CIS367 - Computer Graphics

More Blender!

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yoo that's some
good Blender

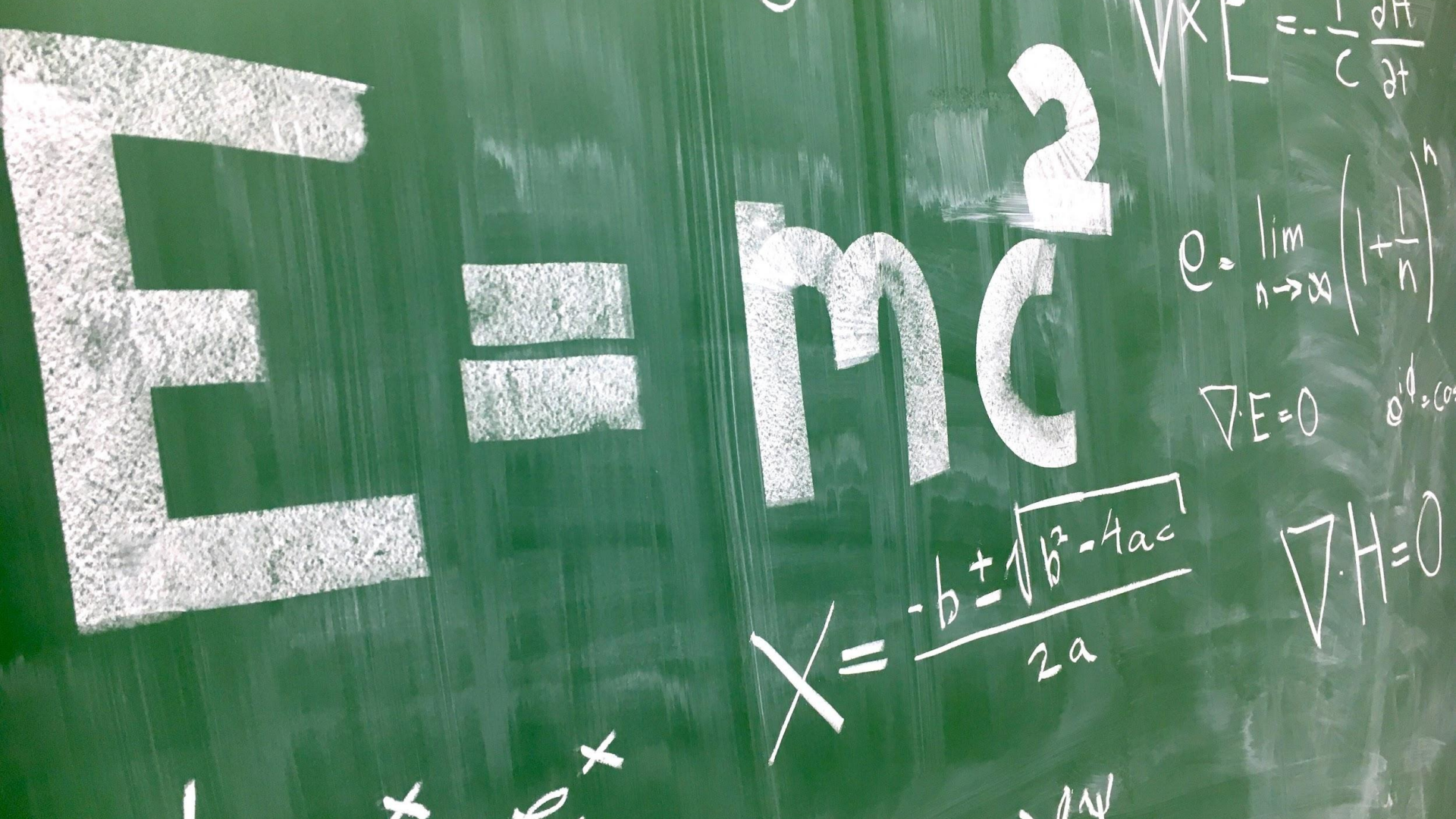
What else could there possibly be?

Physics

Geometry nodes

Post processing

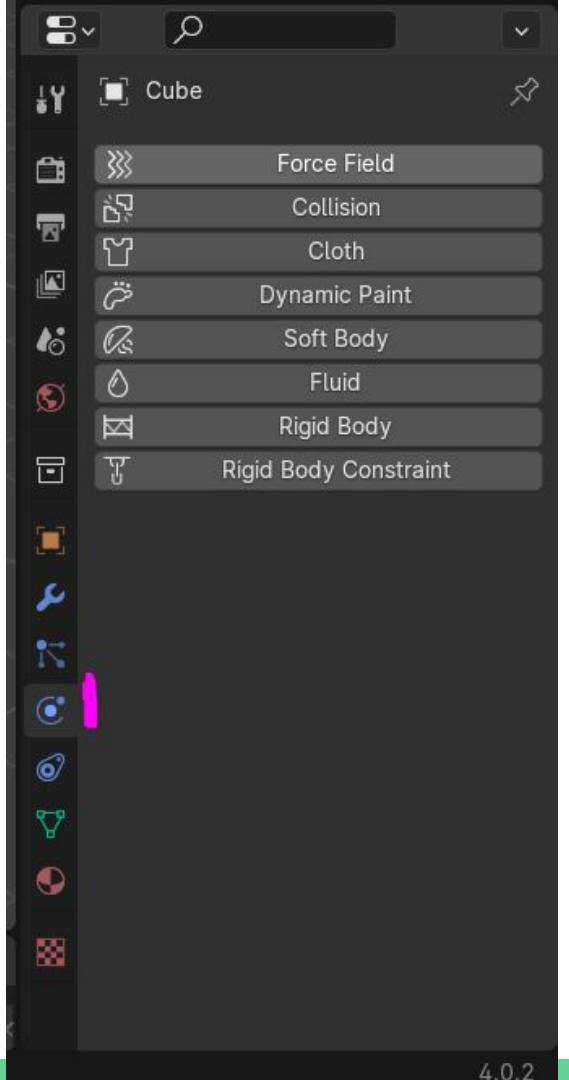
Animation


E = mc²
$\nabla \times E = -\frac{1}{c}\frac{\partial H}{\partial t}$
$e = \lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$
$\nabla \cdot E = 0$
$\nabla \cdot H = 0$
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Physics nodes are fun!

There are a lot of things you can do here

We're going to focus on collisions, cloth, and liquids, however there is a ton you can do with physics here

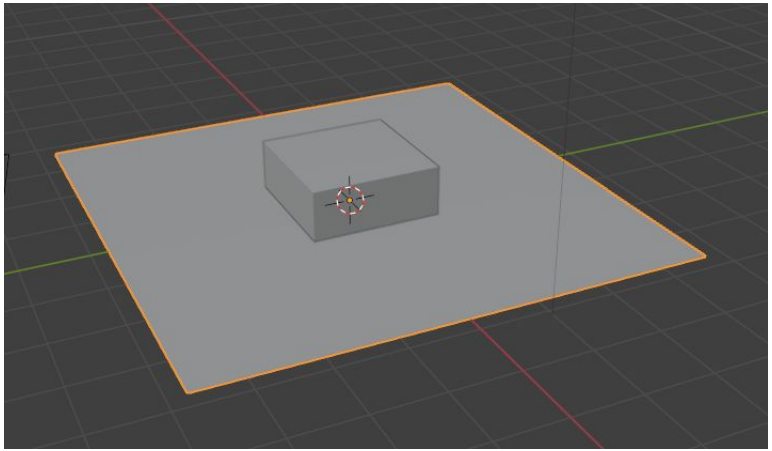


Rigid body collisions

Need minimally **two** things for a collision to occur:

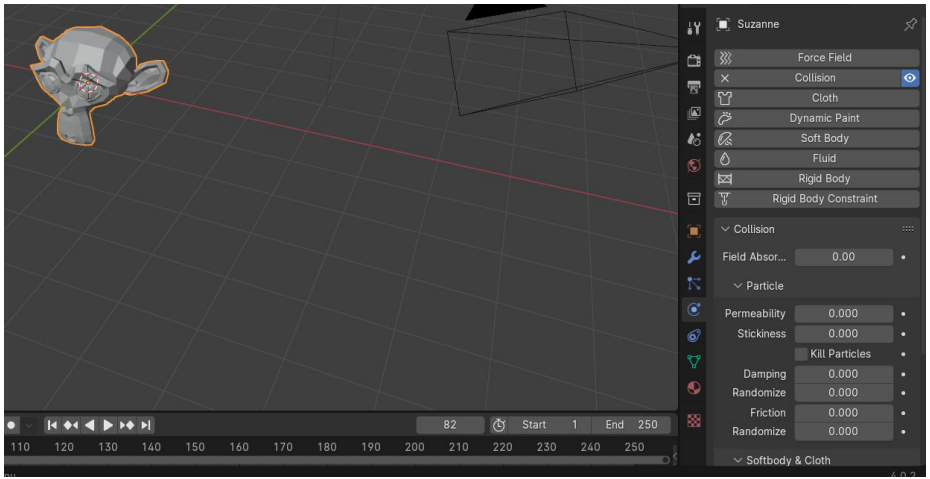
A rigid body that is **active**
A rigid body that is **passive**

Otherwise ➜



If you're seeing oddities with physics, try changing the Collision Shape over to Mesh

Cloth - Collidable Object



GET RID OF THAT CUBE

- Add a monkey it needs to look cute

Give your collidable object a **collision**

- Feel free to play with the params

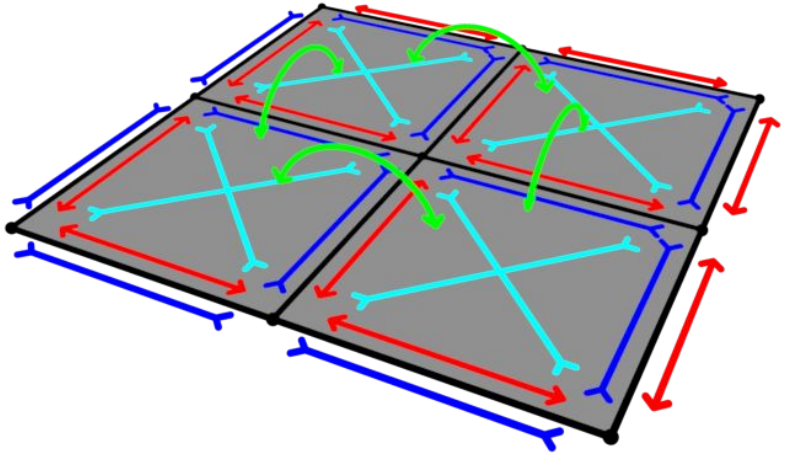
Goal is to make the cloth interact with the object itself

