

CREATING STAR FIELDS & NEBULA IN BLENDER

Blender Nebula Tutorial

3D Procedural Nebula in Blender 2.36 By COG aka Colin Litster

Areas Covered

This tutorial will show how to simply create star fields and nebula within Blender. The techniques used here are relatively straight forward and were discovered by accident whilst trying to create a slow mist like fog for my animated film Cog. As with anything 3D there are many ways to create effects in Blender or any 3D design package. This is just one way and like waves there are billions of stars in the universe as well as usable approaches in Blender. However, the techniques used here are relatively quick to render and are 3D. Which means the camera can travel through them, rotate and move over or pass them and give a good visual impression of gaseous clouds that exit within our galaxy.

Prerequisites

As with all my tutorials you should have a minimum understanding of creating, scaling moving and rotating objects in Blender. How to create a Material and add textures. The Blender 2.3 manual, or the online documentation, is the best place to learn these fundamental skills. You should understand IPOs at least how to select an IPO selection and set a point on an IPO curve. In fact in this exercise only 1 point needs to be set on each IPO curve.

This tutorial was produced in Blender v2.36 but was originally discovered in v2.34 so any of these versions should be possible. I would recommend that you update to v2.36 anyway because of the extra features offered in this latest edition of the free and quite wonderful Blender 3D design suite.

Researching Inspiration

As with my last tutorial I suggested that it is valuable to do some visual research to aid you in the design process. Fortunately there is a wealth of visual material now freely available via the www. Hubble has produced some really fascinating high quality images of our universe. Many of these are so good that they display far more than would be visible with the naked eye or even a high quality film camera in space. Therefore, you might want to use these with caution. For my feature I toned down the effects to give a natural background that will not drown the main action in the scene. Therefore subtlety I believe is important. However, please adapt what is here to your own needs.

Lets get started

Start a new scene in Blender and delete the default cube or plane so that you have no objects in the scene. We are going to create our scene in several stages. The order for doing this will I hope help make it easier for you to see what's going on. In actual fact


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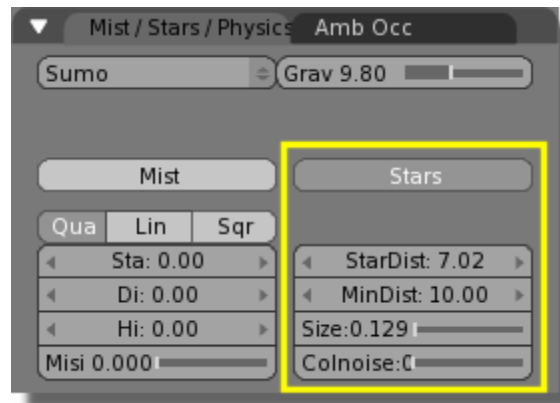
you could create this scene in almost any order and it would still work but since I have the helm at this time I will navigate our starship to help this tutorial in the following order:-

- creating a background star field
- creating the nebula gases
- colouring the gases
- creating the nebula stars
- lighting the nebula
- freezing the nebula in space

NOTE: Before we truly start save your blank blend file with a name like nebula-01.blend. This is always a good idea and means that you can increment the number as you move through the tutorial and get back to any point if you make a mistake. Although Blender 2.36 has an excellent undo feature (CTRLZ undo and SHIFTCTRLZ redo) nothing beats this extra level of backup.

Creating a background star field

Blender has a reasonable star feature built in. It is found in the World setting of the Materials setting. You can select it by pressing F8 on your keyboard or selecting the world symbol on the panel once the materials button has been selected.  Once selected ensure that the Mist/Stars Physics tab is selected and that the following settings are entered.



That's the:-

Stars button selected. (Stars can be turned on and off with this button)

StarDist: 7.02 (The average distance between stars. The smaller this is the more stars will be displayed.)

