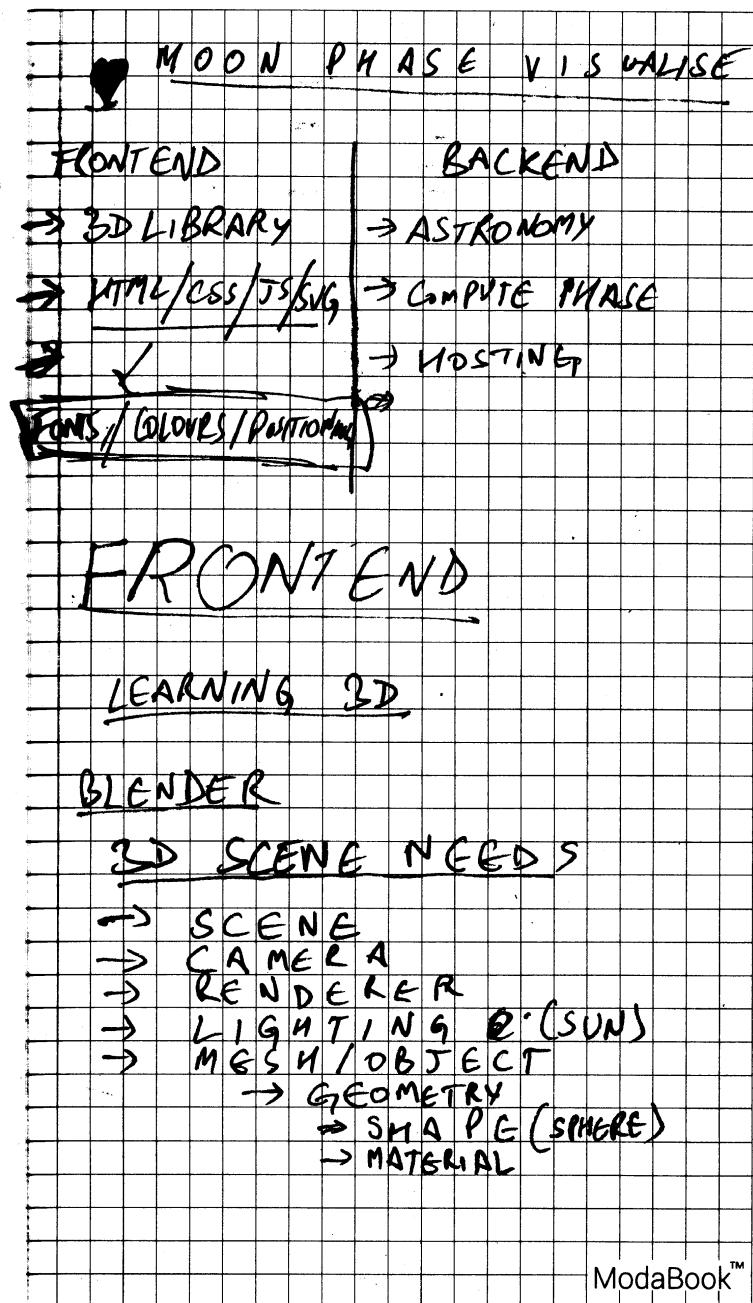
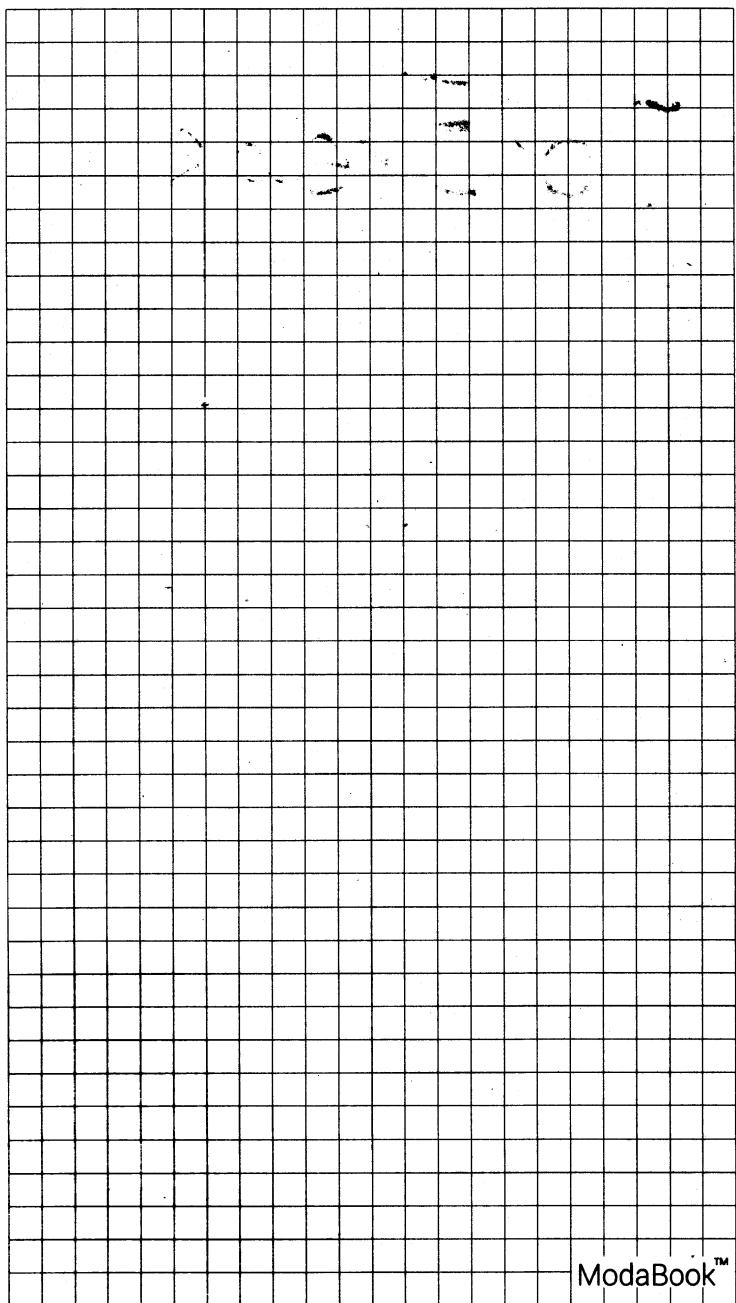
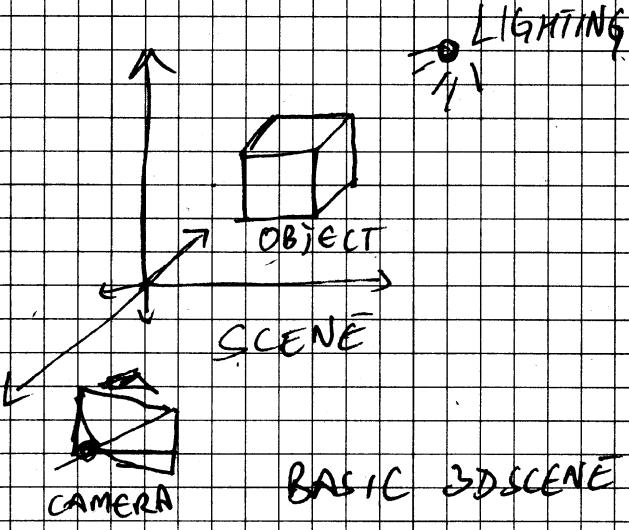