Note: don't skip around in the timeline! Physics need calculation

https://docs.blender.org/manual/en/latest/physics/cloth/introduction.html
https://docs.blender.org/manual/en/latest/physics/cloth/examples.html

The cloth itself

Modeled as a series of springs



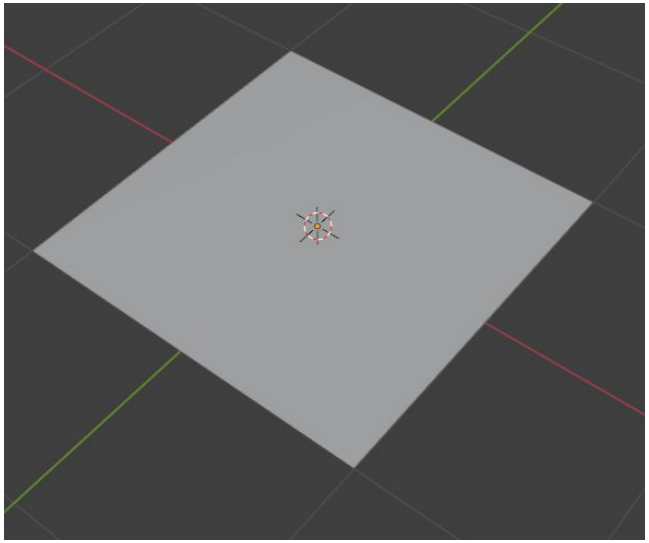
"Illustration of cloth springs; tension springs (blue), compression springs (red), shear springs (cyan), and angular bending springs (green)."

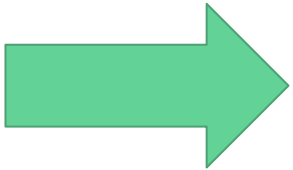
Essentially - gives you the properties of a cloth!

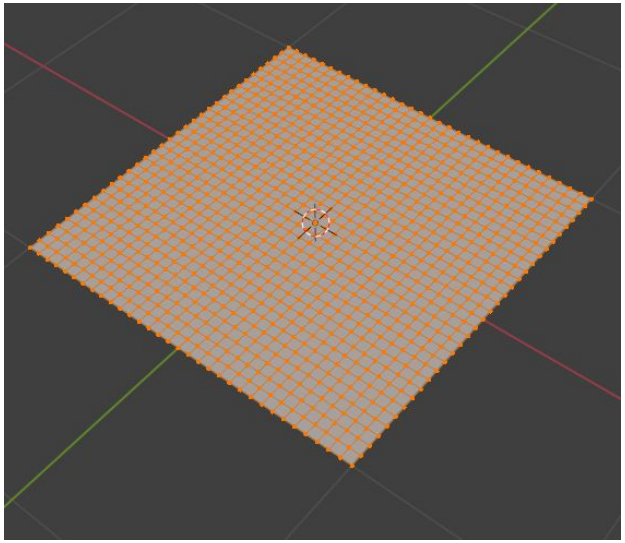
What do we need?

- A plane - SUBDIVIDED

Why?

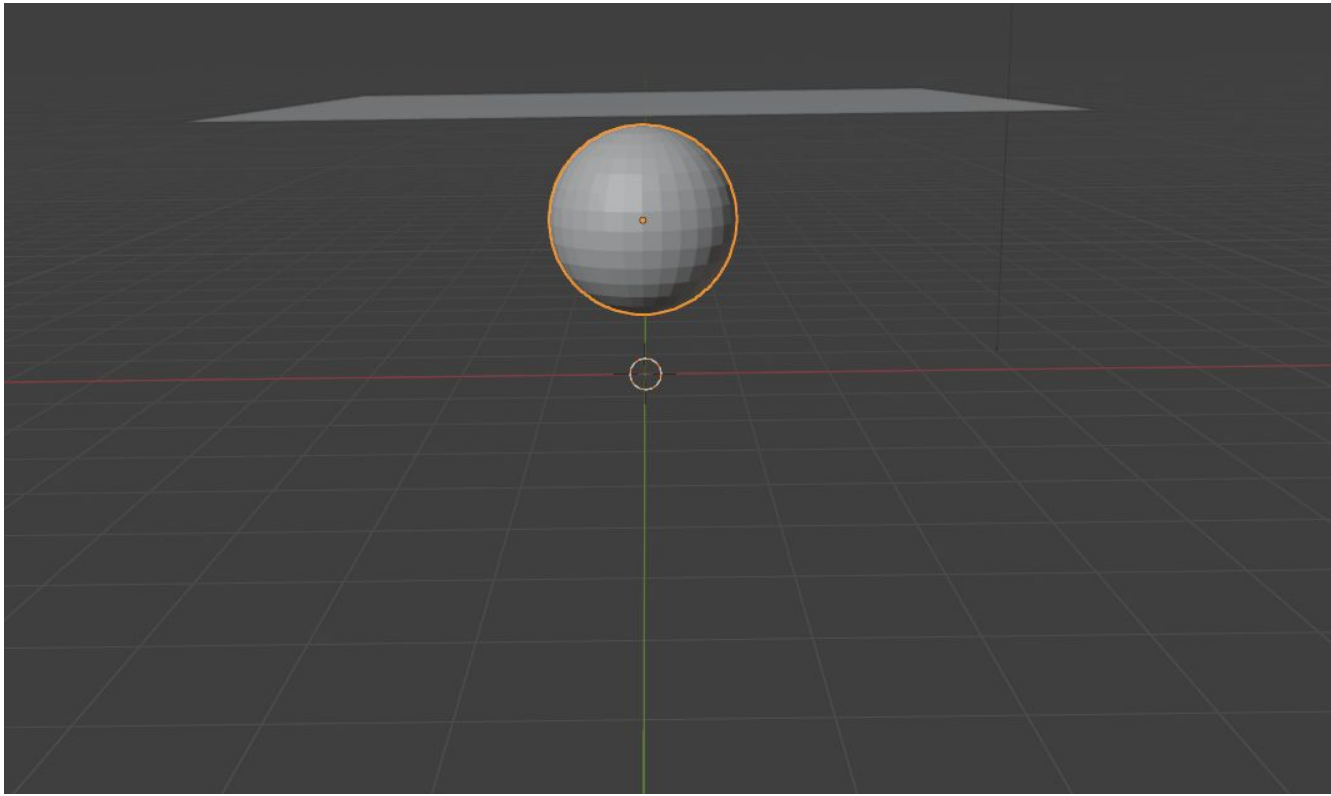


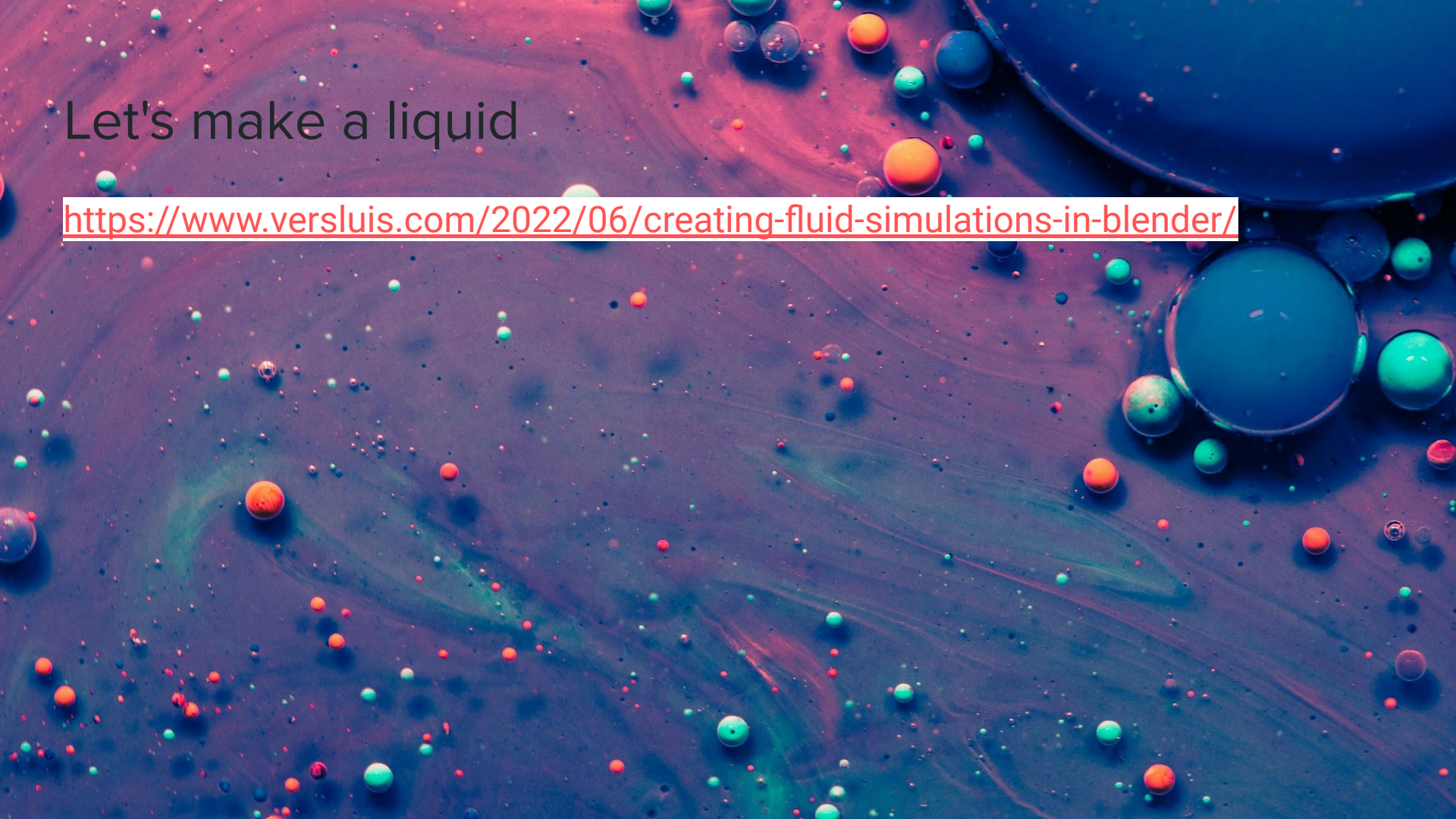




Let's make a spooky ghost

What do we need?





Let's make a liquid

https://www.versluis.com/2022/06/creating-fluid-simulations-in-blender/

What do we need?