MinDist: 10.00 (The minimum distance from the camera before stars appear. This is important as if your not careful stars can actually appear in front of your object)

Size: 0.129 (This is one of the most import star settings. If it's set too high the stars will look like cartoon ones. However, that might be what you are after. In this example its set very small)

Colnoise: 0 (This appears to only have 2 settings i.e. 0 is white stars and 1 are coloured stars. I prefer white stars as the other is a bit too random and colourful.)

You will notice that the camera view will display white dots approximating where the stars will be when you render. Although this can be useful occasionally it will mask your objects, particularly particles. That's why it's occasionally useful to de-select the Stars button while you are placing particles or objects in a scene. However, when you want a test render be sure to turn them on again. Do a test render now and you will probably have a mid blue background with some white stars. Go back to the world settings and turn the colours of the HoR/G/B (Horizon) and ZeR/G/B (Zenith) to black. That's all down to 0.0.

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Re-render and you should have a star field to act as our background for the Nebula.

SAVE your work as nebula-02.blend (F2 Saveas)

Creating the nebula gases

We will create our nebula using a particle system and to do this we require a mesh to act as the particle emitter. You can use any mesh object Uvsheres, Icospheres, Cylinders or Planes. Even Monkey can be used. However, ensure that the object has plenty of vertices so that enough particles will be emitted.

For our example I have used a plane at location X,Y,Z =0, and its size set to **2.475** for X.,Y and Z.

I also have the camera at:-

LocX: 0.0

LocY: -6.256

LocZ: 2.356

RotX: 71.630

RotY: 0.0

RotZ: 46.692

With a default Lens setting of **35.00**

Before we save our work let's prepare the mesh for the particle system. Select the plane if it's not already selected and switch to mesh edit mode by pressing the **TAB** key. Ensure that all vertices are selected by pressing the **A** key. They are selected when highlighted. Then press W and select subdivide 5 times. That will give us a grid of vertices 64 by 64 or 4096 vertices plenty to create a good particle emission.

With the vertices still selected select HASH from the edit window. This will randomise the vertex sequence data and thus produce a better (less regular) nebula.

SAVE your work so far as nebula-03.blend (F2).

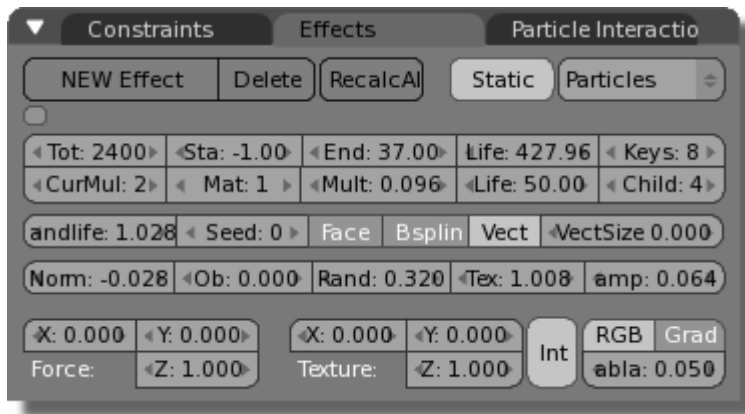


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Creating the particle system for the nebula

The use of particles within Blender is quite complex so I don't intend to give a detailed explanation of the variables. Instead use the settings here and experiment later if you wish. Anyway the distribution of the particles is fairly arbitrary as you will see later you can vary the positioning before you fix them in position.

With the plane selected and NOT in mesh edit. TAB will toggle the 2 states press **F2** for the Object menu and select the Effects tab and New Effect, Particles. Then set the following options:-



You could render this now but because there is no material set it will give a very false impression. So have faith and bear with me because next we will create the nebula gases to be applied to our particle system.

