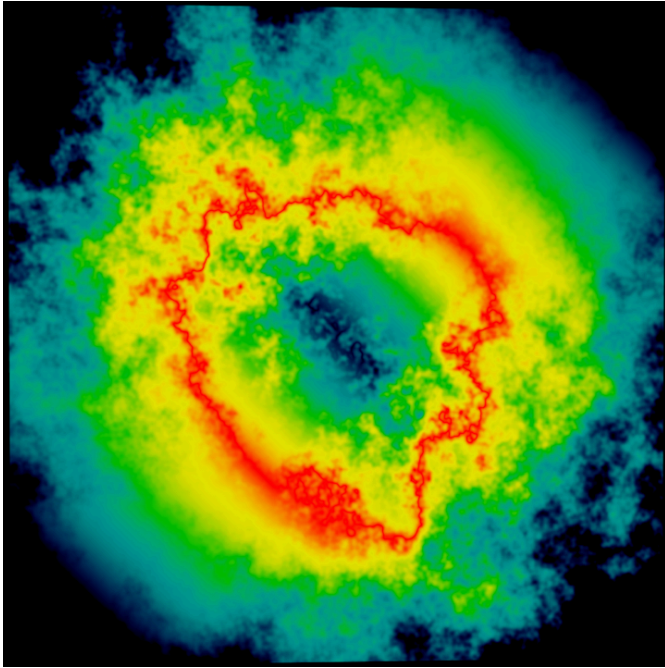


Figure 11. Analysis - image 3, peak position = 75%    Figure 12. Analysis - image 4, inner falloff = 35%

leaving a larger black central hole. If the inner falloff is zero, there is no falloff at all; the red area (the area of maximum strength) then becomes the inner border of the nebula.

## Image 5

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So, with the inner falloff back to 100%, we can see the effect of the outer falloff by reducing it to 50%:

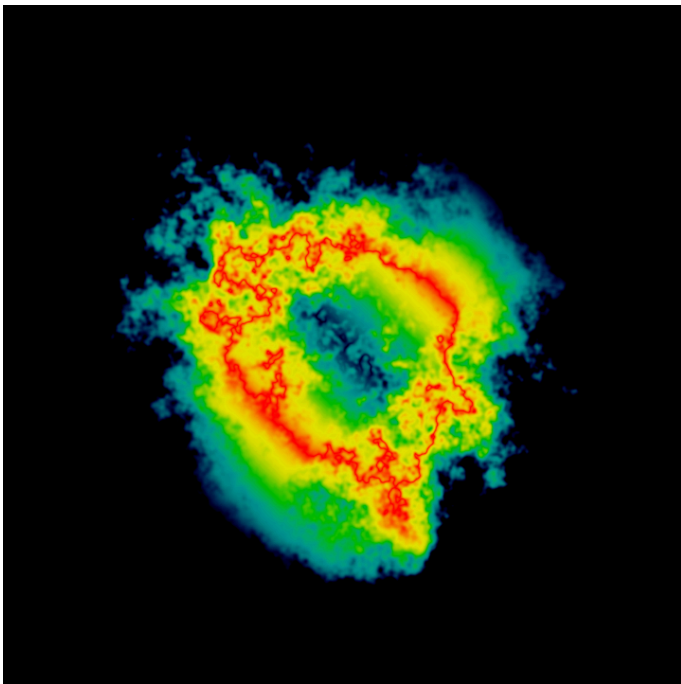


Figure 13 - image 5, outer falloff = 50%

This setting controls the falloff in strength to the outer edge of the nebula, but is only used for the last ring in the stack. Since there is only one ring used in these examples, that is also the last ring. As you see, the falloff is compressed into a smaller area, which make the nebula itself appear smaller; you can use the rings scale to correct this if necessary.



## Image 6

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These settings can all work together to produce a variety of effects. By increasing the peak position to a high value (for example, 98%), setting the inner falloff to very low (say, 2%) and reducing the outer falloff, we can get a very thin shell as seen here:

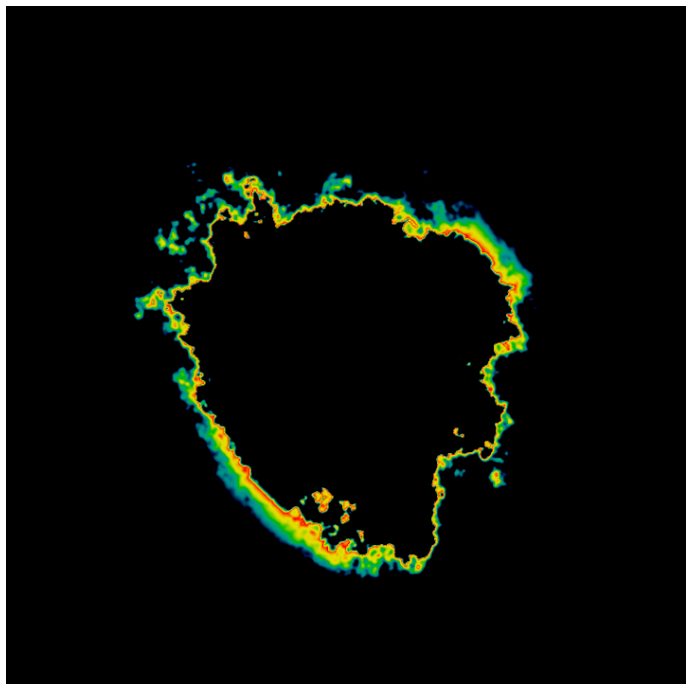


Figure 14 - image 6, multiple settings changed

## Color section

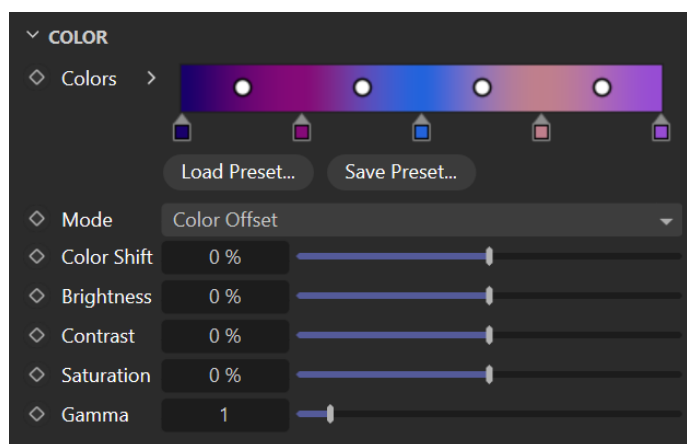


Figure 15. Color section

## 9. Colors

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The colours used in the nebula are taken from the 'Colors' gradient, which must have at least one colour knot (otherwise the gradient is pure black and the nebula will disappear).

## 10. Mode

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Which colour is selected from the gradient depends on the 'Mode' setting. The default is 'Color Offset' in which for each ring the ring's colour offset and falloff determines the colour as explained above. If you make the last ring have a low colour offset, so that the colour selected is from the left of the gradient, it makes sense to have black or some very dark colour as the leftmost colour so that the nebula blends into the background. This is the mode which is most useful in generating a realistic nebula.

The other mode is 'Distance'. Here, the selected colour is chosen depending on the distance of the shaded

point from the centre of the UV map (taking any movement into account from the transform settings). The results from these two modes can be quite different as shown here:

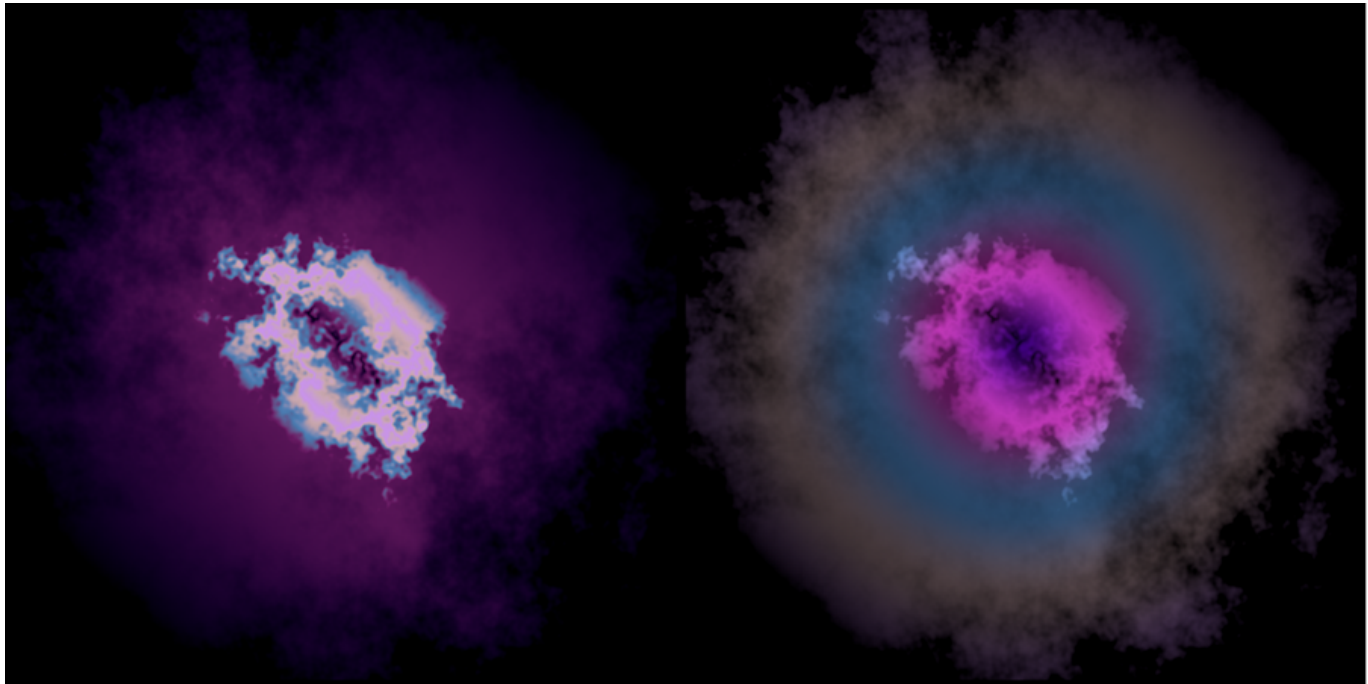


Figure 16. Comparison of colour offset (left) and distance (right) modes

Don't forget that in distance mode, the ring colour offset becomes 'Brightness' and only controls the brightness of the ring, not the colour.

## 11. Color Shift

The 'Color Shift' setting will shift the selected colours to one end of the gradient. The reason for this is that if you have a nebula in which the colours appear to come more from one end of the gradient than the other, and you would like it to be more balanced, you can use this setting to change the range of colours selected. The alternative is to modify your gradient, which is tedious and difficult if there are a lot of knots.

Setting this to a positive value will select colours from the right of the gradient, while negative values shifts the colours to those from the left of the gradient.

## 12. Brightness, Contrast, Saturation, Gamma

The four remaining controls are colour correction settings, giving the same result as if this shader was in a Layer shader and a Brightness/Contrast/Gamma effect (or a Hue Saturation/Lightness effect, when changing lightness) was used.

## Distortion section

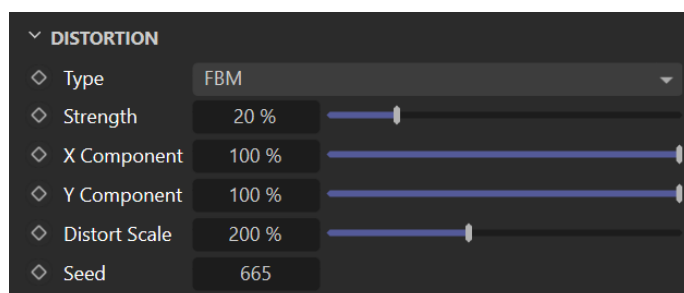


Figure 17. Distortion section

These settings control the ring distortion to produce the 'nebula' shape.

### 13. Type

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The shader uses a Noise shader for the distortion. You can use most of the noise types found in the Noise shader, with the exception of five noises which just don't give usable results with this shader. The default is FBM, which produces nice cloud-like results. Gaseous and Luka are also useful noises here.

### 14. Strength

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The amount of distortion is controlled by the 'Strength' setting. Smaller values are, generally, better.

### 15. X Component, Y Component

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The 'X Component' and 'Y Component' govern the amount of distortion along the X and Y axes. You can use these to stretch the distortion along these axes. For example, the X component could be set to 100% and the Y component set to 5%, then the 'Rotate' setting can be used to form a diagonal band.

### 16. Distort Scale

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The 'Distort Scale' is the same value as the global scale setting in a Noise shader. Changing this will alter the detail in the nebula, so reducing it will increase the smaller details but increasing the scale will reduce them.

### 17. Seed

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Finally, you can set the seed value for the Noise shader to vary the result.