A **fluid domain** ➜ to bound the simulation area

An **emitter** ➜ to create liquid particles

and...

Other things to interact with!

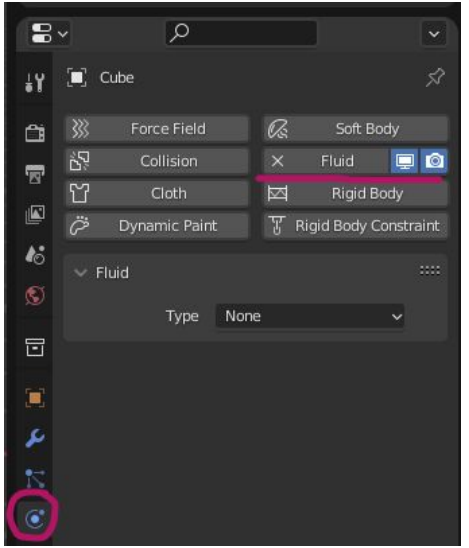
Note: lots of fiddly bits here!

Liquid → Fluid Domain

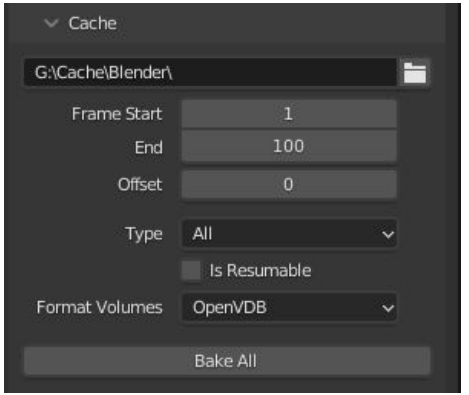
(Bold → things we have to do)

Use the default cube

Physics tab → Fluid



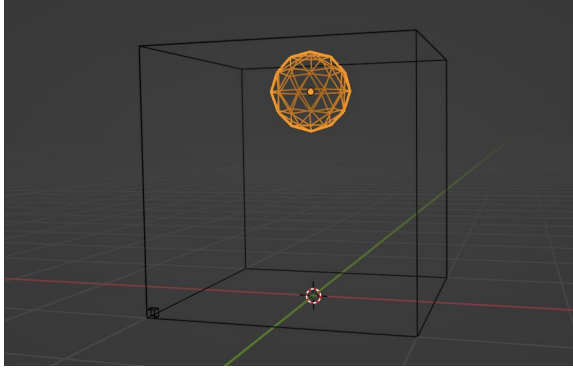
Type → Domain
Domain Type → Liquid
Resolution Divisions → particle size
Cache → where the output goes
Set duration for amount of time to simulate
Cache → Type → All



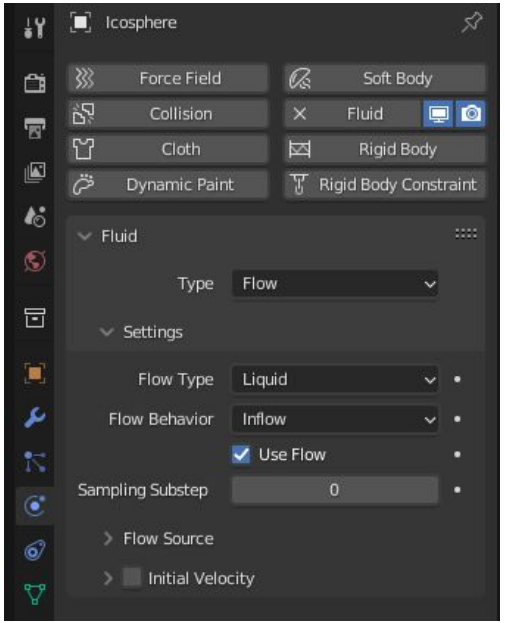
Bake All is how we simulate! Need to free/re-bake when making changes

Liquid

Add an object to emit liquid particles
➜ Liquid will fall from it



Physics ➜ **Fluid** ➜ **Flow**
Flow type ➜ **Liquid**
Flow behavior ➜ **Inflow**



Behavior notes:

Geometry	➜ flow object becomes liquid
Inflow	➜ flow object emits liquid
Outflow	➜ Object will drain liquid

Now bake!

Catch that liquid

Add an object to interact with it

Physics ➜ Fluid ➜ Effector

- ➜ Add "Is Planer" in case if things are wonky (or not enclosed object)
- ➜ Rebake!

Liquid into Mesh

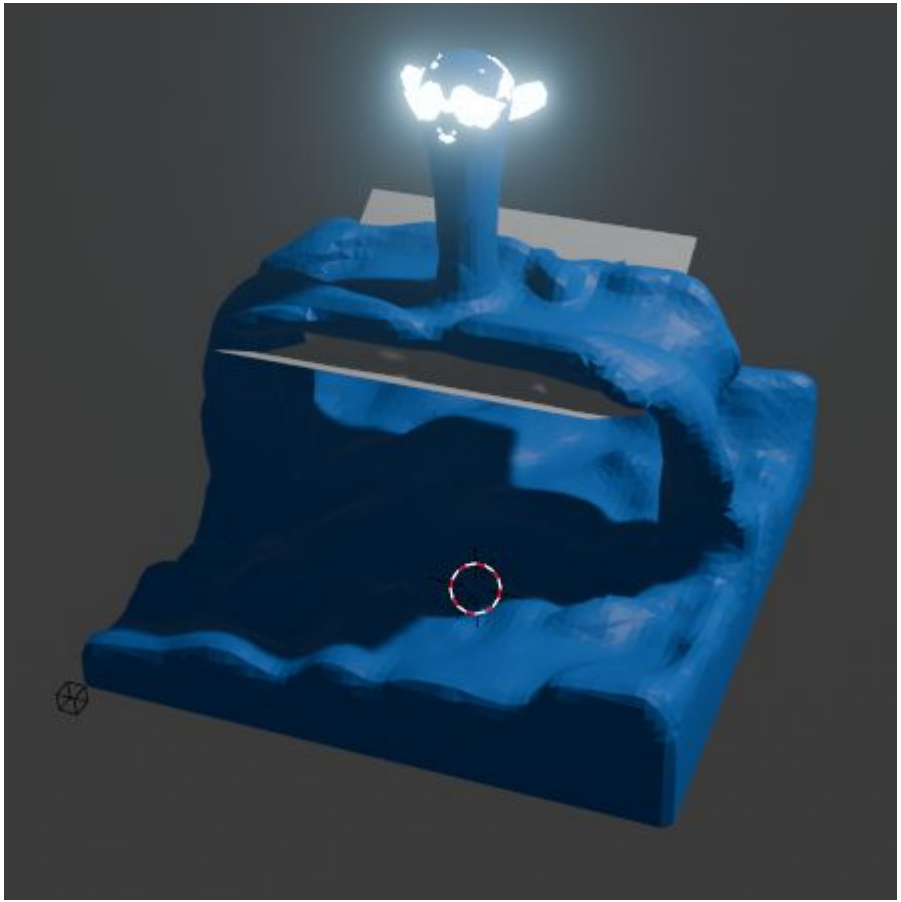
Less preview, more liquid!

Go to the Fluid Domain object (our cube)

Under Liquid, enable Mesh
Disable Liquid
Add material!

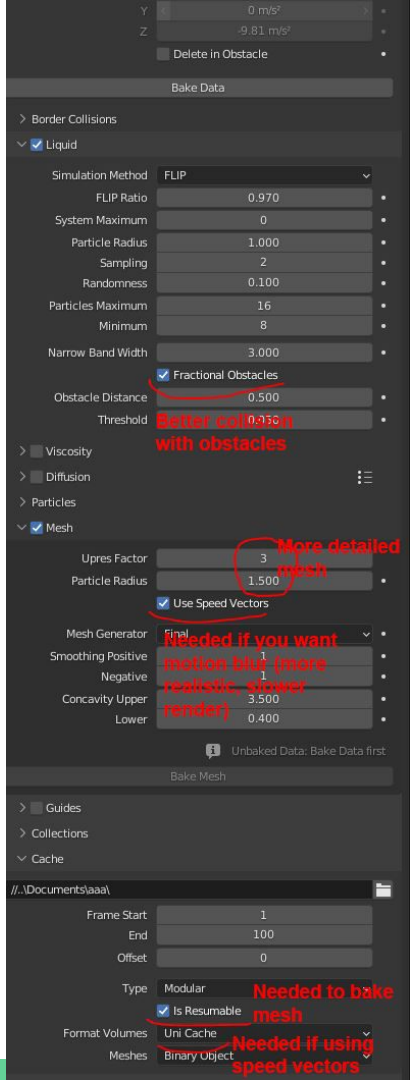
...

Bake!



(Not verified)

https://blenderartists.org/t/fluid-not-simulating-after-domain-is-resized/1396316/2

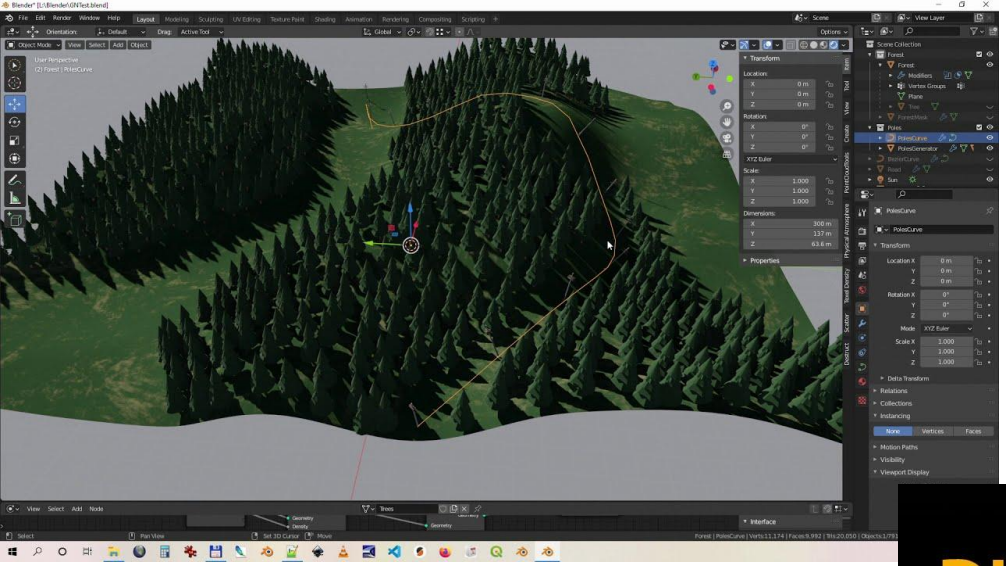


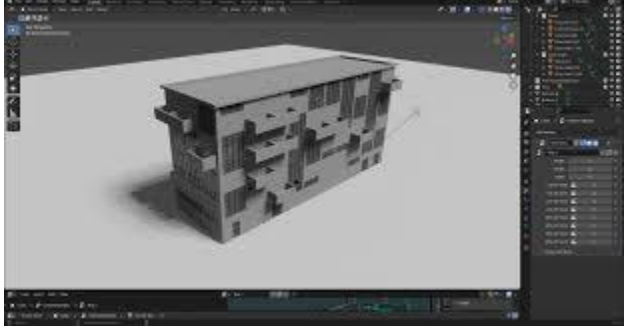
Geometry nodes

Hoo boy....the number of changes this workspace has gone through in the last year...