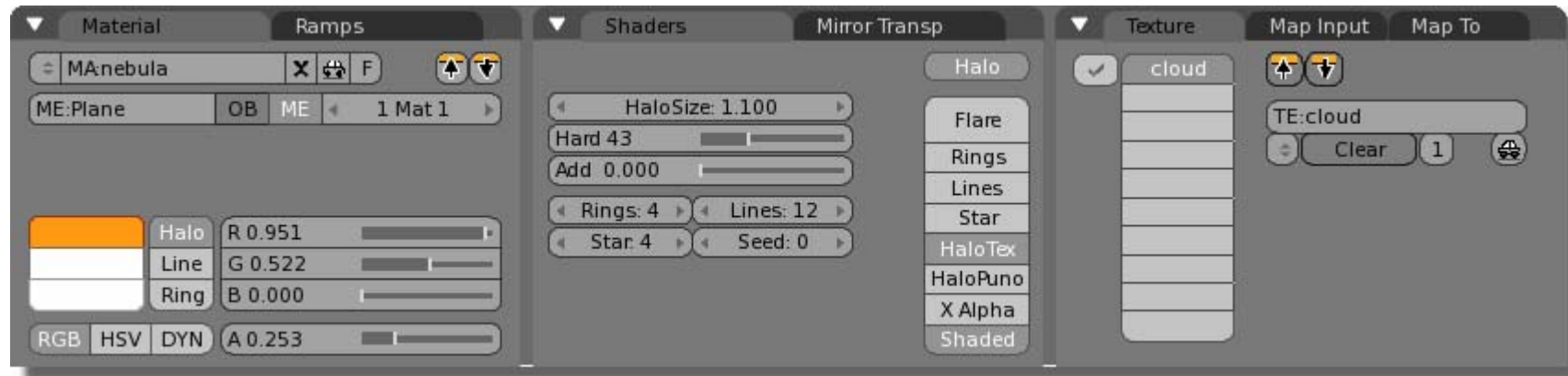
You will be pleased to know that's the only particle settings required. We will merely copy this single object and its attendant particles for use with the proto stars and the internal nebula illumination. But that's later.

Colouring the gases

Particle systems use Halo materials, unless they have Dupliverbed meshes attached (more later). Halos are also complex subjects but with care can produce beautiful and subtle effects. There lies the warning because they can also be gaudy, dire coloured, nightmares as well. So try not to be too wild with settings because it's easy to forget how to get back to that wonderful starting point 30 mins ago. Even with the undo feature in Blender 2.36.

With the plane selected press **F5** for the materials settings and select the Halo material on the Shaders tab. This will change the selections available for this type of shader; we will only be selecting 2 of these settings for the nebula. These are **HaloTex**, which allow a texture to be applied to the halo, and **Shaded** which to receive both light and shadow. This more than anything will help produce the 3D look to the nebula. Copy the other settings from the following screenshot before I continue:-

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The Halo colour is arbitrary although for my purposes this nice orange colour works. Of more importance is the **Alpha** setting of **0.253**. This ensures that in combination with the **Halo Size 1.10** the individual particles will not look like misty stars but more like gases. The **Add** setting is also set to **0** and this will ensure that if multiple particles are in close proximity they will not start emitting or glowing. We will achieve a much more subtle glow later using lights.

Note: You will see that I have named this material meaningfully. This is always a good idea because you might want to use this material again by appending it to another blend file. It's so easy to forget which material or object is which if they only have the default names.

You can if you wish render this now to see how it's shaping up. Make sure that the Stars are selected in the world settings **F8** to give a nice space background.

It will probably look a little uninteresting. That's because it is more like even fog rather than textured gas. It needs texture to give it some shape.

Adding a texture

Select Texture by pressing **F6** and from texture slot 0, that's the top one (I wish they would number these by each slot. Note to Blender requests) and from the **Texture Type** select **Clouds** and use the following settings.

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Notice that the **NoiseSize** is **1.394** This setting more than any other will make or break your nebula. If it's set to low the cloud pattern will repeat across the nebula and look very unnatural. If you set it too high the gaseous effect will not work and it will look much like the untextured render you did before applying this texture. If you get repeating patterns increase this setting slowly and render between each change until you get a pleasing result. Judging by eye is often the only way to get the right result.