## Moon Phase Documentation

# Moon Phase Documentation



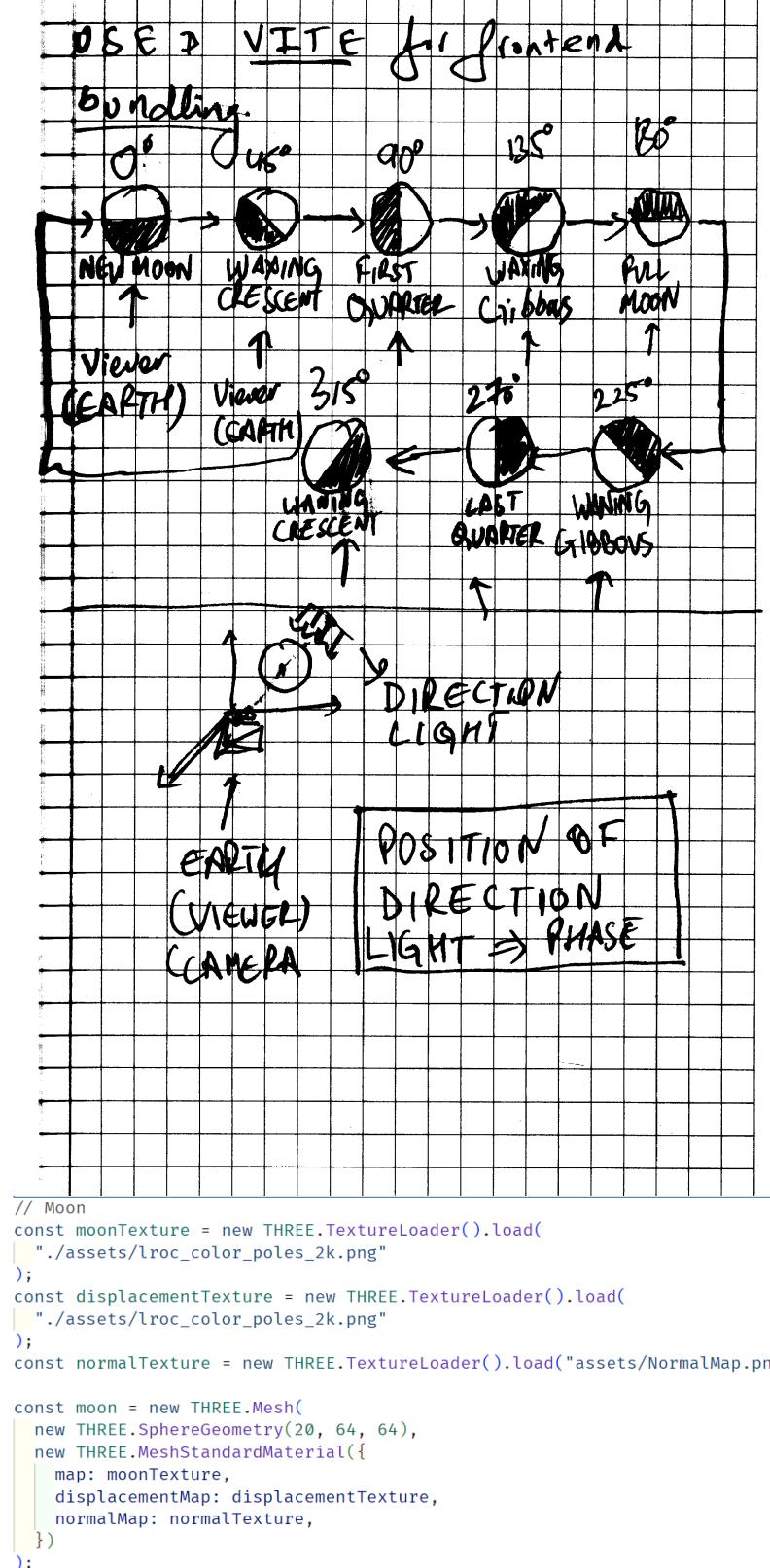


USED three JS library  
to render 3d objects

SHERE → MATERIAL  
(HIGH RES FROM NASA)  
(TEXTURE)  
→ DISPLACEMENT  
(DEPTH) MAP (for LAYERS)