Note: if you are looking through guides/tutorials ensure you have the correct version

➜ And if you're at a newer version, lookup what old nodes have been renamed as :)

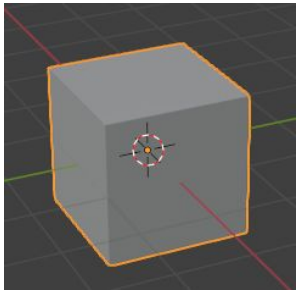




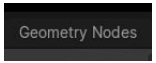
DUNGEON MAKER
WITH GEOMETRY NODES
Blender Tutorial

Lets instance some things

First, start with an object



Then, pop over to Geometry Nodes



Then make it the basis for some nodes

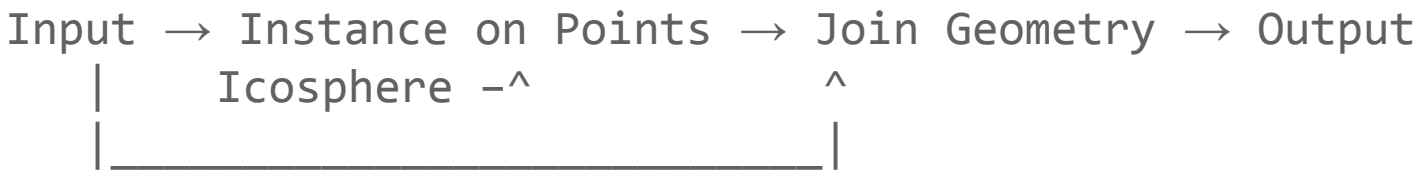
Some handy shortcuts

(There are many, but here are a couple that are helpful)

- Shift + right click will create a point on an edge you can add new edges from
- Ctrl + right click will sever an edge
- Dragging from a node outwards will auto-popup available nodes
- Shift + a will pop up the find menu where you can just start typing

(There's a popular extension called Node Wrangler that a lot of people use as well, if you get deep into this)

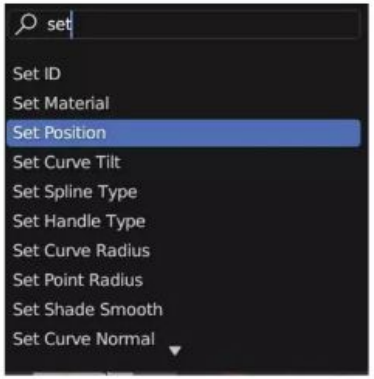
Either use that shape or sever the link and start building

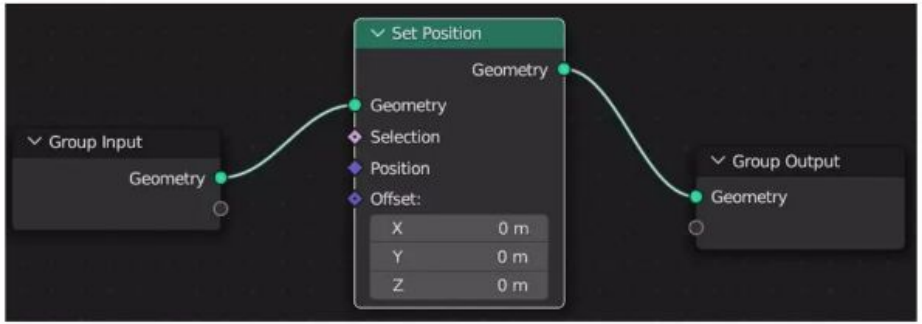


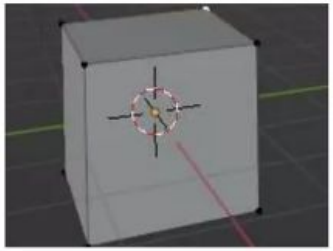
Borrowing some slides...

https://www.slideshare.net/ahlaamnss/3d-scientific-visualization-with-blender-geometry-nodespptx

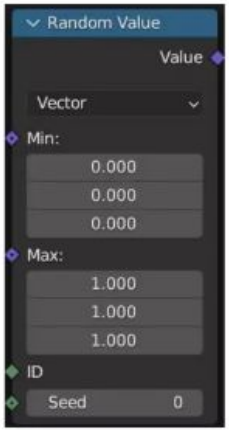
https://uhstudio.com/posts/geometry-nodes-snippets

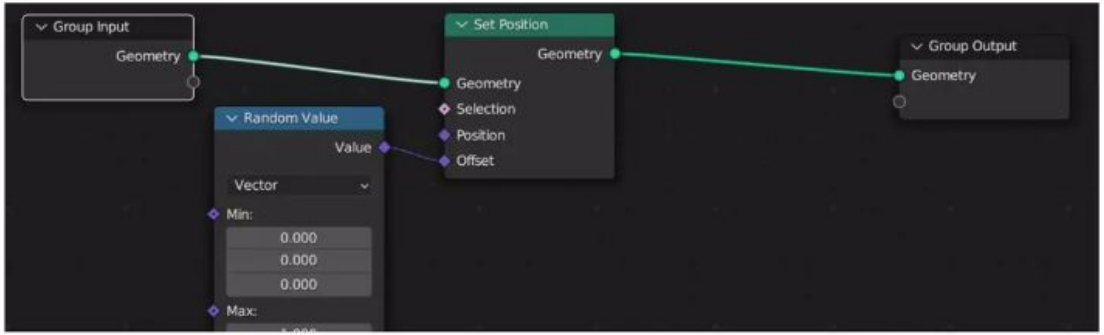


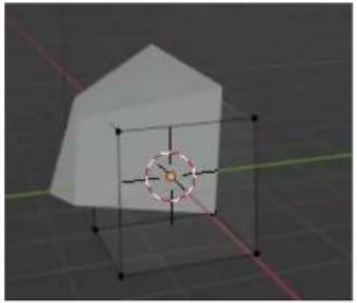


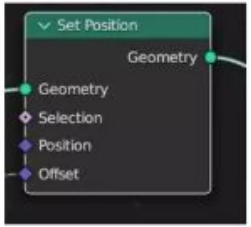


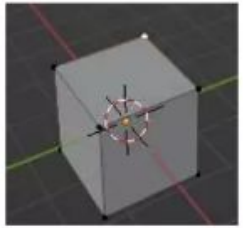
Set Position of the cube

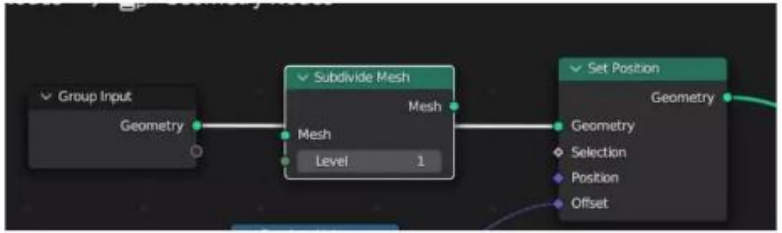






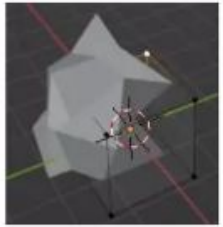


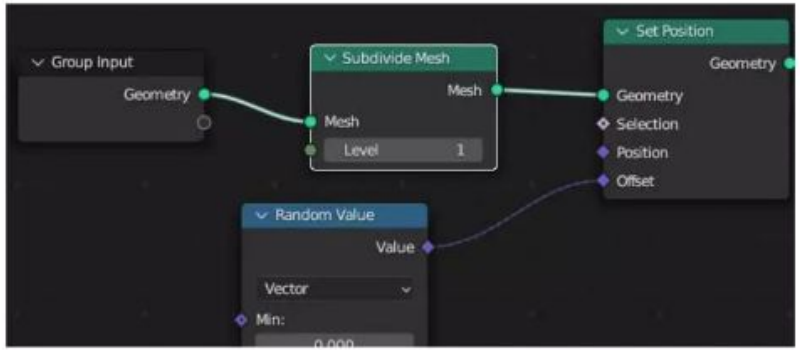


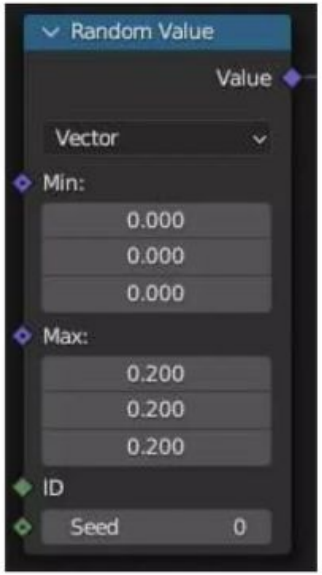


The hiding key is M in the keyboard to see the changes in the geometric node

Adding a Subdivided Mesh to set The level of them



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Vector
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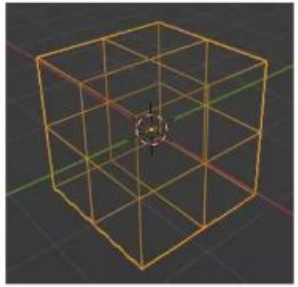
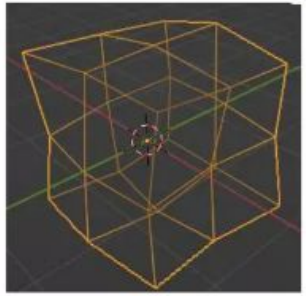
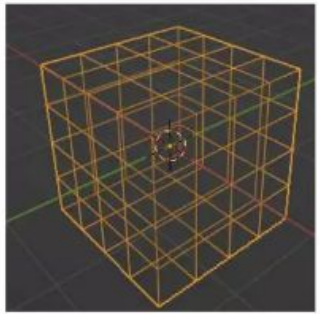
Seed 0