In order to get this texture right for a nebula effect we need to setup the way it will affect the material colour and transparency. In fact this texture is only used to set the alpha colour and is multiplied. Normally if you wanted alpha applied to a material you would have to set **Ztransp** in the Mirror Transp tab of the materials buttons but for a nebula it's best not to. That's because nebula quite frequently have black areas through which little or no light can penetrate. Therefore in this example it works really well to have ZTransp deselected.



With all other settings as above Render again and you should have a reasonable gaseous effect.

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SAVE your work once more remembering to increment the filename number.

Creating the nebula stars

To make a nice nebula it would be good to have a few proto stars within the nebula gases. Because we want them to be placed throughout the nebula we might as well use a similar particle system to create them. To save time we will create a copy of the nebula mesh object and just make some minor alterations.

IMPORTANT NOTE

When you copy an object all its materials, particles and any IPOs are copied with it. Whilst particles and IPOs are referenced to each copy the materials will be shared. That means if you alter a material on a copied object it will change on all other objects using the same material. Therefore remove the material from each copy and start each of these object materials from scratch. It's also a good idea to place each copy on a different layer so that you don't edit the wrong object. This is how to do it.

With the nebula object selected press **SHIFTD** to make a unique copy of the mesh.

Your copy will be in grab mode and if you move the mouse the new copied object will move with it.

Click the right mouse button and the object will default to its creation point right on top of the nebula mesh.

Press **M** which will bring up the layer selection and select another layer and the object will go to that. To see that layer you need to select the correct layer from the header on any of the view windows. You have 20 layers to choose from.

Before we go any further let's remove the material from this copied particle mesh and rename it appropriately.

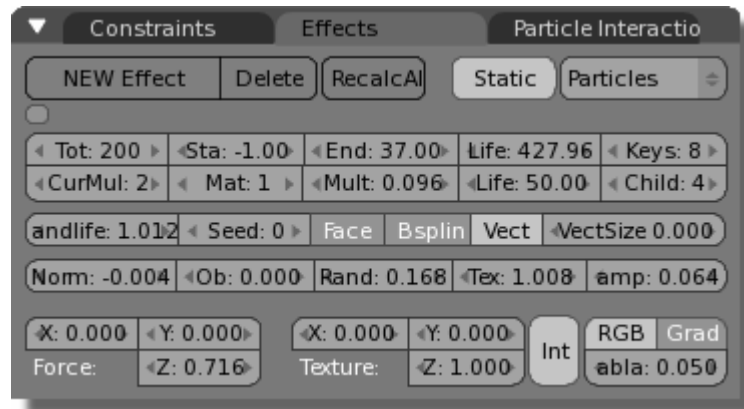
With the copied object selected, press **F5** for the material buttons and in the material tab select the **X** just by the little car symbol. This will delete the material link to this object.

Press **F9** for the Editing button and change the **OB:** name to stars.

Changing the particle system to give a few stars

Press **F7** (Object button) and make the following changes to the particle system.

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As you will see there are a few changes here. Most notably the **Tot** set to **200**. The reason for these changes is to produce only a few stars within the nebula.

Setting the Star material

For stars we need another type of Halo material but this time using some of the other options. So select **F5** for the material buttons and add a new material with the following settings.



Note the low **HaloSize** of **0.35** and the **A(lpha)** setting of **0.167**. This ensures that the stars will not be too large or overwhelm the scene. Also these Halos have **Rings**, **Lines** and **Star** set.

SAVE your work once more incrementing the number in the blend filename. Remember that's **F2**.