SMALL EMISSION SPHERES FOR  
STARS

```
//Geometry and Material for Stars
const stargeo = new THREE.SphereGeometry(0.25, 24, 24);
const starmat = new THREE.MeshStandardMaterial({
  color: 0xffffffff,
  emissive: 0xf0ff99,
});
function addStar() {
  const star = new THREE.Mesh(stargeo, starmat);
  const [x, y, z] = Array(3)
    .fill()
    .map(() => THREE.MathUtils.randFloatSpread(200));
  star.position.set(x, y, z);
  scene.add(star);
}
Array(200).fill().forEach(addStar);
```



## COORDINATE GEOMETRY

If  $[x, y]$  is Given, POLAR COORDINATES

$\downarrow$   
CARTESIAN  
COORDINATES

$$\text{Atan } 2(y, x) = \theta$$

$$\sqrt{x^2 + y^2} = \text{distance}$$

$\theta \rightarrow$  Can be found  
by using "backend  
python program  
using "Ephemeris"

Specifically using "DE421"

by NASA JET PROPULSION  
LABORATORY  
(MORE IN BACKEND)

$\rightarrow$  Accurate till 2050

fixed needed  
Light Distance

Should be  
(constant)

If  $[D, \theta]$  is Given, CARTESIAN COORDINATE

$$x = D \cdot \cos(\theta)$$

$$y = D \cdot \sin(\theta)$$

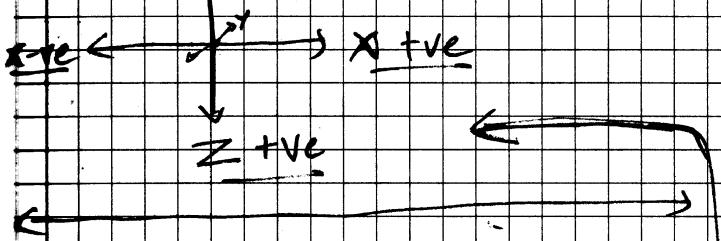
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~~3DS~~ three JS

$z$  is depth, not height

In 3DS

$$z = \sqrt{r^2}$$



EPHEMERIS PHASE ANGLE WITH

A  $270^\circ$  offset.  $\rightarrow$  for 3DS

$$0^\circ \cancel{\text{sun angle}}$$

(new moon) is given as  $270^\circ$

$$\theta = [\theta + 270] \% 360$$

Fix

$$\text{degree} = \frac{\text{RADIANS} \times 180}{\pi}$$

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```

function pol2rect(r, theta) {
  return [r * Math.cos(theta), r * Math.sin(theta)];
}

const sunangle = (angle + 270) % 360;
const radians = (sunangle * Math.PI) / 180;
const xz = pol2rect(80, radians);
directionalLight.target = moon;
directionalLight.position.set(xz[0], 0, xz[1]);
scene.add(moon);
  
```

ENGLISH

MINOTI

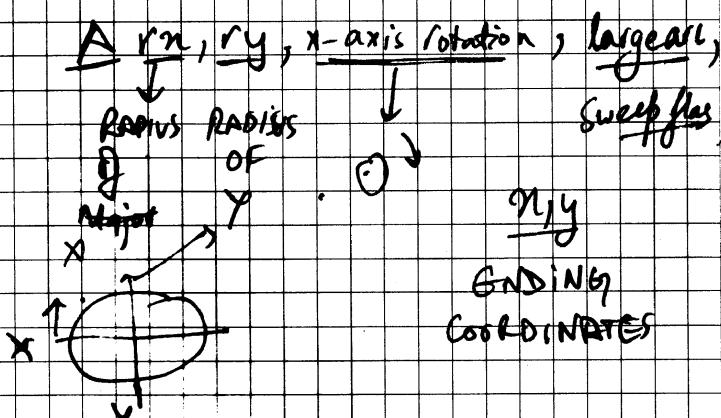
- NEW MOON  $\rightarrow 0^\circ \rightarrow$  नया चांद / नया चंद्र  
 WAXING CRESCENT  $\rightarrow 45^\circ \rightarrow$  वृद्धि चंद्र / वृद्धि चांद  
 FIRST QUARTER  $\rightarrow 90^\circ \rightarrow$  पहली तिमाही / पहला चंद्र  
 WAXING GIBBOUS  $\rightarrow 135^\circ \rightarrow$  दोस्री तिमाही / दोस्रा चंद्र  
 FULL MOON  $\rightarrow 180^\circ \rightarrow$  पूर्ण चांद / पूर्ण चंद्र  
 WANING GIBBOUS  $\rightarrow 225^\circ \rightarrow$  तीसरी तिमाही / तीसरा चंद्र  
 LAST QUARTER  $\rightarrow 270^\circ \rightarrow$  चारी तिमाही / चारा चंद्र  
 WANING CRESCENT  $\rightarrow 315^\circ \rightarrow$  चौथी तिमाही / चौथा चंद्र  
 NEW MOON  $\rightarrow 360^\circ \rightarrow$  वृद्धि चंद्र / वृद्धि चांद

PHASES OF THE MOON  
LUNAR PHASES

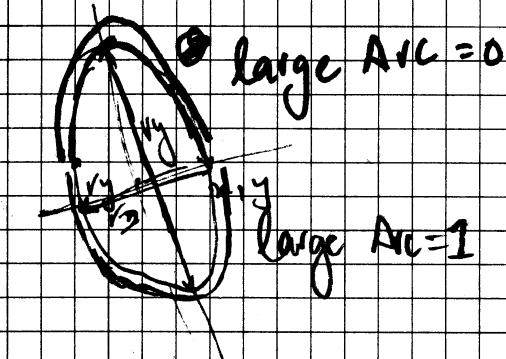
वृद्धि चंद्र /  
वृद्धि चांद  
चौथा चंद्र

FOR 2D (SVG)

SVG  $\rightarrow$  ELLIPTICAL ARC COMMANDS



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So  $\rightarrow$

~~if  $r_x = r_y$~~

ARC C = CIRCLE

~~if  $R_y = 0$~~   
ARC STRAIGHT LINE

Moon (CIRCLE) SVG

+



PHASE SVG

Phase tubes used to cover the  
for Phase



→ WANING  
GIBBOUS

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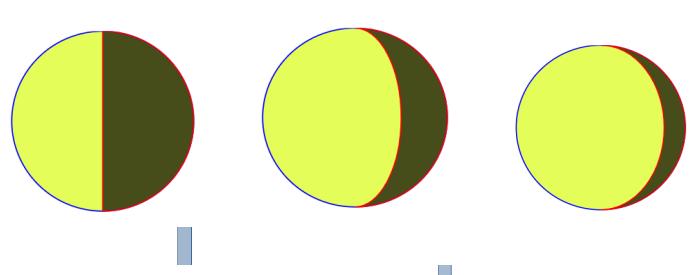
```

