

# Gas Giant

## A shader plugin for Cinema 4D

For space scenes in Cinema 4D, if you want a gas giant planet there is the supplied Planet shader. This has some very basic variants for Saturn, Neptune, etc. but is not very good. Most users probably resort to using a bitmap to create a gas giant, but then you run into potential copyright issues and there is only a limited number of bitmaps available.

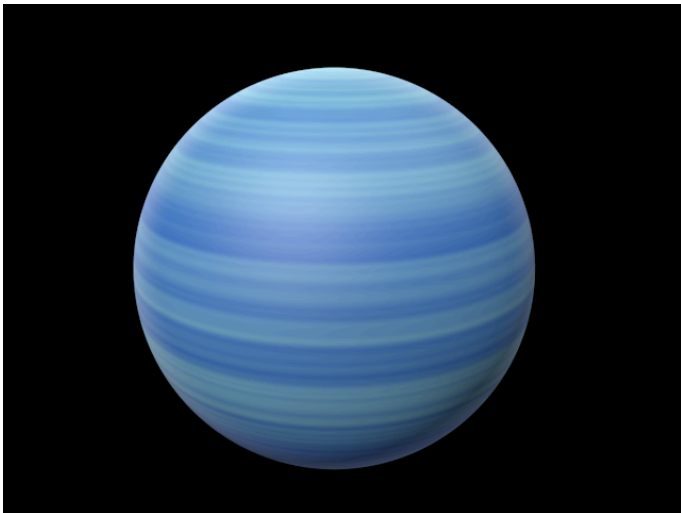
This shader is an attempt at a better gas giant. It is quite customisable and fully procedural.

### Using the shader

The shader is intended to be applied to a sphere, though of course you can add it to any object. There are two aspects to using the shader: selecting the required colours and adding some distortion to the resulting colour bands.

#### Colours

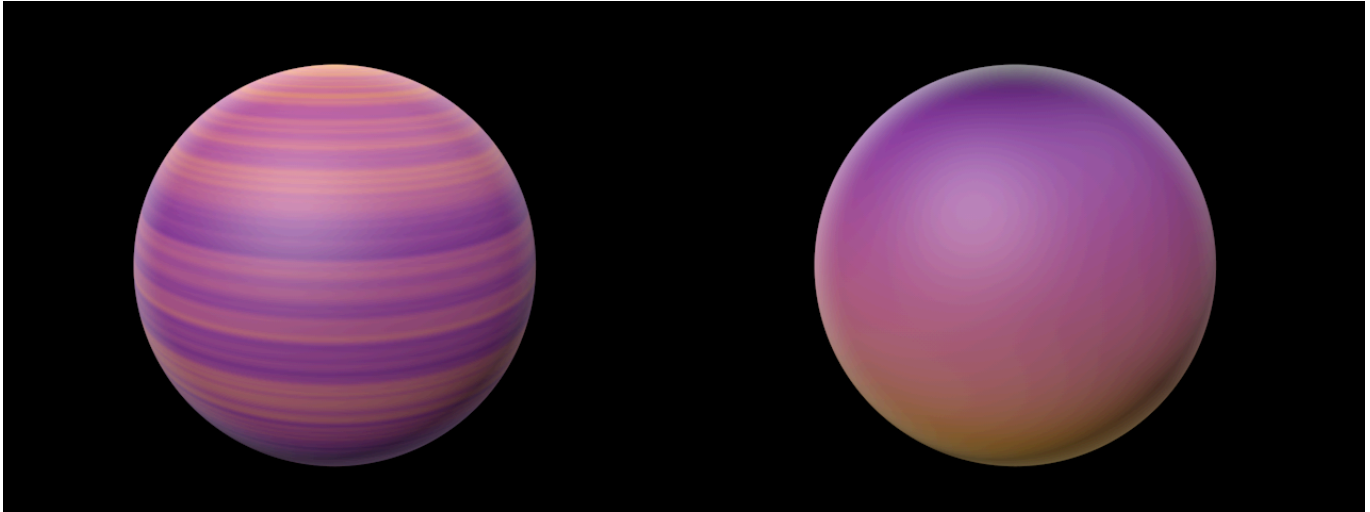
The default shader loads with a simple dark blue to light blue gradient and no distortion, giving a series of bands as shown in Figure1.