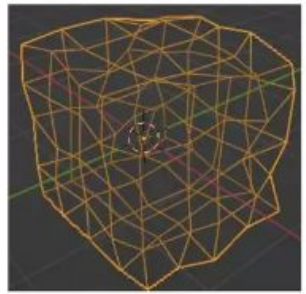


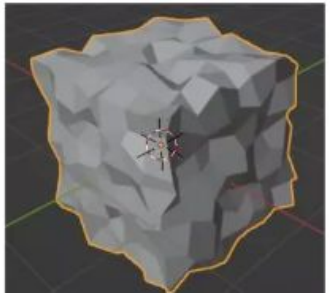

Subdivide Mesh
Mesh
Mesh
Level 1

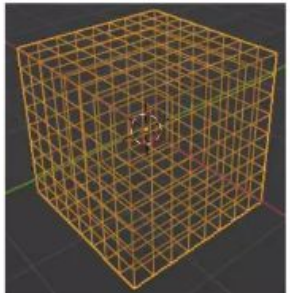




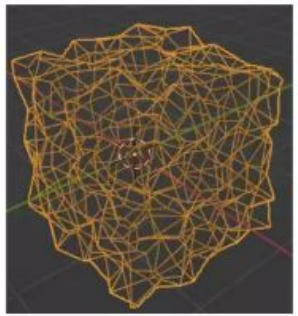

Subdivide Mesh
Mesh
Mesh
Level 2



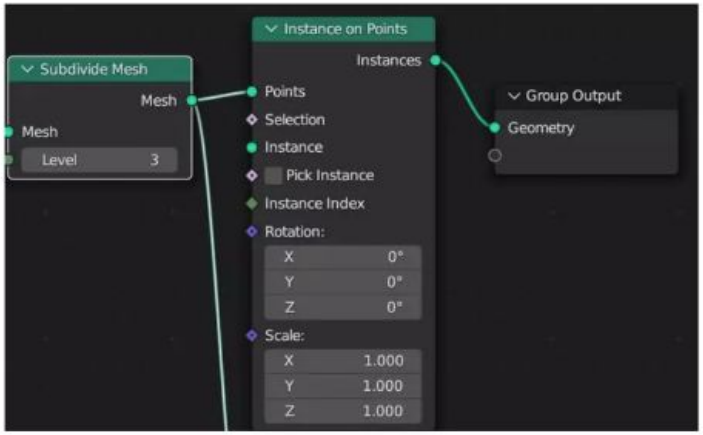


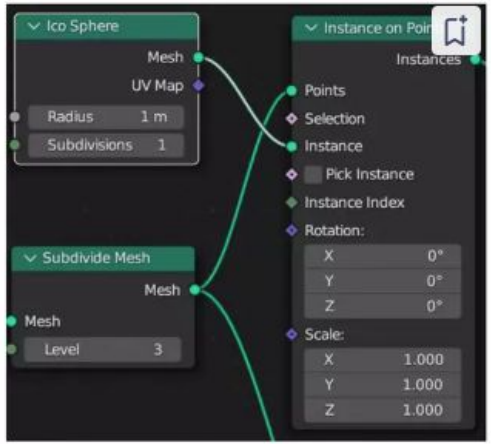


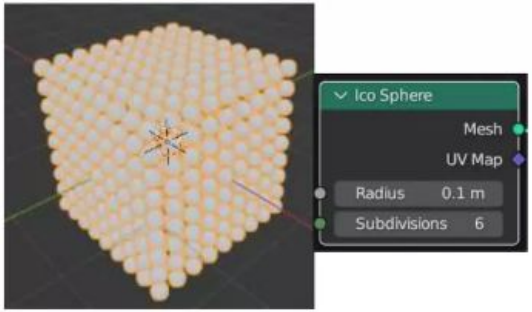

Subdivide Mesh
Mesh
Mesh
Level 3

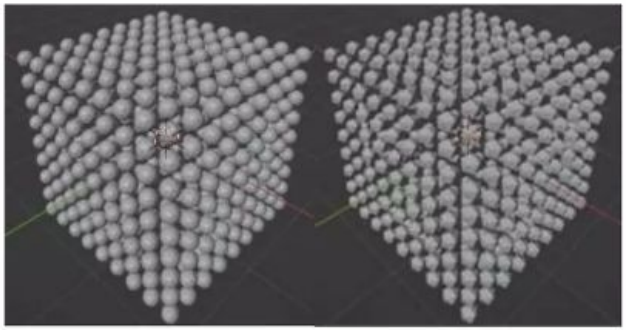


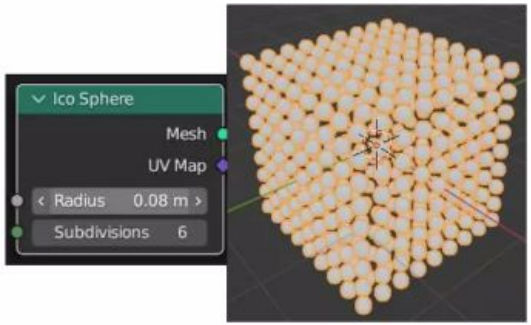

Instance on Points
Instances
Points
Selection
Instance
Pick Instance
Instance Index
Rotation:
X 0°
Y 0°
Z 0°
Scale:
X 1.000
Y 1.000
Z 1.000

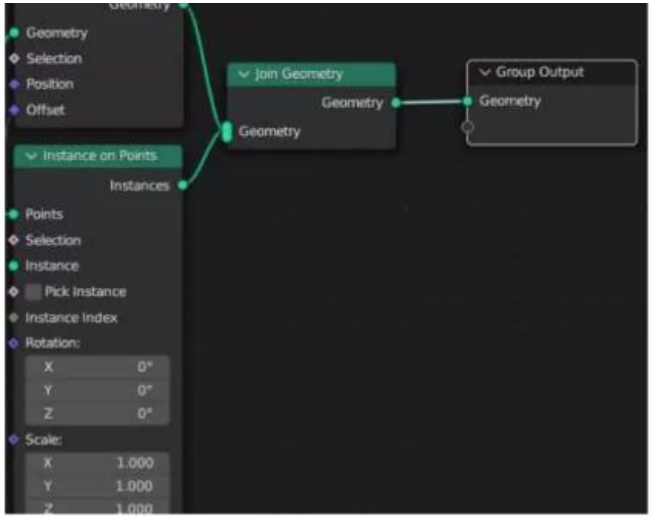

Subdivide Mesh
Mesh
Mesh
Level 3
Instance on Points
Instances
Points
Selection
Instance
Pick Instance
Instance Index
Rotation:
X 0°
Y 0°
Z 0°
Scale:
X 1.000
Y 1.000
Z 1.000
Group Output
Geometry

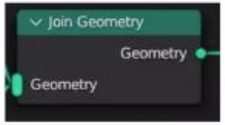

Ico Sphere
Mesh
UV Map
Radius 1 m
Subdivisions 1
Subdivide Mesh
Mesh
Mesh
Level 3
Instance on Poi
Instances
Points
Selection
Instance
Pick Instance
Instance Index
Rotation:
X 0°
Y 0°
Z 0°
Scale:
X 1.000
Y 1.000
Z 1.000