1 <?xml version="1.0" standalone="no"?>
2 <svg width="12cm" height="5.25cm" viewBox="0 0 1200 400" xmlns="http://www.w3.org/2000/svg" version="1.1">
3   <title>Example arcs01 - arc commands in path data</title>
4
5   <circle cx="100" cy="75" r="75" fill="#e4fd58" stroke="blue"
6     stroke-width="1" />
7   <path d="m100,0 a20,20 0 1,1 0,150 a20,20 0 0,0 0,-150"
8     fill="rgba(0,0,0,0.695)" stroke="red" stroke-width="1" />
9
10  </svg>
11

```

const moon\_phases\_en = [  
 "New Moon",  
 "Waxing Crescent",  
 "First Quarter",  
 "Waxing Gibbous",  
 "Full Moon",  
 "Waning Gibbous",  
 "Last Quarter",  
 "Waning Crescent",  
];

const moon\_phases\_hi = [  
 "नया चांद/अमावस्या",  
 "शुक्ल पक्ष हेसिया चांद/वर्धमान चांद",  
 "पहली तिमाही/अर्द्ध चंद्र",  
 "शुक्ल पक्ष कुबड़ा चांद",  
 "पूर्णचंद्र/पूर्णिमा",  
 "कृष्ण पक्ष कुबड़ा चांद",  
 "अंतिम तिमाही/अर्द्ध चंद्र",  
 "कृष्ण पक्ष हेसिया चांद/वर्धमान चांद",  
];



# BACKEND

SKYFIELD → PYTHON MODULE

FLASK → WEB FRAMEWORK

DE421 → PLANETARY AND LUNAR  
EPHEMERIS  
VALID FROM 1900 - 2050

↳ A TABLE CONTAINING  
PLANETARY POSITIONS

NORMAISE PHASE ANGLE  
= moon\_phase\_name  
TO ↳ NAME

Moon Phases =

[ "NEW MOON", "WAXING CRESCENT",  
"FIRST QUARTER", "WAXING GIBBOUS",  
"FULL MOON", "WANING GIBBOUS",  
"LAST QUARTER", "WANING CRESCENT" ]

DEGREES =

[ 0, 45, 90, 135, 180, 225, 270, 315 ]

Indexn = round(Phase / 45) \* .8

```

from skyfield.api import load
from skyfield.framelib import ecliptic_frame
def phase():
    ts = load.timescale()
    t = ts.now()
    # t = ts.utc(2023, 7, 3, 11, 39, 47)
    # year, month, day, hour, minute, second

    eph = load('de421.bsp')
    sun, moon, earth = eph['sun'], eph['moon'], eph['earth']

    e = earth.at(t)
    s = e.observe(sun).apparent()
    m = e.observe(moon).apparent()

    _, slon, _ = s.frame_latlon(ecliptic_frame)
    _, mlon, _ = m.frame_latlon(ecliptic_frame)
    phase = (mlon.degrees - slon.degrees) % 360.0

    percent = 100.0 * m.fraction_illuminated(sun)

    # print('Phase (0°-360°): {:.1f}'.format(phase))
    return phase
# print('Percent illuminated: {:.1f}%'.format(percent))
def moon_phase(degree):
    moon_phases = [
        "New Moon",
        "Waxing Crescent",
        "First Quarter",
        "Waxing Gibbous",
        "Full Moon",
        "Waning Gibbous",
        "Last Quarter",
        "Waning Crescent",
    ]
    degrees = [0, 45, 90, 135, 180, 225, 270, 315]
    print(len(moon_phases))
    i = round(degree / 45) % len(degrees)
    moon_phase = moon_phases[i]

    return moon_phase

```

# HOSTING

→ VPS → Virtual Private Server

(FROM LINODE AWS LIGHTSAIL,  
DIGITAL OCEAN ETC)  
(\$ \$ / Month)

→ ~~FREE~~ DOMAIN → ~~\$ 1.99 / Month~~  
(Google domain,  
Go daddy) etc

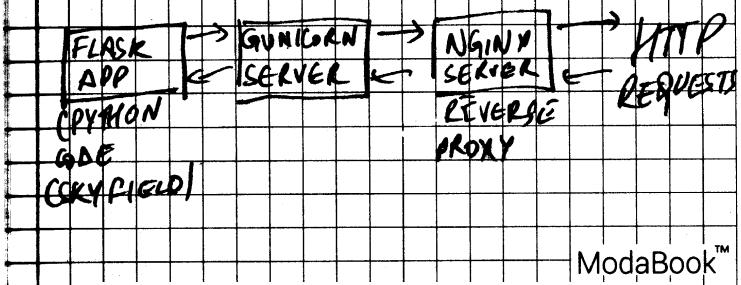
## VPS Setup

NGINX → FOR REVERSE PROXY

GUNICORN → SERVER GATEWAY

## FLASK → FRAMEWORK

→ JINJA 2 → TEMPLATE ENGINE  
TO SEND PHASE ANGLE  
FRONT END



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```

from flask import Flask, render_template
from moon import phase

app = Flask(__name__)

@app.route("/moon")
def hello_world():
    angle = str(phase())

    return render_template("moon.html", angle=angle)

```

```

# main driver function
if __name__ == "__main__":
    app.run(host="0.0.0.0")