*Figure 1. Default shader effect*

These bands are produced by using a noise function (fBm, fractal Brownian motion) to select colours from the gradient. The gradient must have at least two different colours to produce these bands, with one colour the result is a solid colour with no banding.

There is an alternative mode, however: you can select a colour from the gradient according to the Y-value of the texture (UV) coordinates. This produces a smooth gradient on the object but which can still be distorted. This might not sound very useful, but it produces a much smoother, more subtle result which can be very effective. You can also add polar caps using this method by setting the cap colour at each end of the gradient. Compare the two images in Figure 2 where the one on the left selects colours with the fBm value while the one on the right uses the Y height (no distortion used in either case).



*Figure 2. Gradient mode: left, fBm Value; right, Use Height*

The colour controls are as follows.

### 1. Gradient

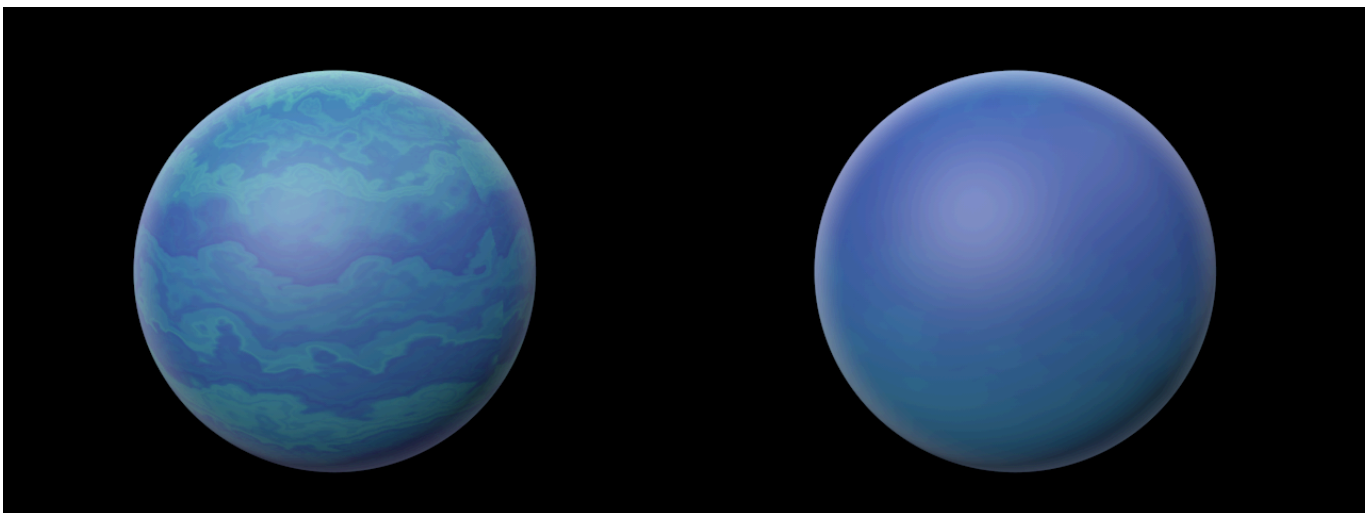
The colour gradient to use. There must be at least two different colours.

### 2. Gradient Mode

Selects between the fBm value and the UV height (Y value) to choose colours as discussed above.

### 3. Octaves

This is a measure of the complexity of the fractal function. It is not used in gradient height mode. Generally, a lower value results in fewer bands and the boundary between them is soft and blurred. With higher values, you see more and narrower rings with harder boundaries. Compare the images in Figure 3, the first with 8 octaves and the second with 2 (distortion of 10% strength was applied):



*Figure 3. Contrasting octave value results: left, 8 octaves (the default); right, 2 octaves*

Note how the lower value gives a better impression of subtle clouds (like Uranus) and the higher value gives distinct bands (like Jupiter).