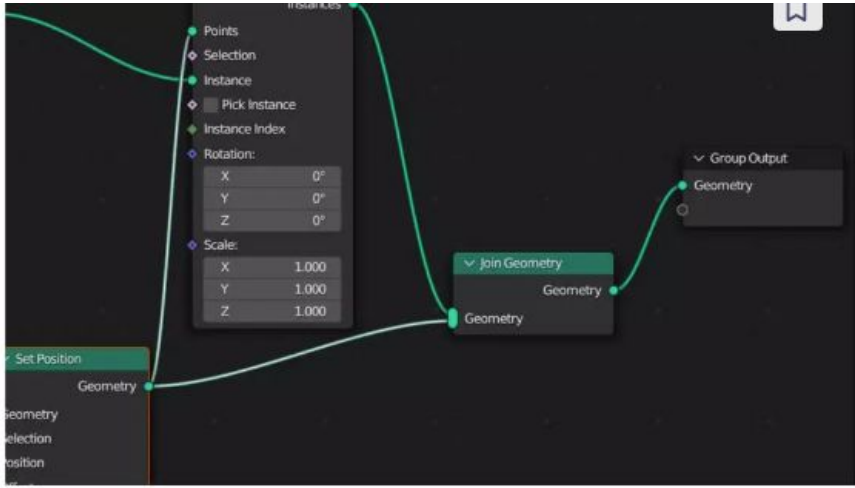

Ico Sphere
Mesh
UV Map
Radius 0.1 m
Subdivisions 6



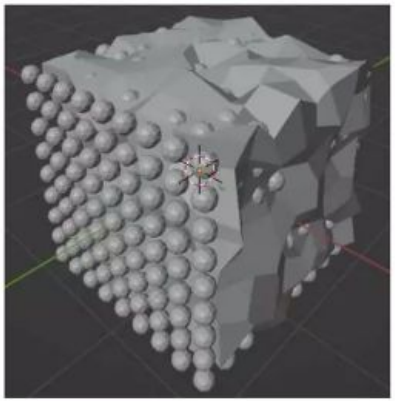

Ico Sphere
Mesh
UV Map
‹ Radius 0.08 m ›
Subdivisions 6

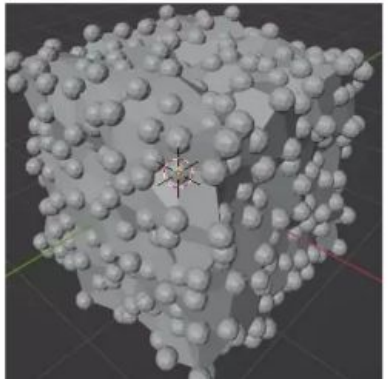






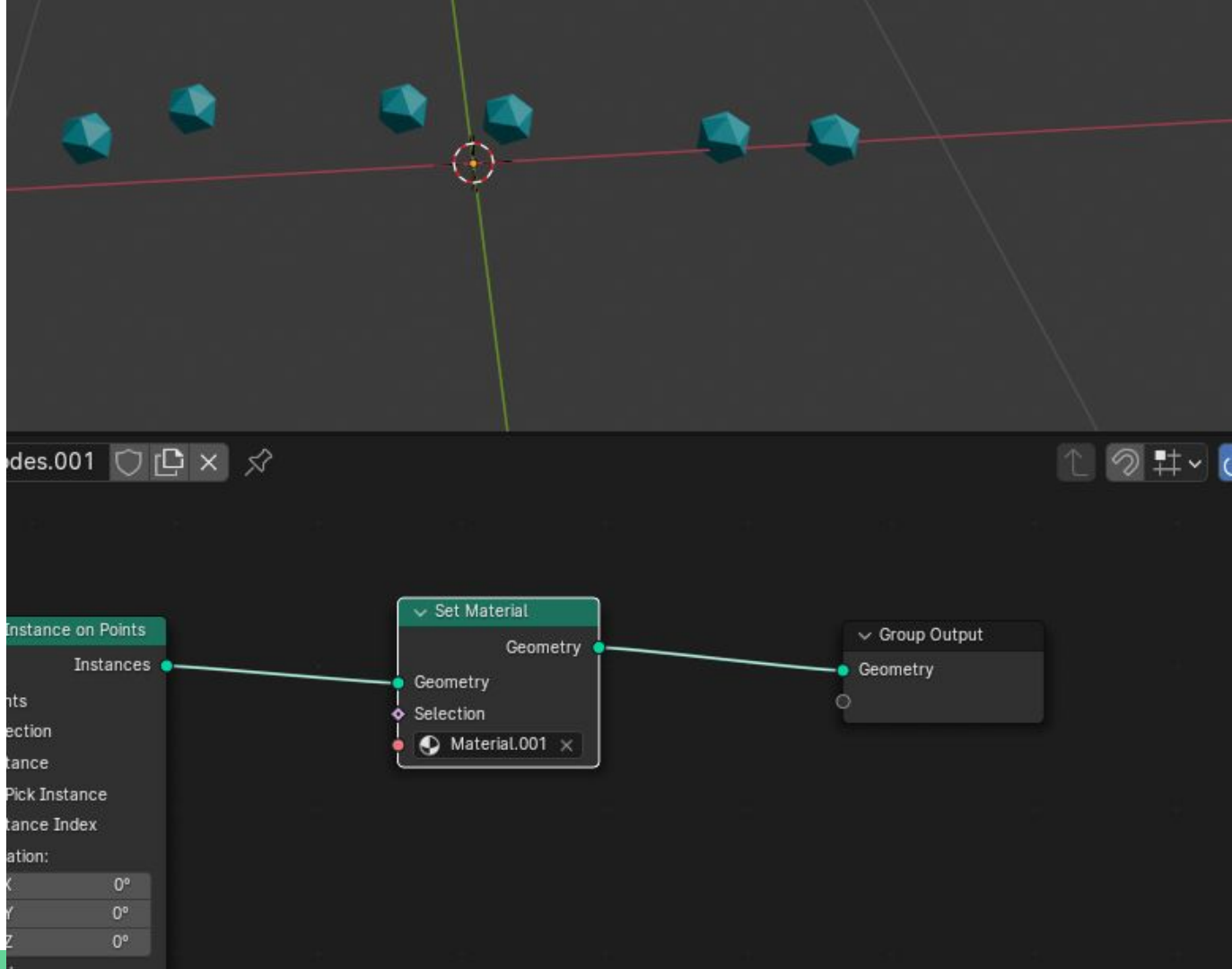
Connecting Nodes By Adding Join Geometry





Bland?

Need to Set Material!



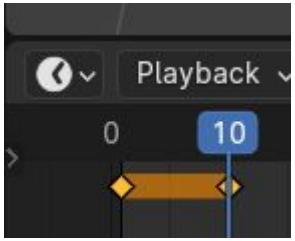
Animation!

Animation!

Keyframes, interpolation, rendering

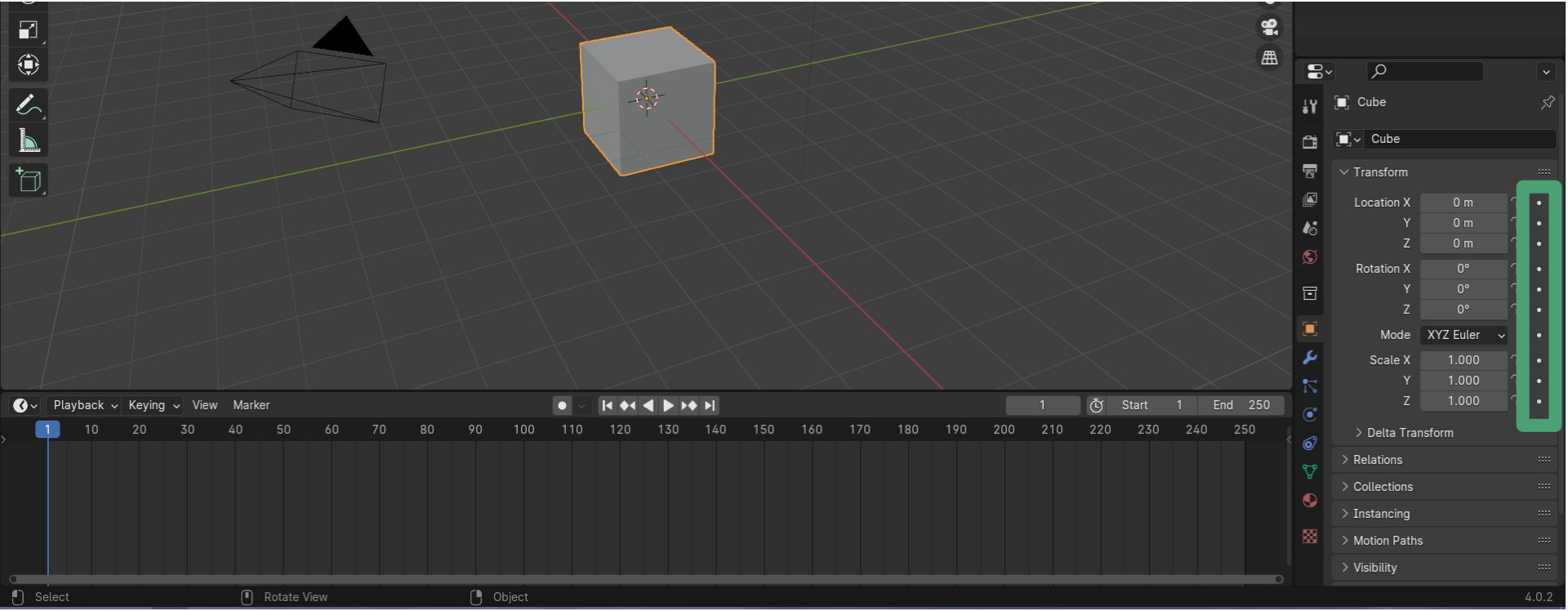
Keyframe:

- Starting or stopping point! Something is 'keyed' there
- Endpoint for a transition

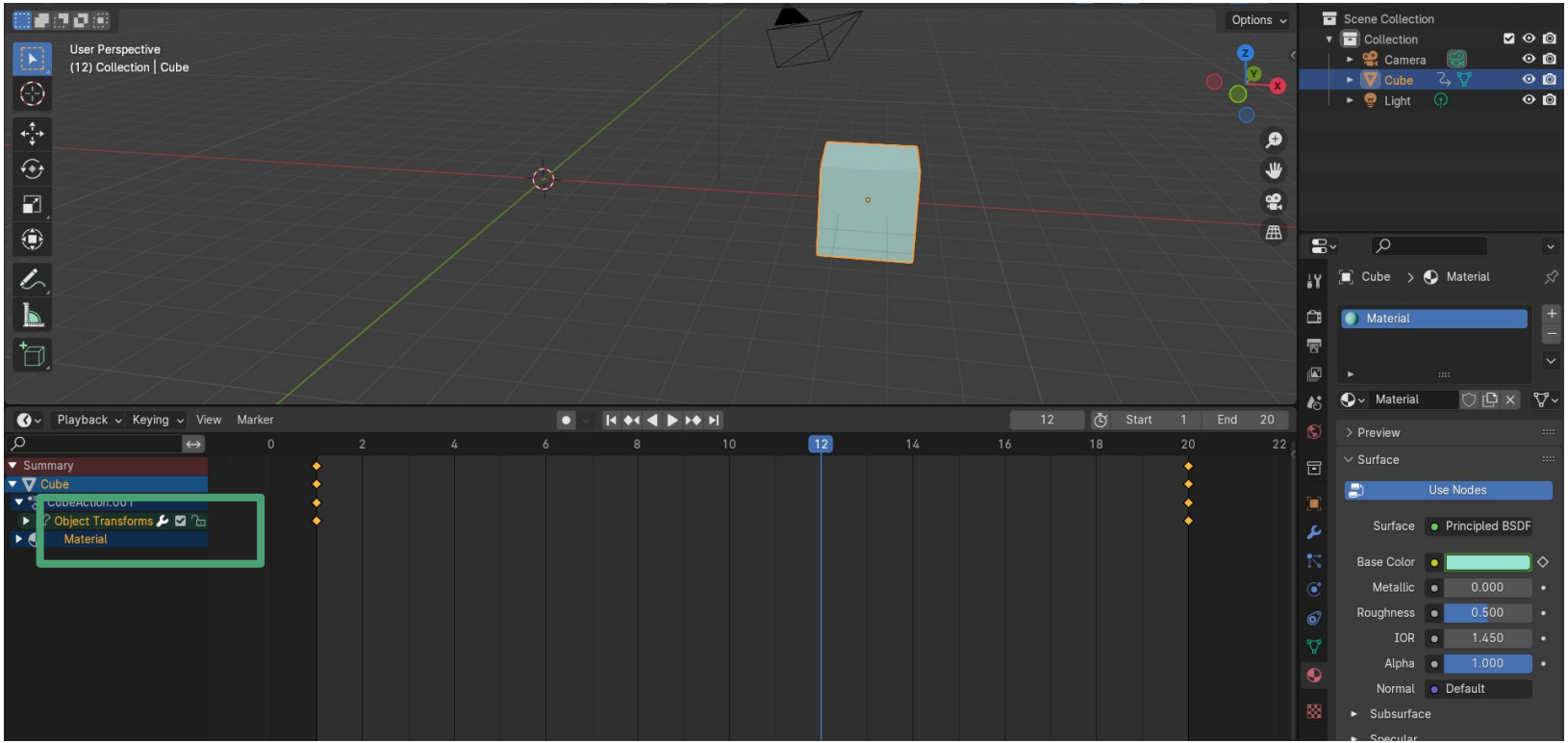


Interpolation:

- Smooth transition between keyframes
- You can set the interpolation you want!