## Other Options section

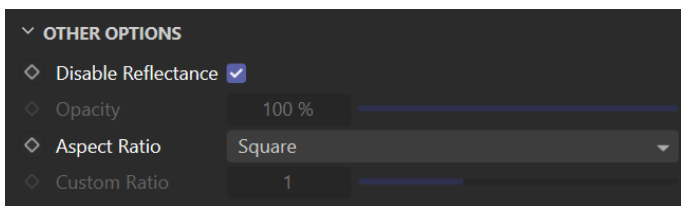


Figure 18. Other Options section

### 18. Disable Reflectance

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It is recommended that the material with the Nebula shader should have the reflectance channel disabled. If this switch is on, which it is by default, reflectance is disabled automatically so you don't have to remember to do it. If you really want it back on, turn this switch off.

This switch only applies to the standard renderer, and not to Redshift.

### 19. Opacity

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This setting is only available if the shader is in the alpha channel. Reducing this value will darken the alpha channel, reducing the opacity of the nebula.

### 20. Aspect Ratio/Custom Ratio

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If the object the shader is placed on is not square, the nebula will be stretched, either horizontally or vertically, depending on the object's width and height. If that happens, you can adjust the aspect ratio used in the shader by choosing 'Custom' from the 'Aspect Ratio' menu and entering the correct value into the 'Custom Ratio' field. Or, you can just drag the slider left or right until the aspect looks about right (when rendered in the viewport or picture viewer, not in the material preview as this is always square).

What value should you enter into the custom ratio field? The easiest thing is just to use the width of the object

divided by its height. So if the object is, for example, 1200 by 800 scene units in size, enter '1200/800' into the field. Cinema will calculate that entry to give an aspect ratio of 1.5.

If you are using a Background or Sky object, they don't have a size so you can't do this. In each case the object fills the render area, so all you need to do is change the menu to 'Screen' which will automatically use the correct ratio.

### Hints and tips on using the shader

#### *1. Shader brightness*

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If you need the rendered result to be brighter, in the luminance channel set 'Mix Mode' to multiply then increase the 'Brightness' setting (in the channel itself, not the 'Brightness' setting in the shader) to get the required brightness.

#### *2. Using an alpha channel*

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If you are rendering this shader against a plain black background you don't need to worry about using an alpha, since the shader renders black outside the nebula itself. In most cases though, you will have something in the background, perhaps a star field created with StarScape, as is the case in the banner image at the start of this manual. In that case you will want to see the stars in the areas where the nebula itself is not rendered, and for that you need to add an alpha channel.

The simplest way to do this is to click the 'Copy to Alpha' button at the top of the interface. This will:

- remove any existing shader in the alpha channel;
- add an exact copy of the shader into the alpha channel;
- turn on the 'Pre-multiplied' switch in the alpha channel;
- and turn on the alpha channel automatically.

That's really all you need to do, although you could - if you needed to - tweak the values of the shader in the alpha channel. The only other thing you might want to do is reduce the opacity of the nebula by decreasing the 'Opacity' setting, which you can only do in the alpha channel.

You can also copy the shader manually from the luminance channel or even create a Nebula shader in the alpha. If you do either of these things, remember to turn on 'Pre-multiplied' in the alpha or it won't work correctly.

**Important note #1:** clicking this button will copy the shader over whatever is in the alpha channel. For example, if the shader is in a Layer shader in the luminance channel, and you click this button, only the shader itself will be copied over. If the alpha channel contained a Layer shader, that will be removed and the Nebula shader copy added instead.

**Important note #2:** if you use an alpha, just remember that every time you change the nebula settings in the luminance channel you should copy the modified shader to the alpha by clicking the copy to alpha button. If you don't, your alpha shader settings will be different from the shader in the luminance channel, and the result may not look right.

#### *3. Using this shader with Redshift*

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This shader works fine in Redshift but there are one or two additional points to note.

First, you need to create a C4D Shader material in Redshift. Since it isn't possible to write a native Redshift node to reproduce this effect, you must use the C4D Shader material. It's not difficult but there are a few steps to follow. Because this applies to all the shaders I've written, there is an article on my website with full details

of how to use standard Cinema 4D shaders in Redshift, you can find it at [https://www.microbion.co.uk/html/blog31\\_01\\_25\\_c4dshader\\_redshift.php](https://www.microbion.co.uk/html/blog31_01_25_c4dshader_redshift.php).