```

# QR Code

Generated for CHAITANYA.MALHOTRA@GMAIL.COM/1000

QR code beautified using →

- STABLE DIFFUSION
- CONTROL NET
- PHOTOSHOP

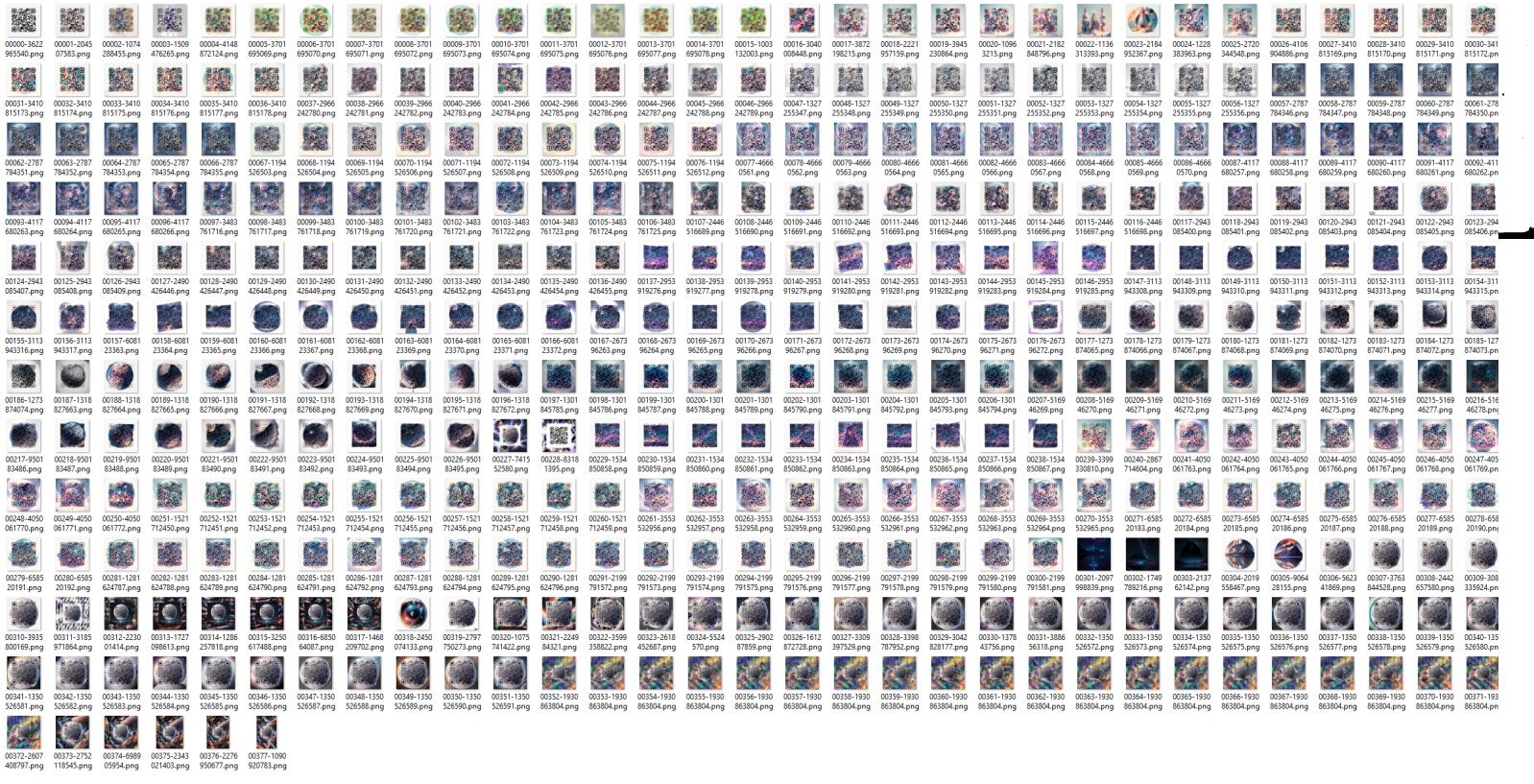
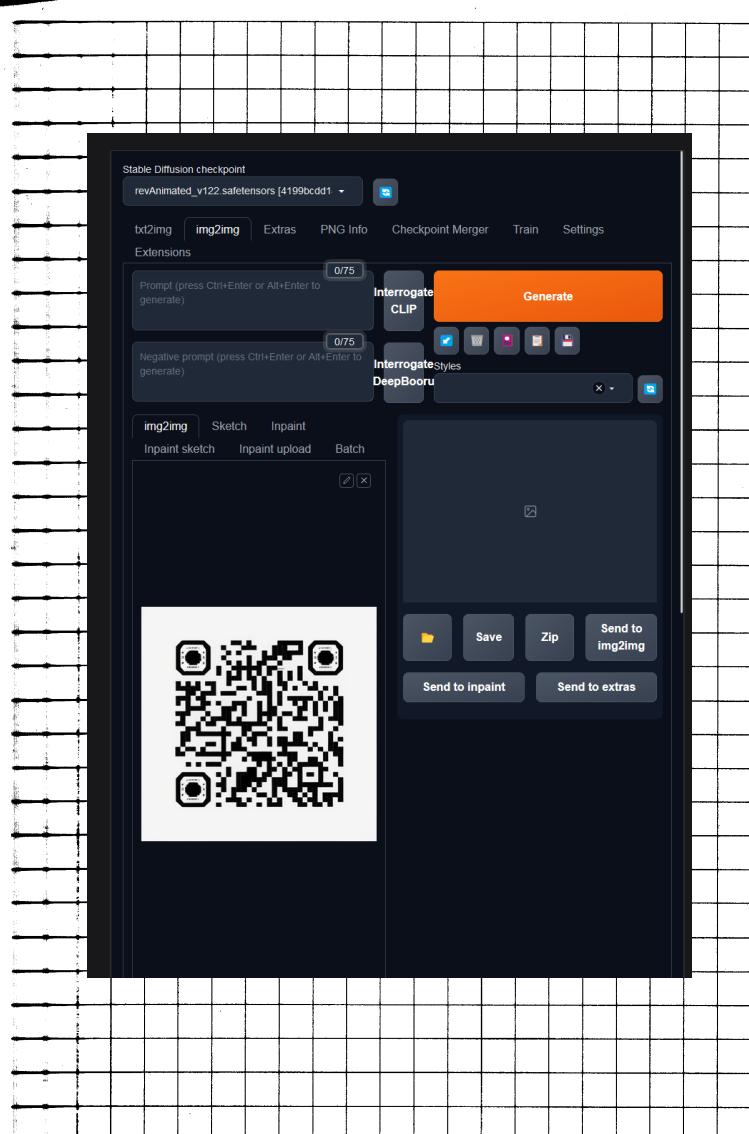
## WEB UI FOR STABLE DIFFUSION

