T3-Visualização de uma imagem 360

Faça um notebook que leia uma imagem equiretangular de 360 graus e renderize para uma camera que tenha uma API Camera(fov,w,h,d,theta,phi), onde theta e phi sao os angulos em coordenadas polares do eixo xe da câmera no sistema da imagem360.

In [1]:

```
import sys
import numpy as np
import matplotlib.pyplot as plt
from math import sin, cos, sqrt

TOL = sys.float_info.epsilon
#print(TOL)
```

In [2]:

```
def vetor(x,y,z):
    return np.array([x,y,z],dtype = np.float)

def dot(u,v):
    return u[0]*v[0]+u[1]*v[1]+u[2]*v[2]

def norma(u):
    return sqrt(dot(u,u))

def unit(u):
    norm = norma(u)
    return u/norm if norm> TOL else u
```

In [15]:

```
class Camera:
    def __init__(self,fov,w,h,d, theta,phi):
        self.fov = fov
        self.w = w
        self.h = h
        self.d = d
        self.a = 2*d*np.tan(fov*np.pi/360)
        self.b = self.a*w/h
        self.eye = np.array([0.,0.,0.])
        theta = theta*np.pi/180
        phi = phi*np.pi/180
        ct = cos(theta)
        st = sin(theta)
        cp = cos(phi)
        sp = sin(phi)
        self.ze = np.array([st*cp, st*sp,ct])
        up = np.array([0,0,1])
        self.xe = unit(np.cross(self.ze, up))
        self.ye = unit(np.cross(self.ze, self.xe))
        self.img = np.zeros(shape=(h,w,3),dtype=np.float)

    def ray_to(self,xi,yi):
        x = self.b*(xi/self.w-0.5)
        y = self.a*(yi/self.h-0.5)
        z = self.d
        ray = x*self.xe+y*self.ye+z*self.ze
        return ray

    def pixel(self,xi,yi,rgb):
        self.img[yi,xi,:] = rgb

    def get_w(self):
        return self.w

    def get_h(self):
        return self.h

    def imshow(self):
        plt.imshow(self.img)
        #plt.set_aspect("equal")
        plt.show()

    def mostra(self):
        print('fov=',self.fov,'d=',self.d)
        print('(w,h)=(',self.w,",",self.h,")")
        print('(b,a)=(',self.b,",",self.a,")")
        print('xe=',self.xe)
        print('ye=',self.ye)
        print('ze=',self.ze)
```

In [16]:

```
cam = Camera(60, 800,600,1,120,180)
cam.mostra()
v0 = cam.ray_to(400,300)
v1 = cam.ray_to(400,0)
ang = np.arccos(dot(unit(v0),unit(v1)))*180/np.pi
print(ang)
```

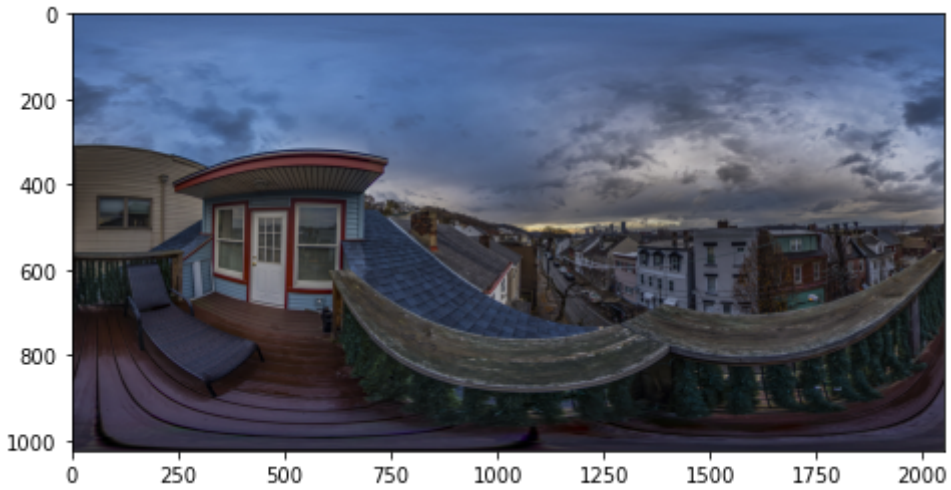
```
fov= 60 d= 1
(w,h)=( 800 , 600 )
(b,a)=( 1.539600717839002 , 1.1547005383792515 )
xe= [ 1.2246468e-16  1.0000000e+00 -0.0000000e+00]
ye= [ 5.00000000e-01 -6.12323400e-17 -8.66025404e-01]
ze= [-8.66025404e-01  1.06057524e-16 -5.00000000e-01]
29.999999999999993
```

In [17]:

```
class Img360:
    def __init__(self,radius,img360):
        self.radius = radius
        self.img360 = img360
        self.w = img360.shape[1]
        self.h = img360.shape[0]

    def trace(self,ray):
        xy = sqrt(ray[0]*ray[0]+ray[1]*ray[1])
        phi = np.arctan2(ray[1],ray[0])
        theta = np.arctan2(xy, ray[2])
        u = 0.5*(1+phi/np.pi)
        v = theta/np.pi
        xi = int((self.w-1)*u)
        yi = int((self.h-1)*v)
        cor = self.img360[yi, xi,:]
        rgb = np.array(cor)
        return rgb/255

class Scene:
    def __init__(self, camera, sphere):
        self.camera = camera
        self.sphere = sphere

    def render(self):
        w = self.camera.get_w()
        h = self.camera.get_h()
        for y in range(h):
            for x in range(w):
                ray = self.camera.ray_to(x,y)
                rgb = self.sphere.trace(ray)
                self.camera.pixel(x,y,rgb)
```

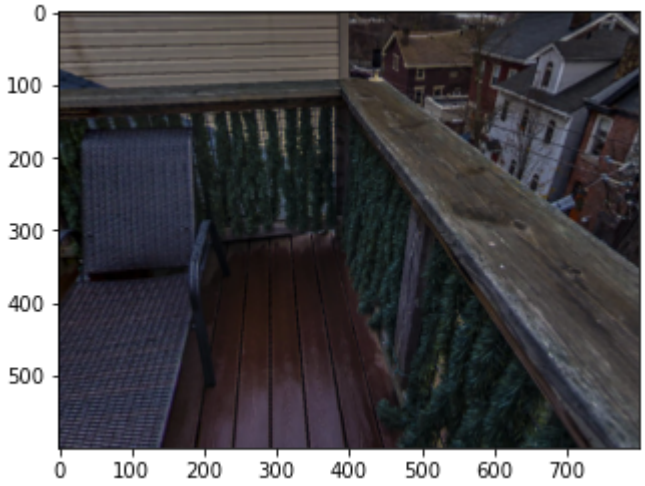
In [18]:

```
path = '' # estou com a imagem na mesma pasta
filename = path + "Sunset_Southside_Slopes_Pittsburgh_Equirectangular_Panoramic.jpg"
plt.figure(figsize=(8,4))
img360 = plt.imread(filename)
plt.imshow(img360)
plt.show()
```



In [19]:

```
img = Img360(10,img360)
scn = Scene(cam,img)
scn.render()
cam.imshow()
```



In [20]:

```
cam = Camera(60, 800,600,1,90,150)
scn = Scene(cam,img)
scn.render()
cam.imshow()
```