Mestrado em
Engenharia Informática

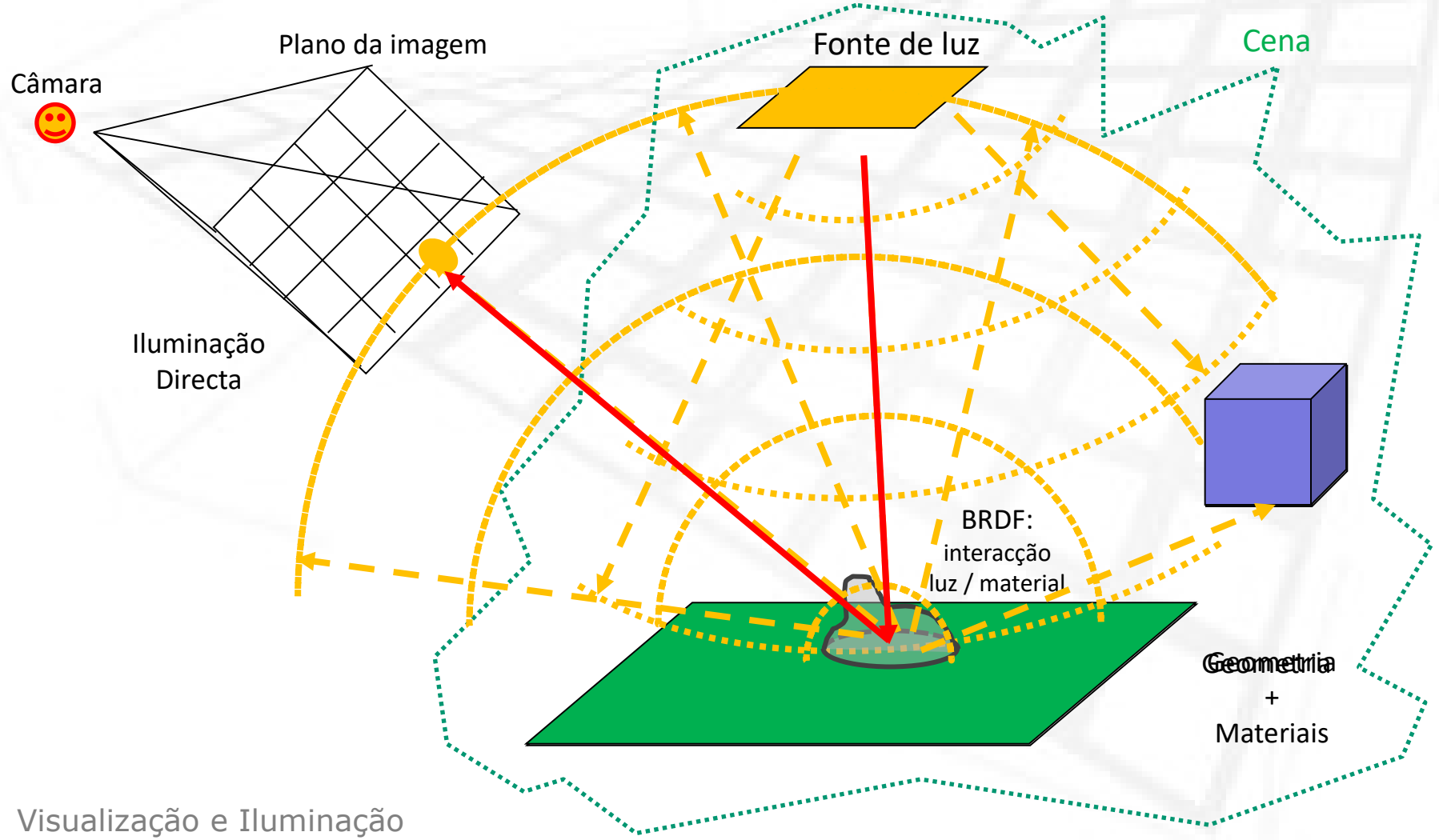
The 3D Rendering Problem