- ↳ AUTOMATIC 1111
- ↳ STABILITY MATRIX

## CONTROL NET SETTINGS

- CONTROL NET MODEL ⇒ SD15 TILE
- PIXEL PERFECT
- PREPROCESSOR ⇒ TILE RESAMPLE

## STABLE DIFFUSION NL for OUTPAINT SPACE ART



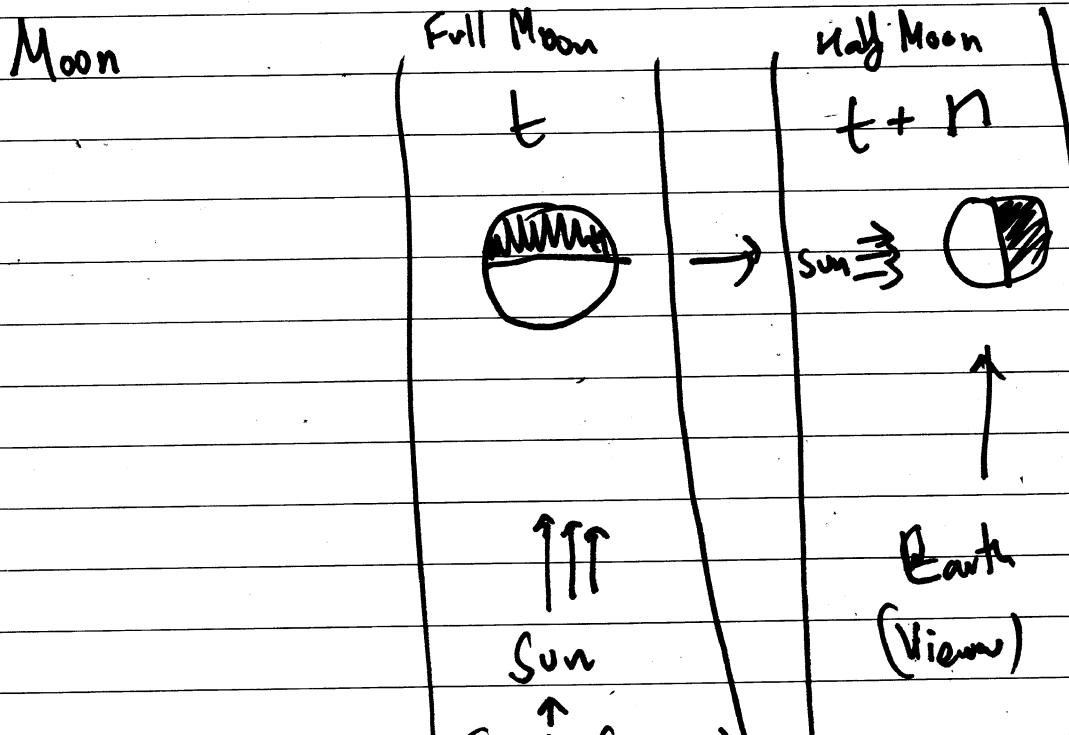
## Three 'js'

3 Things needed for every <sup>Canvas</sup> scene

- Scene
- Camera
- Renderer

Mesh → Geometry (Shape) (e.g. Sphere, cube etc)  
→ Material → color, affected by lighting

Lighting → Ambient light  
→



Given  $(x, y)$  find

Polar Coordinates ~  $(\theta \text{ & distance})$

~~Given~~

↳ Cartesian =  $\theta = \text{Atan2}(y, x) = \text{Radians}$   
 $\text{distance} = \sqrt{x^2 + y^2}$

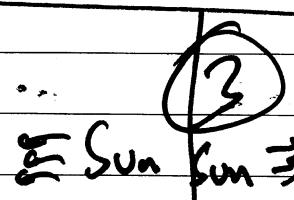
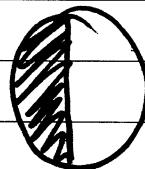
Given  $\theta, \text{distance}$  Find

Cartesian coordinates ~  $(x, y)$

↳ Polar coordinate =  $x = D * \cos(\theta)$   
 $y = D * \sin(\theta)$

①

90° Phase →



270° Phase



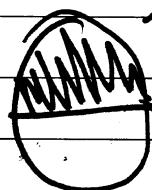
Earth

Earth

Sun

②

180° Phase +



③



④



0 Phase

360° Phase

Sun

Earth

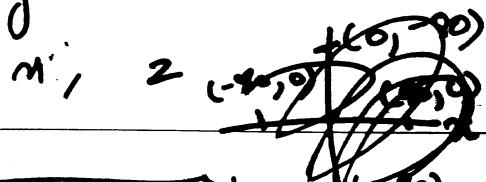
Earth

$$D = 90^\circ$$



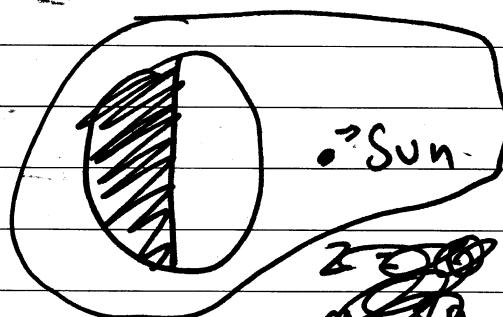
$$\begin{aligned} \cos 0^\circ &= 1 \\ \sin 0^\circ &= 0 \end{aligned}$$