For most purposes you won't see much difference above 9 octaves unless you are looking at the planet in extreme closeup, where higher values may deliver more detail.

#### 4. Lacunarity

Another way to alter the fractal result. For most purposes, a value of 2 is fine. But you can get some interesting effects with different values. Compare the images in Figure 4 with lacunarity values of 2 and 6:

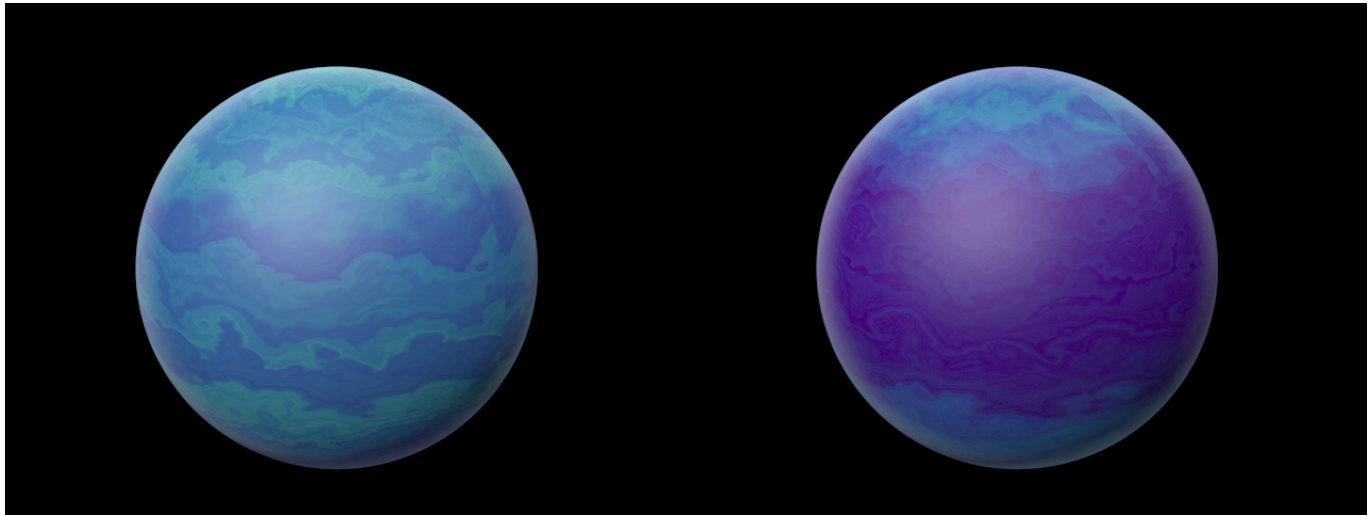


Figure 4. Effect of lacunarity. Left, lacunarity of 2 (the default); right, lacunarity of 6

You can see the difference in bands and also in the changes in the colours used.

#### 5. Remap Color

Look at the image in Figure 5, which uses the fBm gradient mode and whose gradient is one of the presets supplied with Cinema 4D:

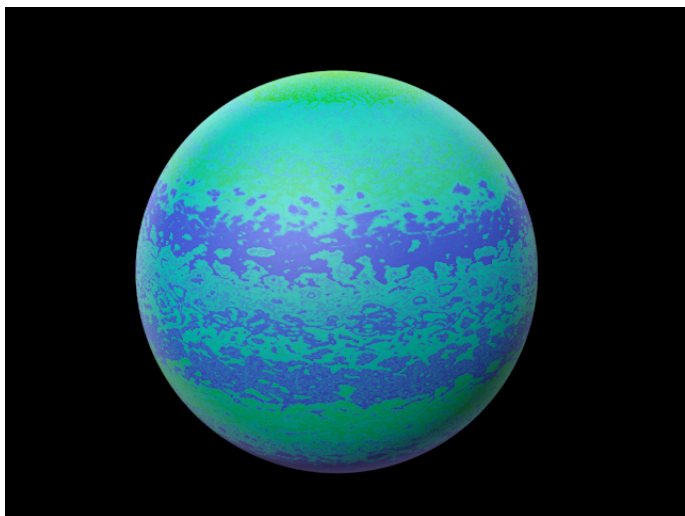


Figure 5. Gradient effect with default colour mapping

The gradient used for the above images actually looks like this (Figure 6):