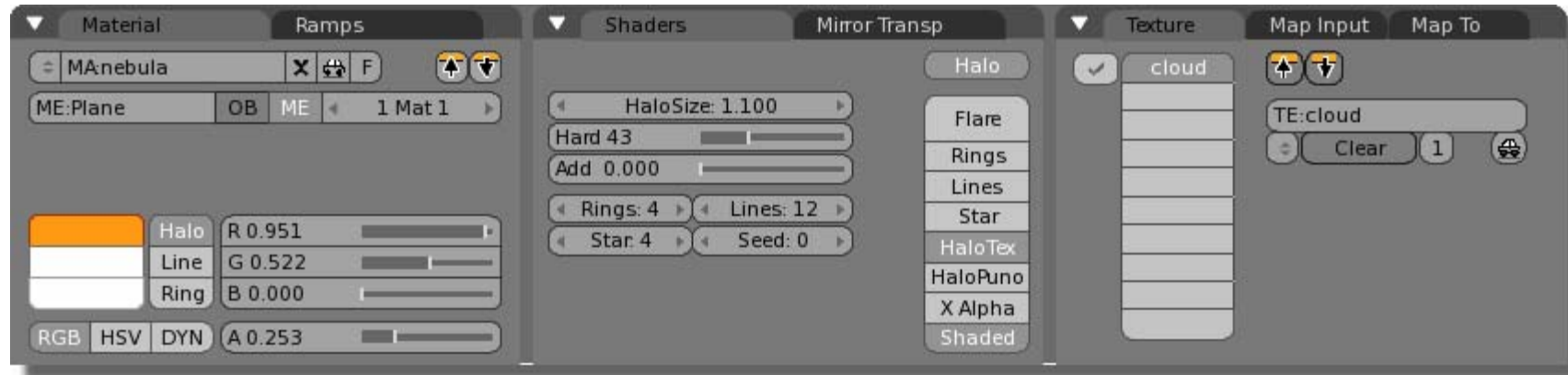
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Render the scene making sure you have all the layers with your nebula and stars selected. You do this by holding down the shift key and selecting each of those layers in the header. Press **F12** to render.

Well we are getting close to finishing our nebula just time to add another little trick to the work.

Lighting the nebula

You will remember that when we created the initial material for the nebula mesh we selected **Shaded** as one of its Halo settings.



This allows the material to receive both light and shadow. That means we can further illuminate the nebula with external or in our case internal lights. The best lights for doing this are sphere lights because we can alter the influence simply by changing their diameter and intensity. However, rather than manually setting the lights lets use another particle system and dupliver a single light throughout the nebula.

Select the stars mesh we have recently been working on and press **SHIFT D** to make a unique copy.

Right click to place the copy over the original but press **M** and select another layer to keep it separate.

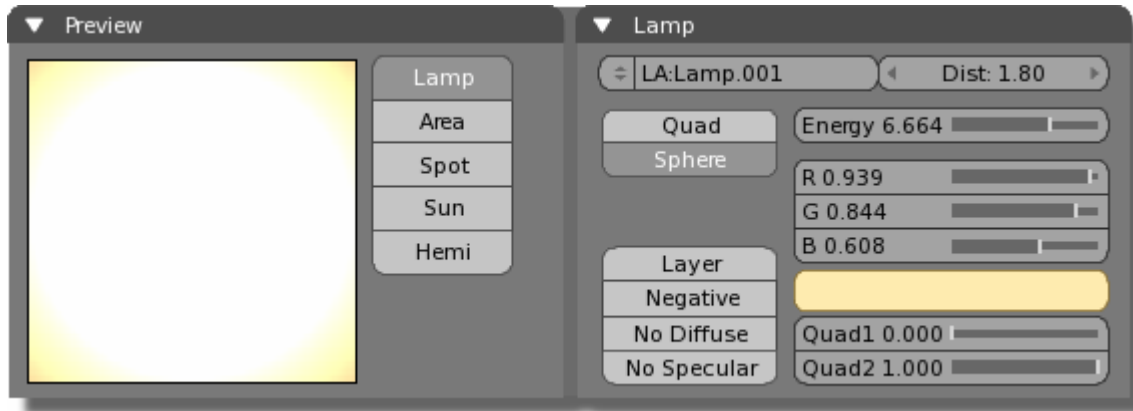
As with the previous copy remove the material and from the Editing button **F9** name it glow.