$$y = 3d = 0$$



$0^\circ$  Phase  
 $360^\circ$  Phase

$$\begin{aligned} n &= 0 \\ z &= -d \\ &= -80 \end{aligned}$$



$$\begin{aligned} \vec{s}_{\text{Sun}} & \\ 90^\circ \text{ Phase} & \\ z &= d \\ n &= 80 \\ z &= 0 \end{aligned}$$

$$\begin{aligned} x &= D * \cos(\theta) \\ y &= D * \sin(\theta) \end{aligned}$$

$$\begin{aligned} \cos 0^\circ &= 1 \\ \sin 0^\circ &= 0 \end{aligned}$$

$$\begin{aligned} \cos 90^\circ &= 0 \\ \sin 90^\circ &= 1 \end{aligned}$$

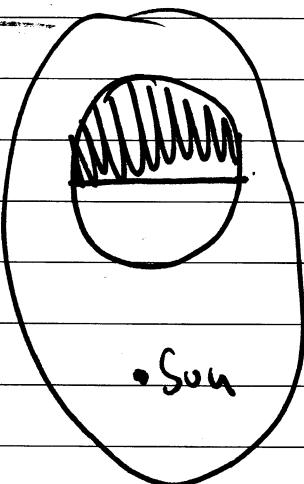
$$\begin{aligned} \sin 180^\circ &= 0 \\ \cos 180^\circ &= -1 \end{aligned}$$

$$\begin{aligned} \cos 180^\circ &= -1 \\ \sin 180^\circ &= 0 \end{aligned}$$

~~$\sin 270^\circ = -1$~~ 

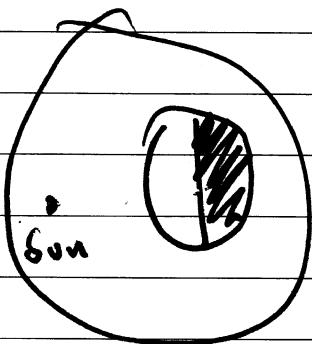
$$\begin{aligned} \cos (270^\circ) &= 0 \\ \sin (270^\circ) &= -1 \end{aligned}$$

$$\begin{aligned} \cos (310^\circ) &= 1 \\ \sin (310^\circ) &= 0 \end{aligned}$$



$180^\circ$  Phase

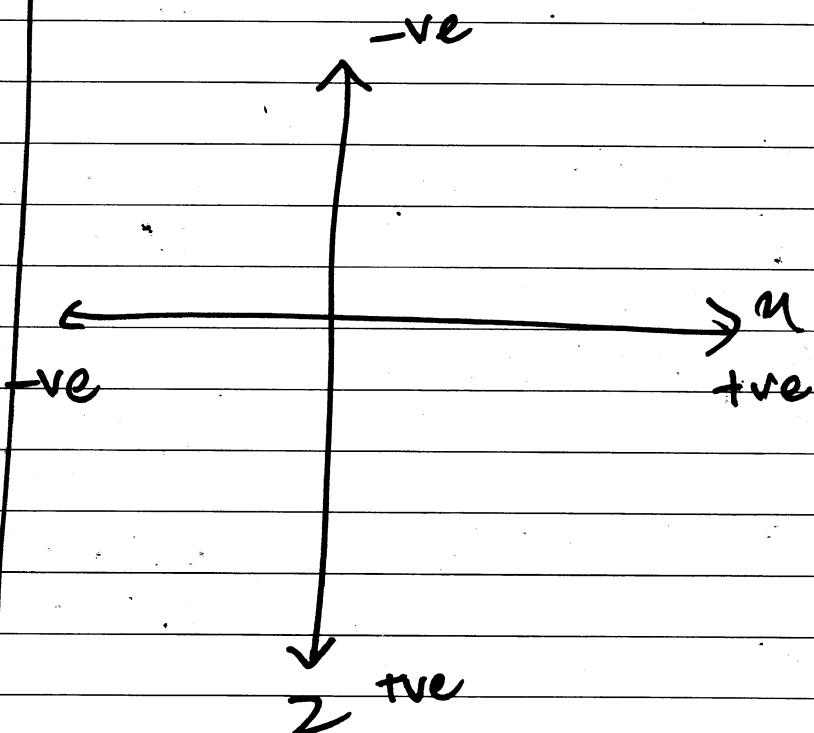
$$\begin{aligned} \vec{s}_{\text{Sun}} & \\ 180^\circ \text{ Phase} & \\ z &= 0 \\ n &= 0 \\ 2 &= 80 \\ z &= 80 \end{aligned}$$



$270^\circ$  Phase

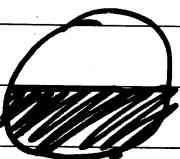
$$\begin{aligned} \vec{s}_{\text{Sun}} & \\ 270^\circ \text{ Phase} & \\ z &= 0 \\ n &= -80 \\ 2 &= 0 \end{aligned}$$