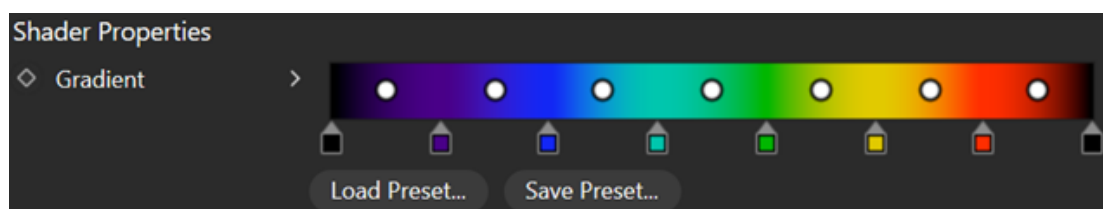
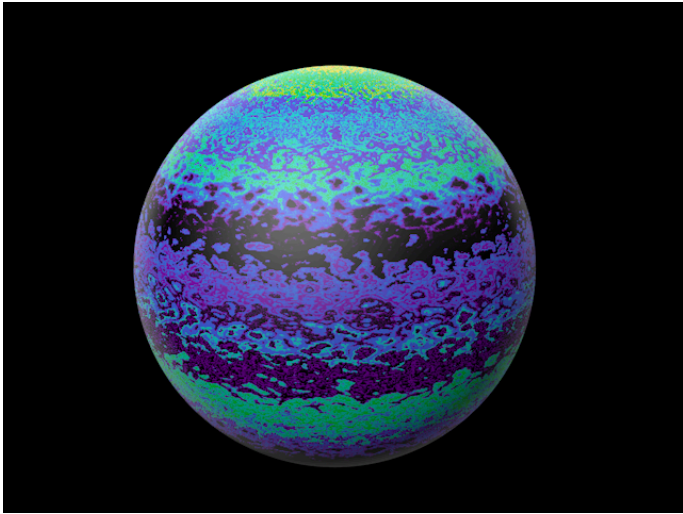


Figure 6. Gradient used in Figure 5

But in the rendered result, the colours come mainly from the middle of the gradient and there is little or none from either end. This is because the fBm function returns values of which the majority are around the middle

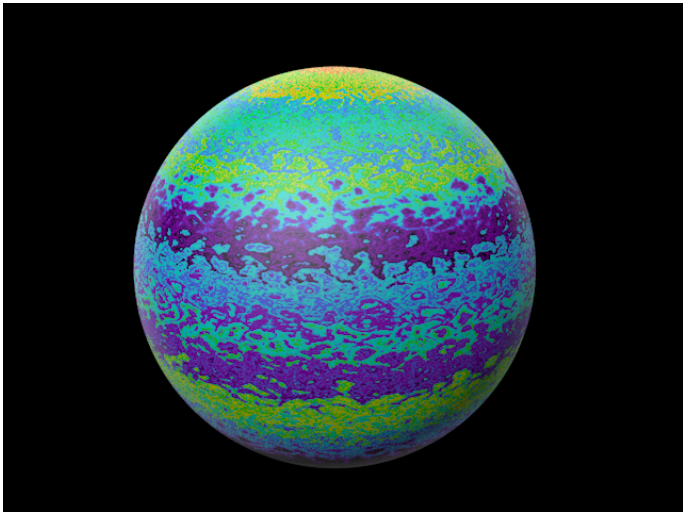
value between 0.0 and 1.0. If we want to see more of the other colours, we can remap this value so that it lies in the full range of zero to one. That is what the 'Remap Color' switch does. Turning that on gives this result: (Figure7):



*Figure 7. Image from Figure 5 but with 'Remap Color' turned on*

This is better, but you can see that the majority of colours are those from the left side of the gradient. This implies that the fBm values the fractal returns are probably mainly below the midpoint (e.g. from 0.35 to 0.55, or something like that). Remapping will spread out the colours but still have a preponderance from the left side of the gradient.