Fortunately the particle system is identical to the star object so we don't have to change that. In fact we don't have to have a material for this particle system because we are going to dupliver a light source to each of the particles. So let's start by creating that single light.

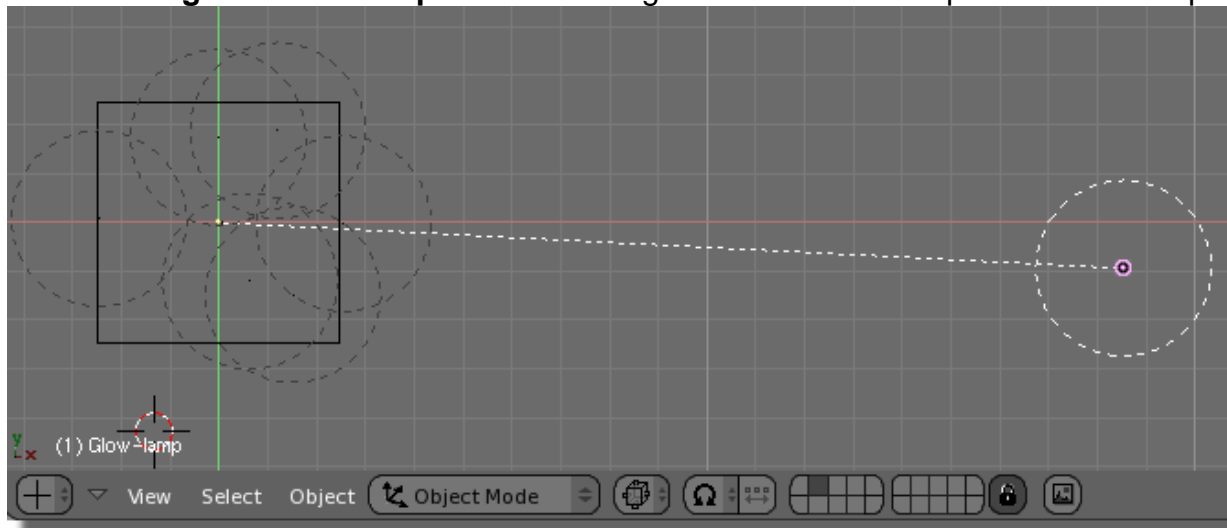
Left click the mouse well outside the camera view and press **SPACE** and **Lamp**, and the default **lamp**.

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Switch to the Material lamp button **F5** and the little lamp button in the Panels header. Set the lamp tab to **Sphere** and the **Energy** up quite high **6.664** the reason for this intensity is because we have not used **Ztransp** in the nebula material and therefore there is no real transparency through each particle. There is however between them, so it does have an illuminating effect which is quite nice. The other setting of note is the **Dist** which is set to **1.80**. This will give a nice tight glow to the stars in the nebula.



To dupliver, or copy this lamp to each particle we need to parent it to the particle system. With the lamp selected hold the Shift key whilst selecting the glow particle system. Then press **CTRLP**. Now just select the glow particle system and press **F7** and from the **Anim settings** tab select **DupliVerts**. Your light should now be duplicated on each particle.



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REMEMBER TO SAVE YOUR WORK

We have almost reached the end so its time to see what our nebula looks like with a final render. So make sure each layer with your objects on is selected. Once again to do that, hold the Shift down while you select those layers in the header of one of the view windows. Press **F8** the world menu and ensure that **Stars** is turned on. Press **F12** to render the scene.