Cube
Cube
Transform
Location X 0 m
Y 0 m
Z 0 m
Rotation X 0°
Y 0°
Z 0°
Mode XYZ Euler
Scale X 1.000
Y 1.000
Z 1.000
Delta Transform
Relations
Collections
Instancing
Motion Paths
Visibility
Playback Keying View Marker
1 Start 1 End 250
1 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250
Select
Rotate View
Object
4.0.2

Can key on nearly any property!



Moving/Spinny camera?

First, let's parent it to our object

- Shift + grab camera ➔ into cube

And then...
https://efredericks.github.io/gvsu-cis367/demos/

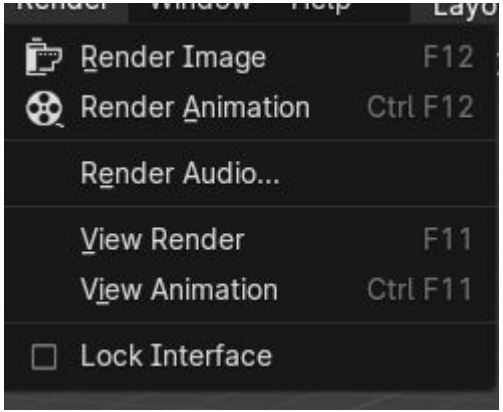
Rotate camera around object (at origin)

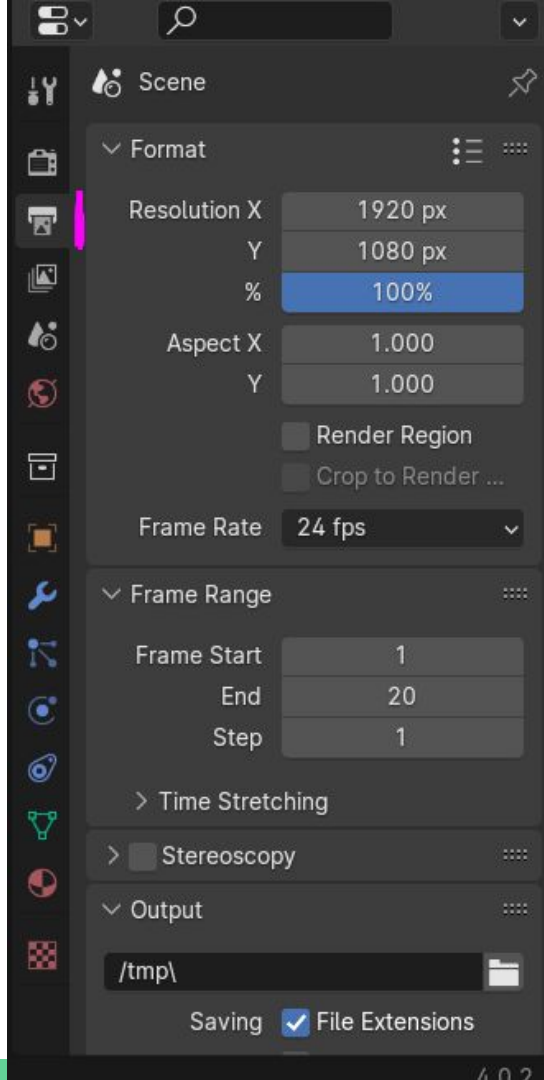
1. Add an empty (axes)
2. Parent camera to empty
   - Click the empty
   - Hold shift, grab camera, move onto empty
3. Animate empty

Rendering an animation

Output settings tab! →

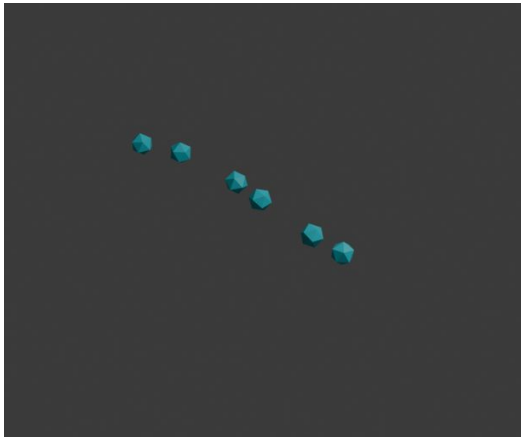
Format, resolution, location, etc.



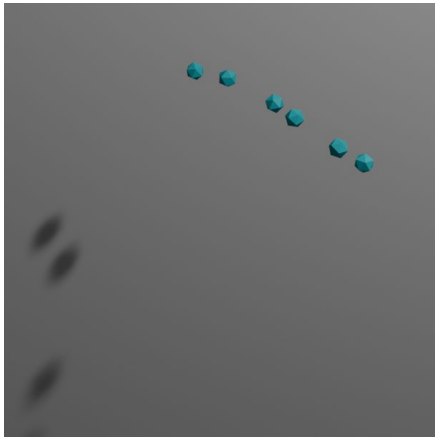


To make things look nicer, need a "background"

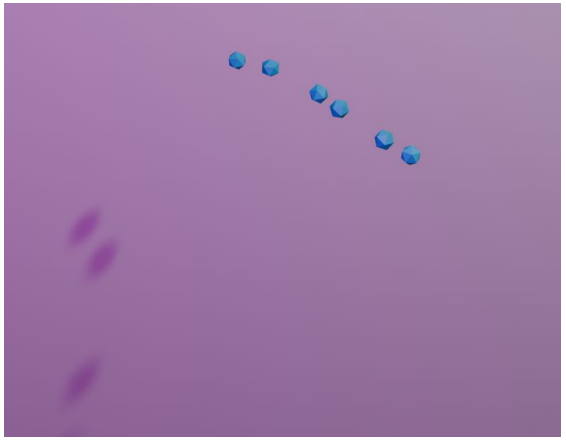
Probably some appropriate lighting too



Normal



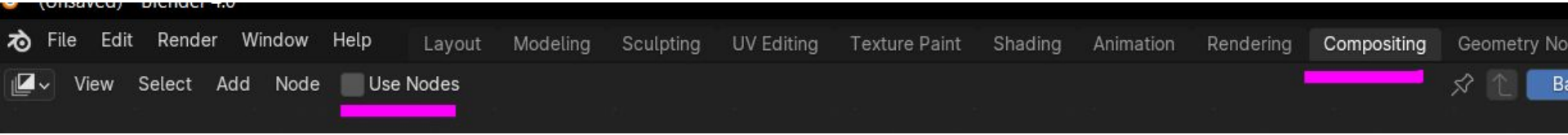
+ Plane



+ Pink light

Post-Processing (a.k.a., the Compositor)

Unfortunately, this is the thing I'm least familiar with and have been most recently learning

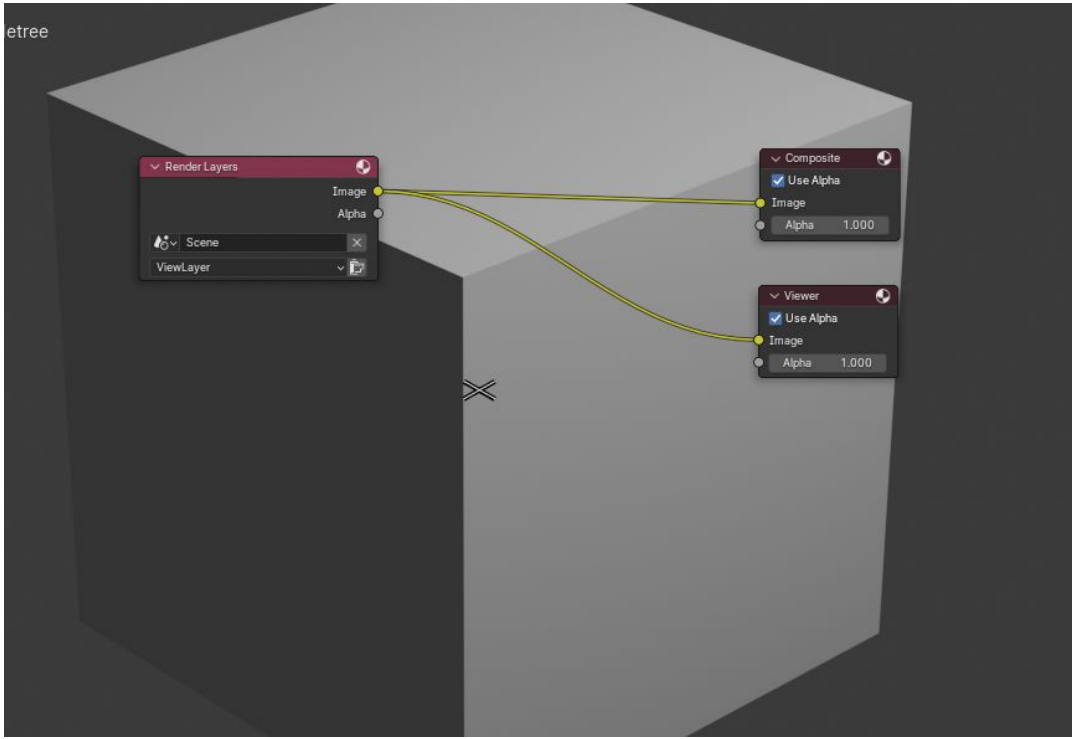


Will apply nodes to each frame of your scene

- Can be used for stitching together movies, After Effects-style processing, etc.

Live view!

Split your output
- need to render first



Filters!