If we could increase the range for most fBm values to, let's say, around 0.4 to 0.6, we would see more of the colours from the right side of the gradient. This is the purpose of the 'Color Shift' setting. Increasing this to 25% gives a more balanced result (Figure 8):



*Figure 8. Previous image with 'Color Shift' set to 25%*

'Color Shift' can also return negative values, and this will shift the colours to the left side of the gradient if required. Use this setting carefully. Values which are too low or too high will mean that most colours come from one of the ends of the of the gradient.

Note that altering the lacunarity will also have a profound effect on the colours selected from the gradient.

### 6. Atmosphere Color

The shader can automatically apply a fresnel effect to simulate the effect of light scattering by the planet's atmosphere. You can select the most appropriate colour to use here.

## 7. Atmosphere Brightness

Alter this setting to change the brightness of the atmosphere effect. A value of zero will remove the effect completely.

## *Distortion*

The coloured bands are fine but we probably also want some distortion of the bands for greater realism. This can be very subtle or wild and chaotic. There are three possible methods for distorting the bands, selected from the 'Distort Mode' menu. Having selected a mode, there are various parameters to change as required.

## 8. Distort Mode

The three options are:

- Simple: a simple noise function which can still produce complex patterns; this is the default setting.
- Curl: a different function which produces long sweeping curves.
- Shader: use any shader to produce the distortion; Noise is the obvious choice but others can work well too.

With these there are several settings to adjust the distortion.

## 9. Curl Offset

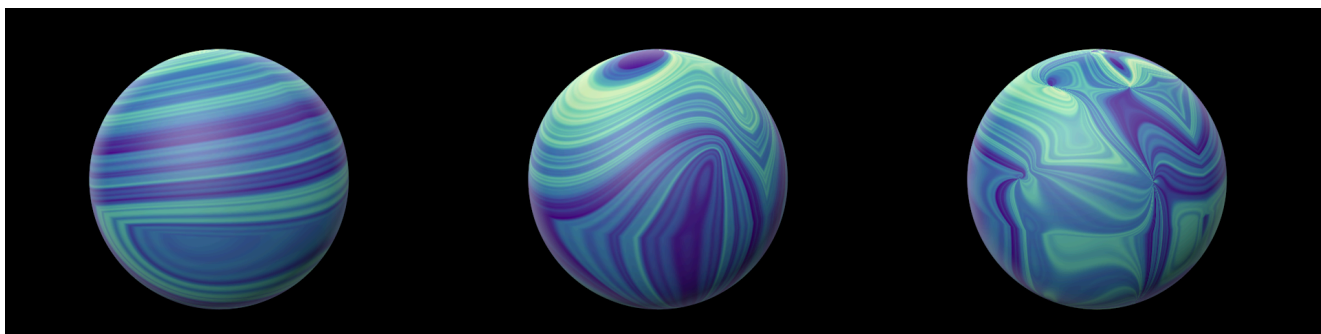
Only available in Curl mode. This is an offset into the curl function. Try changing this to see what effect it has.

## 10. Strength

Available in all three modes, this is the strength of the distortion. A value of zero means that there is no distortion. The slider goes up to 100% but higher values are possible by typing them into the number field.

## 11. Scale

Not available in Shader mode. In Simple mode a smaller scale produces smaller, finer detail until it eventually just becomes a grainy result. In Curl mode increasing the scale results in more and more complex results, with swirling bands of colour. Figure 9 shows Curl mode with scale of 100%, 250% and 500%:



*Figure 9. Curl mode scale values, 100%, 250% and 500%*

In Curl mode, too great a scale just results in noise.

## 12. Complexity

Only available in Simple mode, this is the complexity of the underlying noise function. Lower values produce less detailed results, but can be quite effective. Higher values only produce noticeable differences at high image resolution.



