

Disco Ball Lighting!



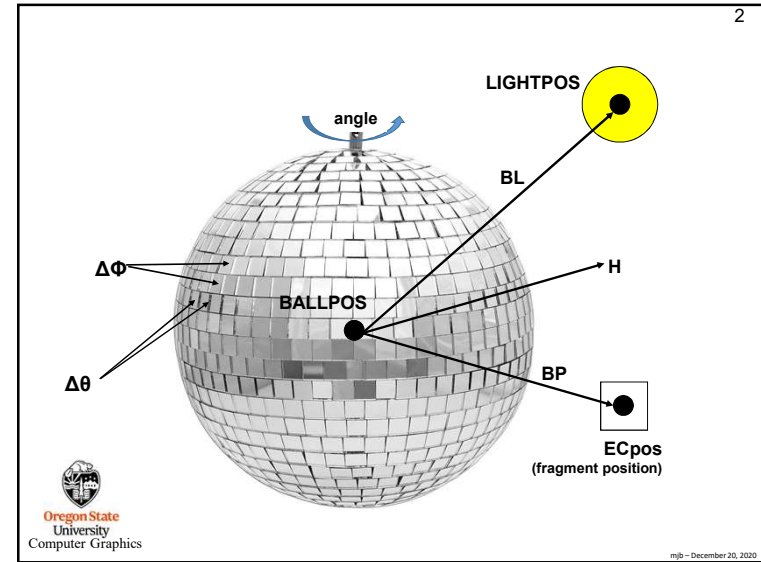
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disco.pptx mjb - December 20, 2020



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```
disco.glib
##OpenGL GLIB
Perspective 90
LookAt 0 0 1 0 0 0 0 1 0

Vertex disco.vert
Fragment disco.frag
Program Disco Program Disco \
    uNumFacets <5 15 50> \
    uPower <1000. 5000. 50000.>

Color 1. 0.5 0.
Teapot
```

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```
disco.vert
#version 330 compatibility

out vec3 vECpos;
out vec4 vColor;
out float vLightIntensity;

const vec3 LIGHTPOS = vec3( 2., 0., 0. );

void
main( )
{
    vECpos = ( gl_ModelViewMatrix * gl_Vertex ).xyz;

    vec3 tnorm = normalize( vec3( gl_NormalMatrix * gl_Normal ) );
    vLightIntensity = dot( normalize(LIGHTPOS - vECpos), tnorm );
    vLightIntensity = abs( vLightIntensity );

    vColor = gl_Color;

    gl_Position = gl_ModelViewProjectionMatrix * gl_Vertex;
}
```

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```

disco.frag, I
#version 330 compatibility

in vec3 vECpos;
in vec4 vColor;
in float vLightIntensity;

uniform int uNumFacets;
uniform float uPower;
uniform float Timer; // built-in to glman

const float PI = 3.14159265;
const vec3 BALLPOS = vec3( 0., 2., 0. );
const vec3 LIGHTPOS = vec3( 2., 0., 0. );
const vec3 LIGHTCOLOR = vec3( 1., 1., 1. );

void
main( void )
{
    int numTheta = uNumFacets; // # in longitude direction
    int numPhi = uNumFacets; // # in latitude direction
    float dtheta = 2. * PI / float(numTheta);
    float dphi = PI / float(numPhi);
    // spherical coord angles between the facets
    vec3 BP = normalize( vECpos - BALLPOS ); // vector from ball center to the
    // point we care about
    float angle = radians( Timer * 360. ); // ball rotation angle
    float c = cos( angle );
    float s = sin( angle );
    vec3 bp;
    bp.x = c * BP.x + s * BP.z;
    bp.y = BP.y;
    bp.z = -s * BP.x + c * BP.z; // but, rotate the vector, not the ball
    
```

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```

disco.frag, II
vec3 BL = normalize( LIGHTPOS - BALLPOS ); // vector from the ball center
// to the light
vec3 H = normalize( BL + bp ); // vector halfway between BL and bp - if a facet aligns with this angle,
// the point we care about will get a lot of light
float xz = length( H.xz );
float phi = atan( H.y, xz );
float theta = atan( H.z, H.x ); // turn the H vector into spherical coordinates

int itheta = int( floor( ( theta + dtheta/2. ) / dtheta ) );
int iphi = int( floor( ( phi + dphi/2. ) / dphi ) );

float theta0 = dtheta * float(itheta);
float phi0 = dphi * float(iphi); // figure out what the closest facet to H is

vec3 N0;
N0.y = sin(phi0);
xz = cos(phi0);
N0.x = xz * cos(theta0);
N0.z = xz * sin(theta0); // N0 is the discrete facet normal vector

float d = max( dot( N0, H ), 0. ); // like the cone angle on a spotlight
const float DMIN = 0.990; // acos(0.990) is about 8 degrees
if( d < DMIN )
    d = 0.;
d = pow( d, uPower ); // specular brightness

gl_FragColor = vec4( vColor.rgb * vLightIntensity + d * LIGHTCOLOR, 1. ); // diffuse + specular
    
```

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