Spectral Effects: Chromatic Refraction and Wavelength Interference

Each Wavelength of Light Has a Slightly Different Index of Refraction so that each Wavelength Bends Differently in a Prism.

http://www.edmundoptics.com

Rainbows

Rainbow Strategy

1. Draw one big quadrilateral across the scene
2. Anywhere that .7400 ≤ cos(Θ) ≤ .7490, paint a color
3. Otherwise, discard.

<table>
<thead>
<tr>
<th>Color</th>
<th>λ (nm)</th>
<th>η</th>
<th>Θ (°)</th>
<th>Θcos(Θ)</th>
<th>D (°)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>650</td>
<td>1.510</td>
<td>42</td>
<td>0.743</td>
<td>50.0</td>
</tr>
<tr>
<td>Green</td>
<td>500</td>
<td>1.519</td>
<td>41</td>
<td>0.755</td>
<td>51.5</td>
</tr>
<tr>
<td>Blue</td>
<td>400</td>
<td>1.528</td>
<td>40</td>
<td>0.766</td>
<td>53.0</td>
</tr>
</tbody>
</table>

Primary Rainbow

Secondary Rainbow

Spectral Colors

```
vec3 SunDirection = vec3( 0., SunY, 10. );
vec3 PtToSun = normalize( SunDirection );
vec3 PtToEye = normalize( vec3(0.,0.,0.) - ECposition );
float costheta = dot( PtToEye, PtToSun );
float R = Pulse( .7400, .7490, Tol, costheta );
float G = Pulse( .7490, .7605, Tol, costheta );
float B = Pulse( .7605, .7700, Tol, costheta );
float t = ( λ – 400. ) / ( 600. – 400. );
vec3 rgb = Rainbow( t );
```

Or anything else, really. You just need a large “fragment-generator”.

Spectral Colors

1. Draw one big quadrilateral across the scene
2. Anywhere that .7400 ≤ cos(Θ) ≤ .7700, paint a color
3. Otherwise, discard.
Rainbow( float t )
{
    t = clamp( t, 0., 1.);
    vec3 rgb = vec3( 0., 0., 0.);
    if( t >= 0. )
    {
        rgb.g = 4. * ( t - (0./4.) );
        rgb.b = 1.;
    }
    if( t >= (1./4.) )
    {
        rgb.g = 1.;
        rgb.b = 1. - 4. * ( t - (1./4.) );
    }
    if( t >= (2./4.) )
    {
        rgb.r = 4. * ( t - (2./4.) );
        rgb.g = 1.;
    }
    if( t >= (3./4.) )
    {
        rgb.r = 1.;
        rgb.g = 1. - 4. * ( t - (3./4.) );
    }
    return rgb;
}

Changing the Range [0.,1.] to Rainbow Colors

Oil Slicks

$$\lambda = \frac{2d\eta}{m + \frac{1}{2}}$$

$$\lambda = \frac{2d\eta}{m}$$

For a CD, \( d = 1600 \text{ nm} \)
For a DVD, \( d = 740 \text{ nm} \)