### 13. Iterations

Not available in Shader mode. The number of iterations is the number of times the distort function is processed for each point. In other words, if iterations is set to 3, the simple noise or curl function is called once, then again using the result of the first pass, and then a third time using the result of the second pass. As you might expect, this considerably increases the complexity of the final result. Figure 10 shows the shader in Curl mode with 1, 2, and 3 iterations respectively:

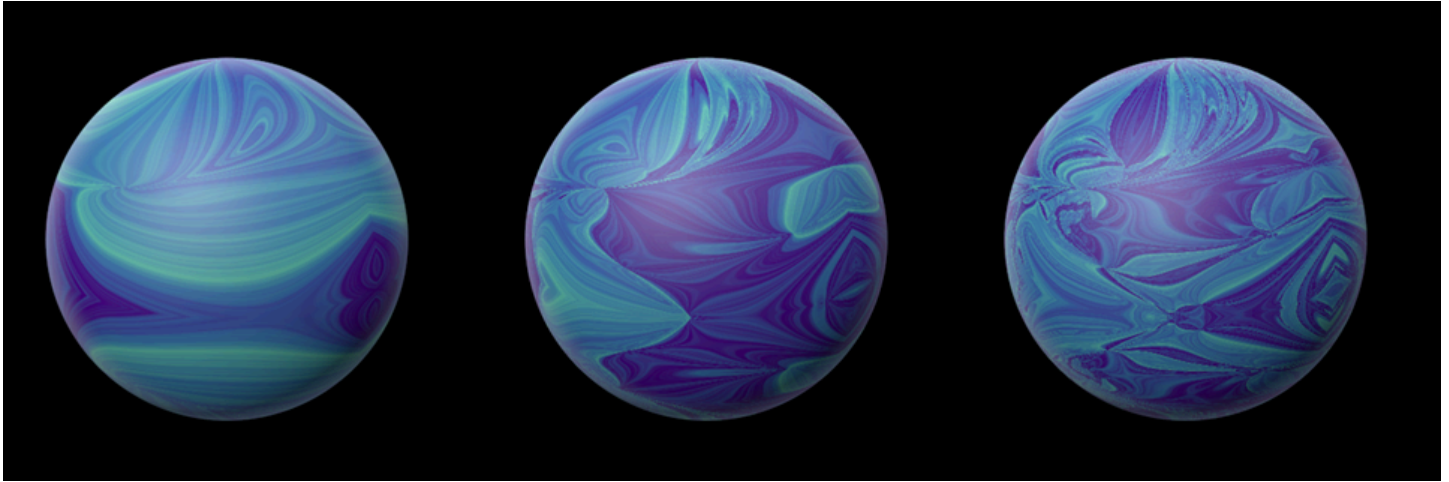


Figure 10. The effect in Curl mode of using 1, 2, or 3 iterations

### 14. Animation Speed

If the distortion mode is set to 'Simple' you can animate the noise using this control. The higher the value, the faster the animated effect. You won't see this until the animation is rendered, it won't show in the viewport.

This is not available in 'Curl' mode. In 'Shader' mode you can of course animate the shader used.

### 15. Seam Avoidance

The distortion functions can result in a very obvious seam when the shader is applied to a sphere. This may or may not matter. If you are creating a still image, you can simply rotate the sphere so the seam is not visible. If you can't do that, this control offers two ways to try to avoid seams. These are as follows:

- None: no attempt is made to avoid a seam (this is the default).
- Reflect UVs: UV X and Y coordinates have values ranging from 0 to 1. In this mode, values of 0.5 or greater are converted into their mirror value, so that (for example) 0.6 becomes 0.4, 0.9 becomes 0.1 and so on. The result is that when the edges of the UVs meet, they have the same sampled value and so no seam appears. The disadvantage of this method is that the texture is effectively mirrored around the sphere and this can be noticeable. However, it is the faster method when rendering.
- Blend UVs: in this mode the results of the noise or curl functions are blended when the UV values approach their minimum and maximum values. This is a better method than reflection but is slower to render.

When will you need this setting? There are some general rules.

Simple mode will probably never need it, since the returned result should always be seamless.

Curl mode will always produce a seam and you will need to avoid it using this control.