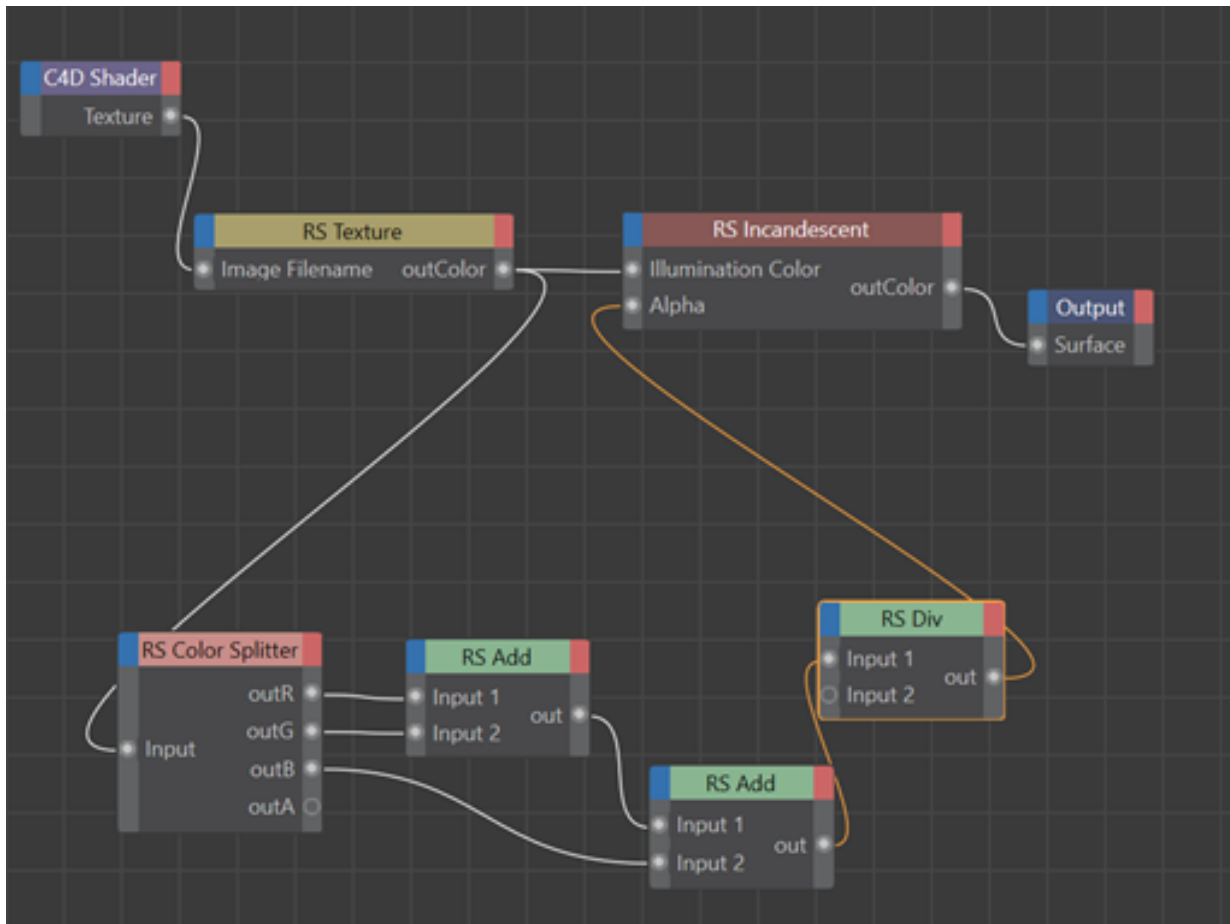


Figure 19. Redshift node tree to include an alpha

However, for this shader, when you follow these steps, the node tree should use an 'RS Incandescent' node, NOT an 'RS Material' node. This is the equivalent of using the luminance channel in the standard renderer material. You can then increase the brightness in the incandescent node's illumination tab with the 'Intensity Multiplier' setting. Using this node you don't need to worry about reflections since the incandescent node doesn't use them.

The problem is how to implement an alpha. Redshift doesn't give us an alpha channel in the same way as the standard renderer. You might think we could simply plug the C4D shader node into the Illumination->Alpha input of the Redshift incandescent material, but doing that doesn't work correctly. The way around this is to get the overall brightness of colour output from the nebula shader and feed that into the opacity setting. We can do this by adding the red, green and blue values of the colour together and dividing by three, to give a single grayscale value. The node tree shown in Figure 19 will do that.

With this method you will certainly need to increase the intensity multiplier in the Redshift incandescent material significantly - perhaps to 10 or more.

## Conclusion

So that is the 2D nebula shader. I hope you find it useful for any space scenes you might be producing. If you have any questions or comments, you can contact me via my website at <https://www.microbion.co.uk/html/contact.htm>. I'll get back to you as soon as I can.

Steve Pedler  
June 2025