Render Layers
Image
Alpha
Scene
ViewLayer
Glare
Image
Ghosts
Medium
Iterations 5
Color Mod 0.250
Mix 0.500
Threshold 0.200
Image
Composite
Use Alpha
Image
Alpha 1.000
Viewer
Use Alpha
Image
Alpha 1.000

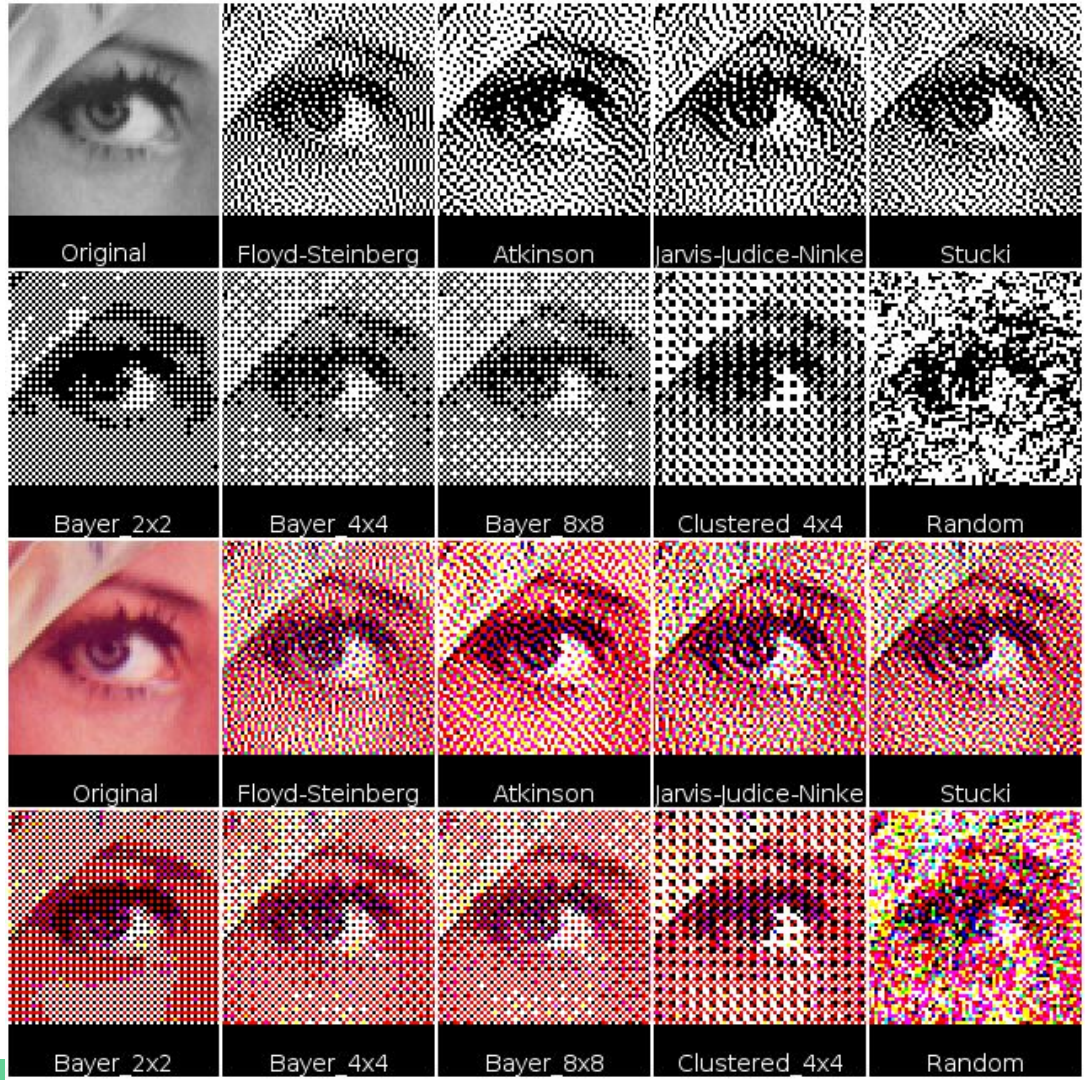
Dithering

Reducing color palette to give it a "chunky" look

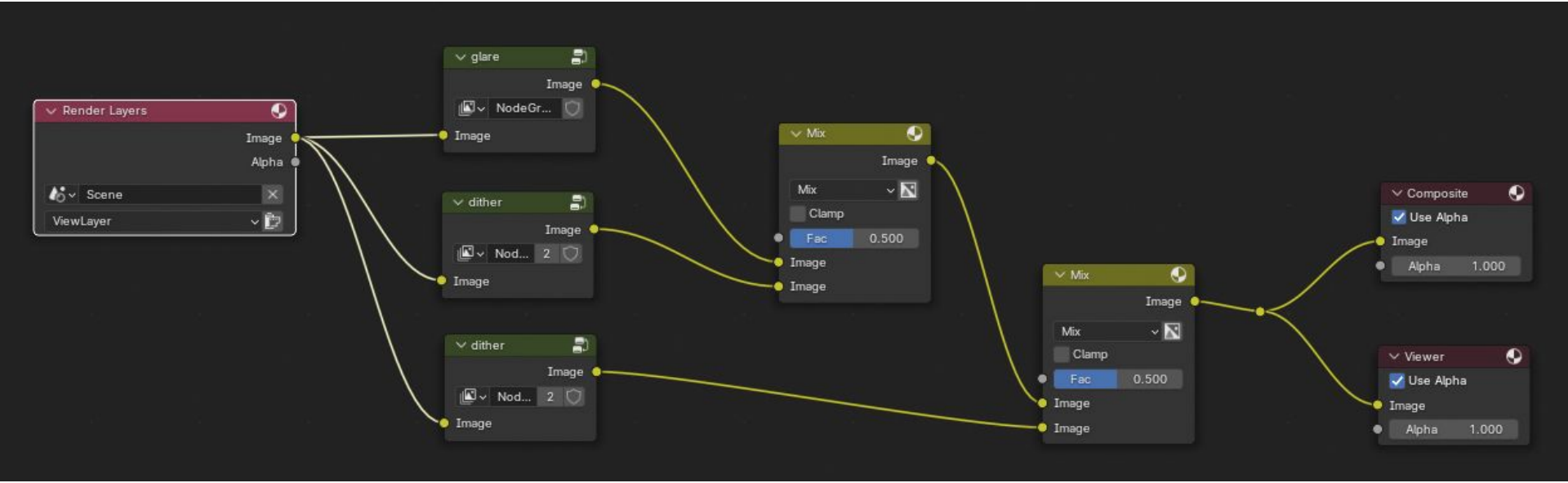
Unfortunately the website where I got the original node group is down...

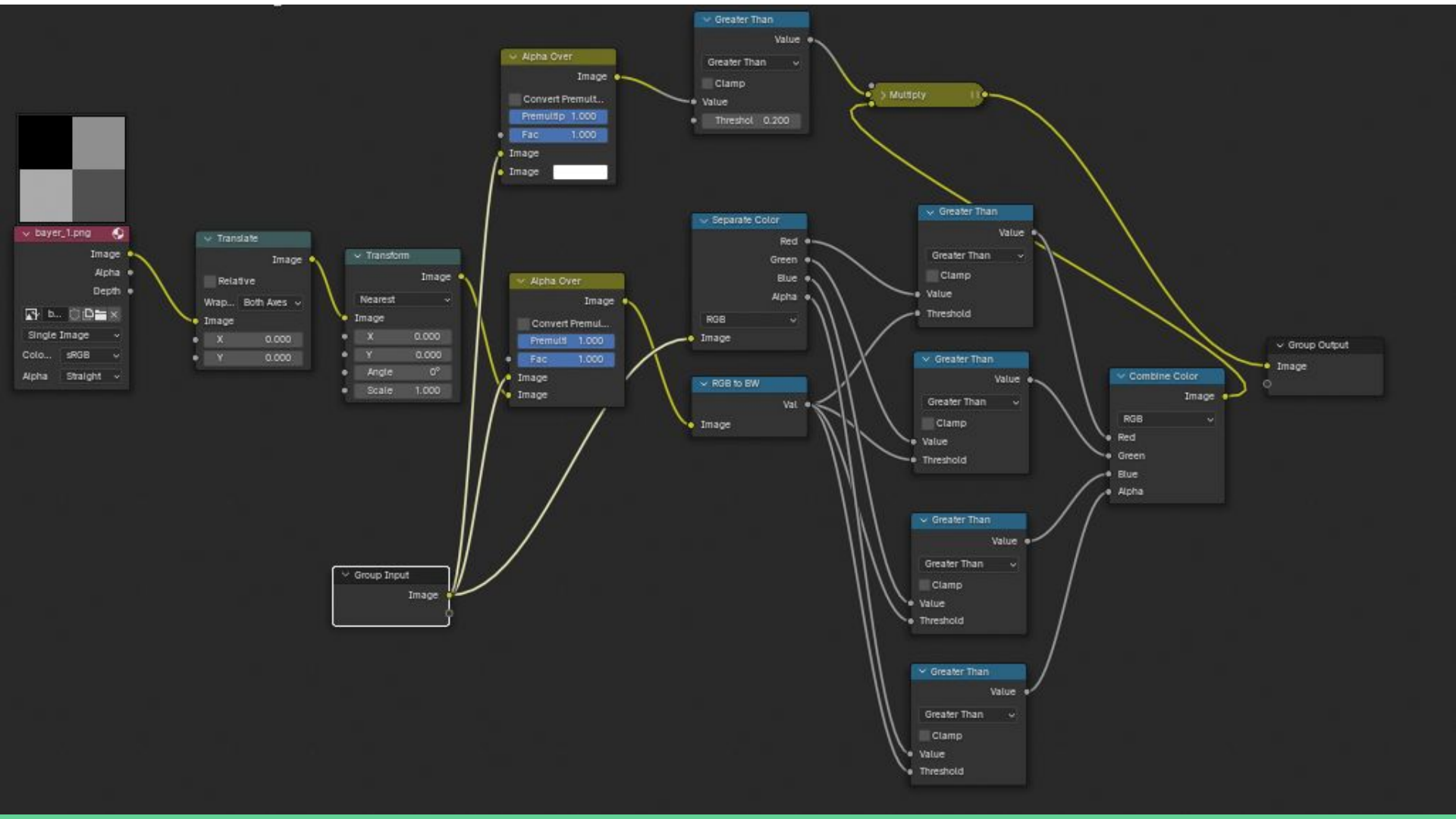
Link to Bayer samples: https://efredericks.github.io/gvsu-cis367/assets/bayer_all.7z

Another explanation: https://blog.kaetemi.be/2015/04/01/practical-bayer-dithering/



Going to need a sample and a node group!




bayer_1.png
Image
Alpha
Depth
Single Image
Color...
sRGB
Alpha
Straight
Translate
Image
Relative
Wrap...
Both Axes
Image
X
0.000
Y
0.000
Transform
Image
Nearest
Image
X
0.000
Y
0.000
Angle
0°
Scale
1.000
Alpha Over
Image
Convert Premult...
Premultip
1.000
Fac
1.000
Image
Image
Alpha Over
Image
Convert Premul...
Premultl
1.000
Fac
1.000
Image
Image
Group Input
Image
Greater Than
Value
Greater Than
Clamp
Value
Threshol
0.200
Separate Color
Red
Green
Blue
Alpha
RGB
Image
RGB to BW
Val
Image
Multiply
Greater Than
Value
Greater Than
Clamp
Value
Threshold
Greater Than
Value
Greater Than
Clamp
Value
Threshold
Greater Than
Value
Greater Than
Clamp
Value
Threshold
Greater Than
Value
Greater Than
Clamp
Value
Threshold
Combine Color
Image
RGB
Red
Green
Blue
Alpha
Group Output
Image

(Glare was just to mess around a bit)