Shader mode may or may not require it. If you use a Noise shader and leave it in its default 'Texture' space, you shouldn't need to worry about seams. However, in 'UV (2D)' space, you will almost certainly get a seam. Other shaders, including useful ones here such as Cyclone, Rust or Galaxy, will all produce a seam.

### 16. Distort Shader

This is the shader used for the distortion in Shader mode. You can use any shader you like here. Noise is the obvious choice but it's worth trying others. You can use a Layer shader and add multiple shaders to that.

### 17. Colour correction

The next four controls are colour correction settings which are the same as used in any other software. Very briefly they are:

- Brightness: alters the brightness of the colours; 100% gives white, and -100% results in black.
- Contrast: alters the contrast between different colours.
- Saturation: alters the colour intensity; the brightness is unchanged but the colour looks more or less vibrant depending on the setting.
- Gamma: alters the gamma value applied to the output colour.

Note these settings give exactly the same result as if you added this shader to a Layer shader then applied a Brightness/Contrast/Gamma effect. They are included here for convenience.

### *Use in Redshift*

Since it isn't possible to write a native Redshift node to reproduce this effect, you must use the C4D Shader material to use this shader in Redshift. 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)

For this particular shader, there are a couple of additional (but optional) steps you can take.

First, in the RS Material node, adjust the brightness and roughness of the reflection. Planets reflect light but you don't really want a shiny mirror planet or one with a bright specular highlight.

Secondly, if you experiment you will see that the atmosphere effect from the shader has little or no effect. To get better results, we need a few more steps in the shader graph for the RS C4D Shader material:

- Add a Fresnel node.
- In the Fresnel node turn off 'Use Index of Refraction' (this is important).
- Link the 'outColor' output of the Texture node to the 'Falloff Color Facing Color' input of the Fresnel node.
- Link the 'outColor' output of the Fresnel node to the 'Diffuse Color' input of the RS Material node.

The node graph is shown in Figure 11.

This works fine and you can change the atmosphere colour by changing the 'Perpendicular Color' in the Fresnel node. Very usefully, you can change the extent of the atmosphere shading by altering the 'Curve Falloff' value. Reducing this will increase the atmosphere effect; in the images in Figure 12., the atmosphere colour is red (easier to visualise) and the default curve falloff setting of 5 is on the left, while the right image has a curve falloff of 2.5.