$$\begin{aligned} n &= -80 \\ z &= 0 \end{aligned}$$



## Conversion

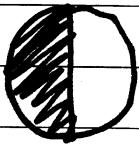
$(\theta + 270^\circ)$



$0^\circ$

$$n = 0$$

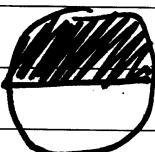
$$z = -1$$



$90^\circ$

$$n = 1$$

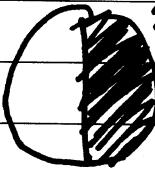
$$z = 0$$



$180^\circ$

$$n = 0$$

$$z = 1$$



$270^\circ$

$$n = -1$$

$$z = 0$$

$$\cos \theta = 1$$

$$\sin \theta = 0$$

$$\cos 90^\circ = 0$$

$$\sin 90^\circ = 1$$

$$\cos 180^\circ = -1$$

$$\sin 180^\circ = 0$$

$$+270^\circ$$

$$(\textcircled{1})$$

$$7.260$$

$$(0 + 270) \cdot \frac{1}{360} = \underline{\underline{270^\circ}}$$

$$(90 + 270) \cdot \frac{1}{360} = \underline{\underline{0^\circ}}$$

$$(180 + 270) \cdot \frac{1}{360} = \underline{\underline{90^\circ}}$$

$$(270 + 270) \cdot \frac{1}{360} = \underline{\underline{180^\circ}}$$

## Post Conversion



~~$(\theta + 270^\circ) \cdot \frac{1}{360}$~~

$$\cos 270^\circ = 0$$

$$\sin 270^\circ = -1$$



$$0^\circ \rightarrow 270^\circ$$



$$90^\circ \rightarrow 0^\circ$$

$$\cos 0^\circ = 1$$

$$\sin 0^\circ = 0$$



$$180^\circ \rightarrow 90^\circ$$

$$\cos 90^\circ = 0$$

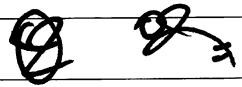
$$\sin 90^\circ = 1$$



$$270^\circ \rightarrow 180^\circ$$

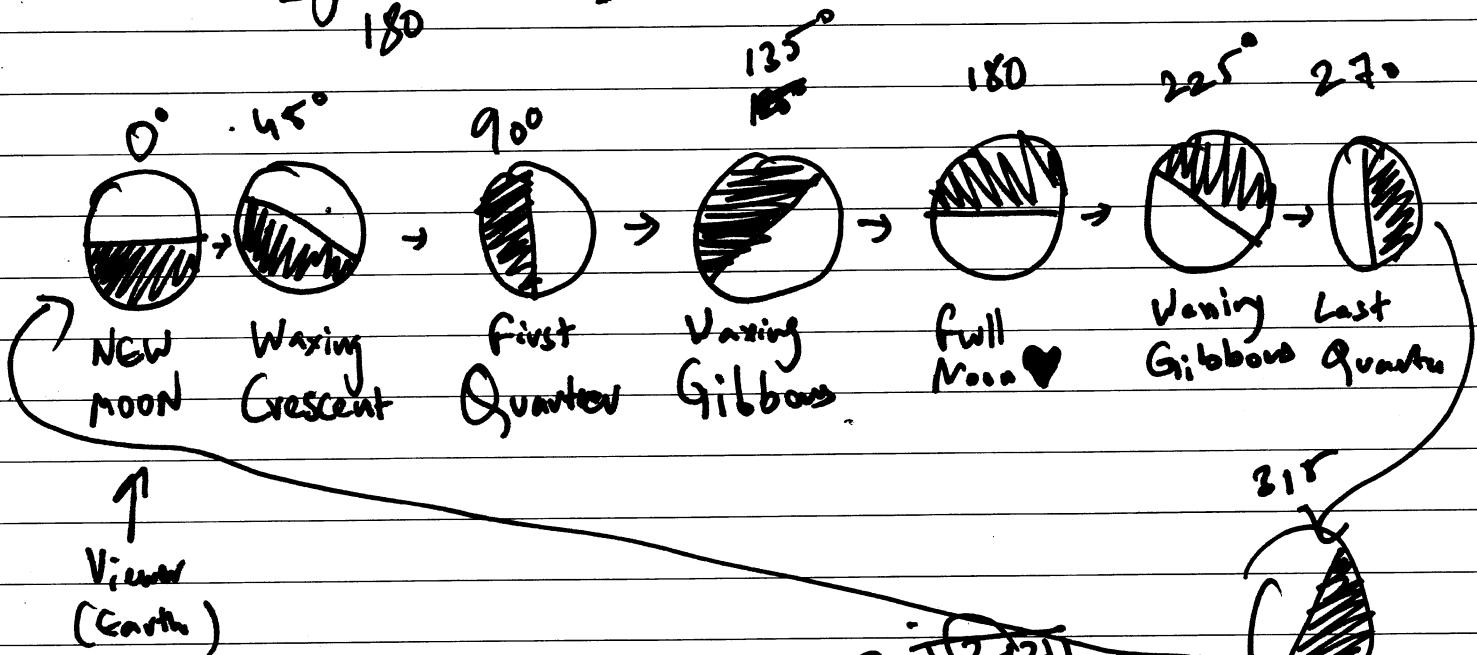
$$\cos 180^\circ = -1$$

$$\sin 180^\circ = 0$$



$$\text{degree} = \text{radians} \times \frac{180}{\pi}$$

$$\frac{\text{degree} \times \pi}{180} = \text{radians}$$



NEW MOON  $\rightarrow 0^\circ$

Waxing Crescent  $\rightarrow 45^\circ$

First Quarter  $\rightarrow 90^\circ$

Waxing Gibbous  $\rightarrow 135^\circ$

Full Moon  $\rightarrow 180^\circ$

Waning Gibbous  $\rightarrow 225^\circ$

Last Quarter  $\rightarrow 270^\circ$

Waxing Crescent  $\rightarrow 315^\circ \rightarrow 337.5^\circ$  ]  $45^\circ \triangleright$

NEW MOON  $\rightarrow 360^\circ$

Phases of the moon  $\rightarrow$  ~~चंद्र चक्रार्थ~~ / चंद्रमा की चक्रार्थ

३० घण्टिया

५५। वर्षया

पूर्णमास चाँद  
उत्तर चाँद  $\rightarrow$  उत्तराशी  
ग्रहे कुल द्वा चाँद  
पूर्णिमा  $\rightarrow$  पूर्णिम्य

३१५



Waxing Crescent

Waning  $\rightarrow$  कृत्ति चाँद

Waxing ग्रह चाँद

पूर्ण