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Freezing the nebula in space

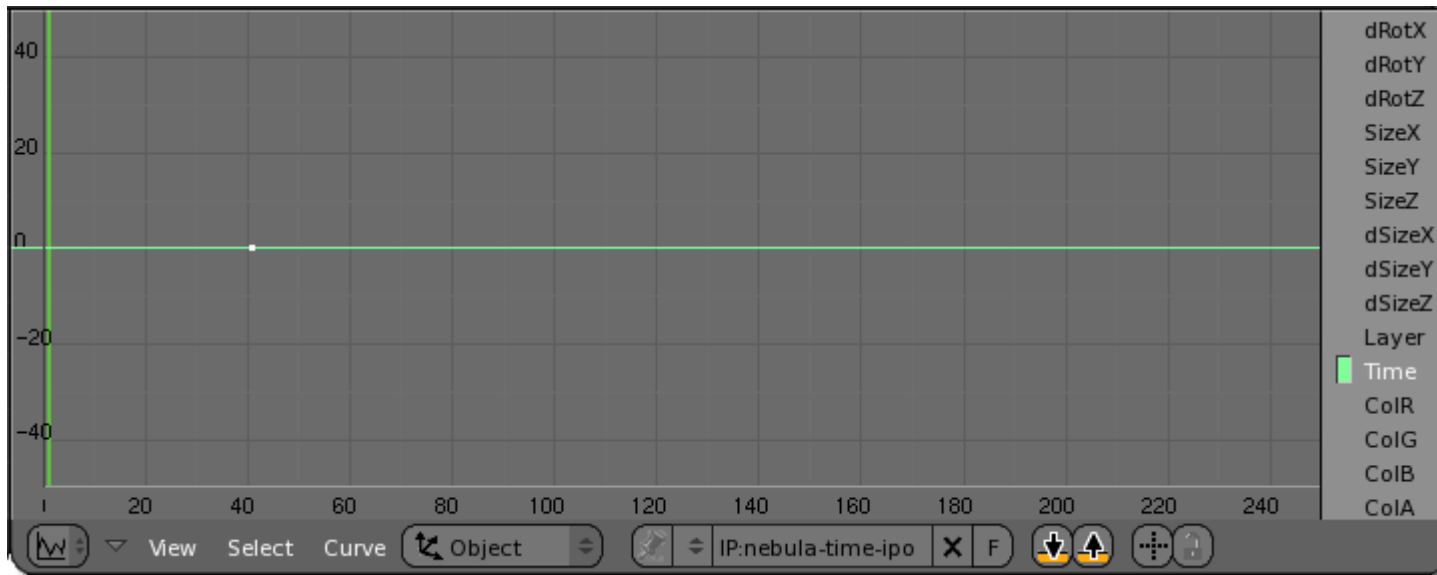
Well it looks very nice but if we were to use it in an animation the nebula would very quickly disperse because at the moment it's a very dynamic particle system.

This is where we need a bit of Blender magic and that comes from the Time IPO.

Time IPO

Each object in Blender can have a time IPO enabling the speed of each object to be independently controlled. Not only can this be used to vary the speed of an object it can also be used to freeze or stop a moving object such as a particle system or even reverse the speed. Thing of this you could make particles go back into their emitter. However, stopping a particle system is what we need here and it's very easy to achieve.

Select the nebula particle system and then an IPO window. With the object selected locate and select the **Time** setting on the right of the IPO window.



Now create one control point by holding **CTRL** and selecting with the **LMB**. Set it as close to 0 as possible. That means the particle system will be frozen near to frame 1 which is as our single frame render was before. All that now is required is that this time IPO is copied to each of the other particle time IPOs. If you don't know how to do this consult the Blender manual or documentation as it's a fundamental skill. If you don't know just select each particle system and set their time IPOs to 0.

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Wrapping things up

Earlier I said that the effect is very 3D well now is the time for you to create an animation around your nebula. You could constrain the camera to one of the nebula and create some keys and suitable points around it. I will leave that up to you. However, hopefully you can see how to adapt the techniques described here to create your own nebula.

You might even like to experiment with cloud systems. Just light them in a similar way to real clouds. It works just as well.

Anyway good luck with your blended nebula. Time to hand over the starship to you.

COG