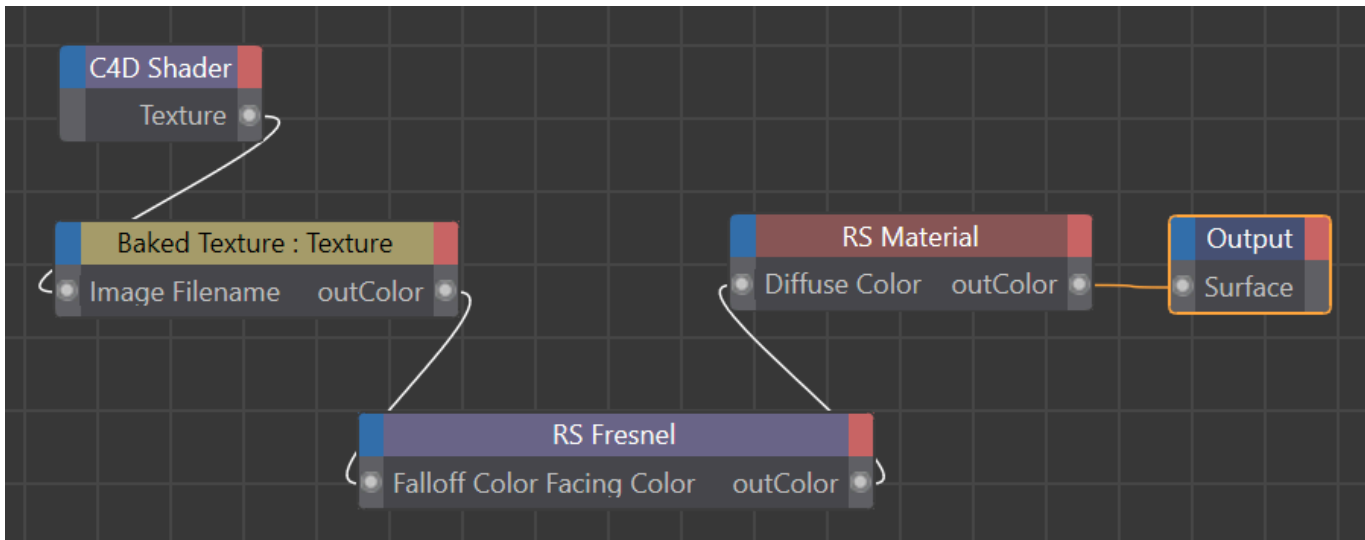


Figure 11. Redshift node graph using a Fresnel node for the atmosphere effect

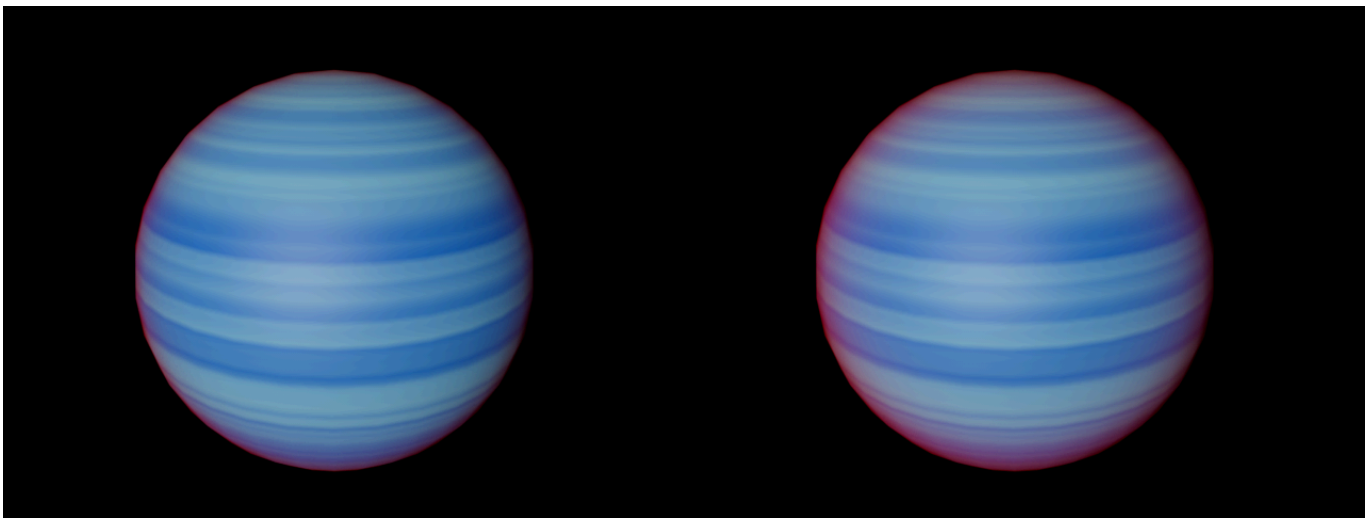


Figure 12. Using a Fresnel node in Redshift. Left, curve falloff of 5 (the default); right, curve falloff of 2.5

Note that if you want to control the other aspects of the shader itself, such as distortion, you will need to edit the shader in the shader graph of the C4D Shader material. Annoyingly, if you are using the Redshift Render View with a Standard material and you make changes in the GasGiant shader itself, these may not cause the Redshift render view to update - then you will have to update the render view manually.

I wish there was a simpler way of using standard C4D shaders in Redshift, but for now this is the best that can be done. To save you some time, a pre-built material using the above setup is included in the download archive, so all you have to do is edit the shader to get the desired result - all the other steps to use this shader in Redshift are already done.

### And finally...

I hope you enjoy using the Gas Giant shader. This is the second in a series of shaders to be used for creating space scenes, with more to follow!

You can get the latest version from my site at <https://microbion.co.uk/html/gasgiant.htm> and if you have any comments (or find any bugs) you can contact me at <https://microbion.co.uk/html/contact.htm>.

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