Visualização e Iluminação

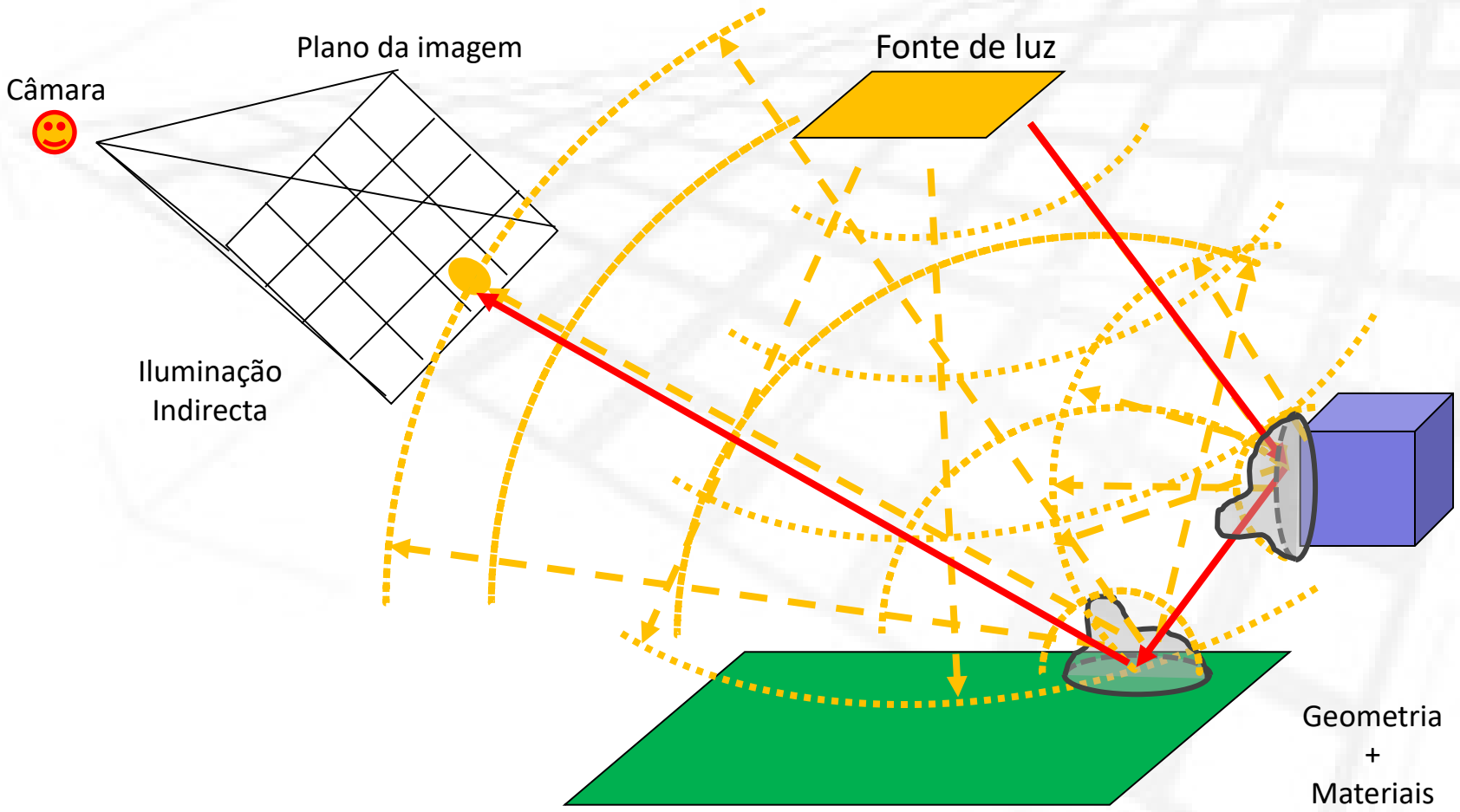
Luís Paulo Peixoto dos Santos

Global Illumination

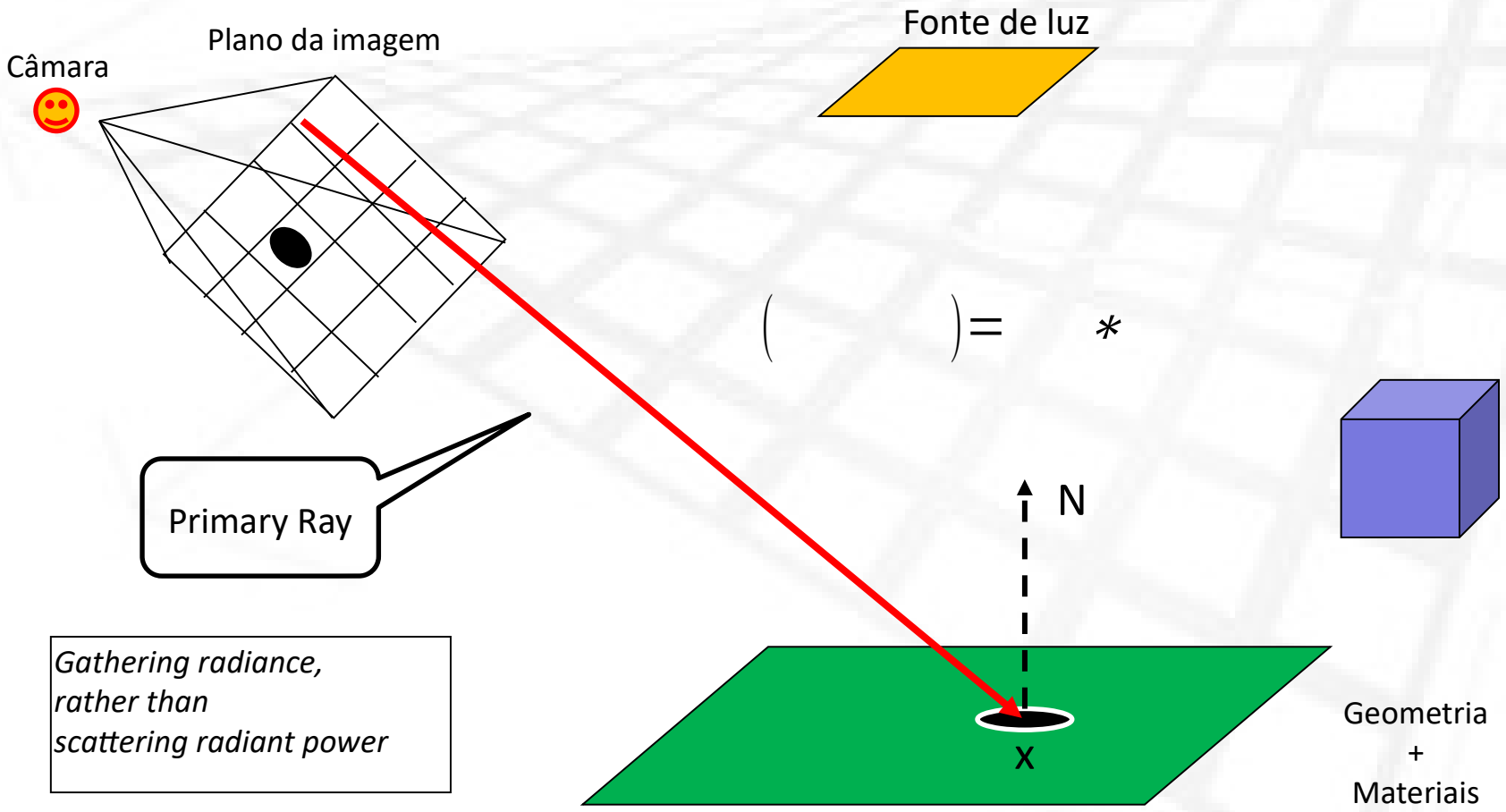
The 3D Rendering Problem



The 3D Rendering Problem

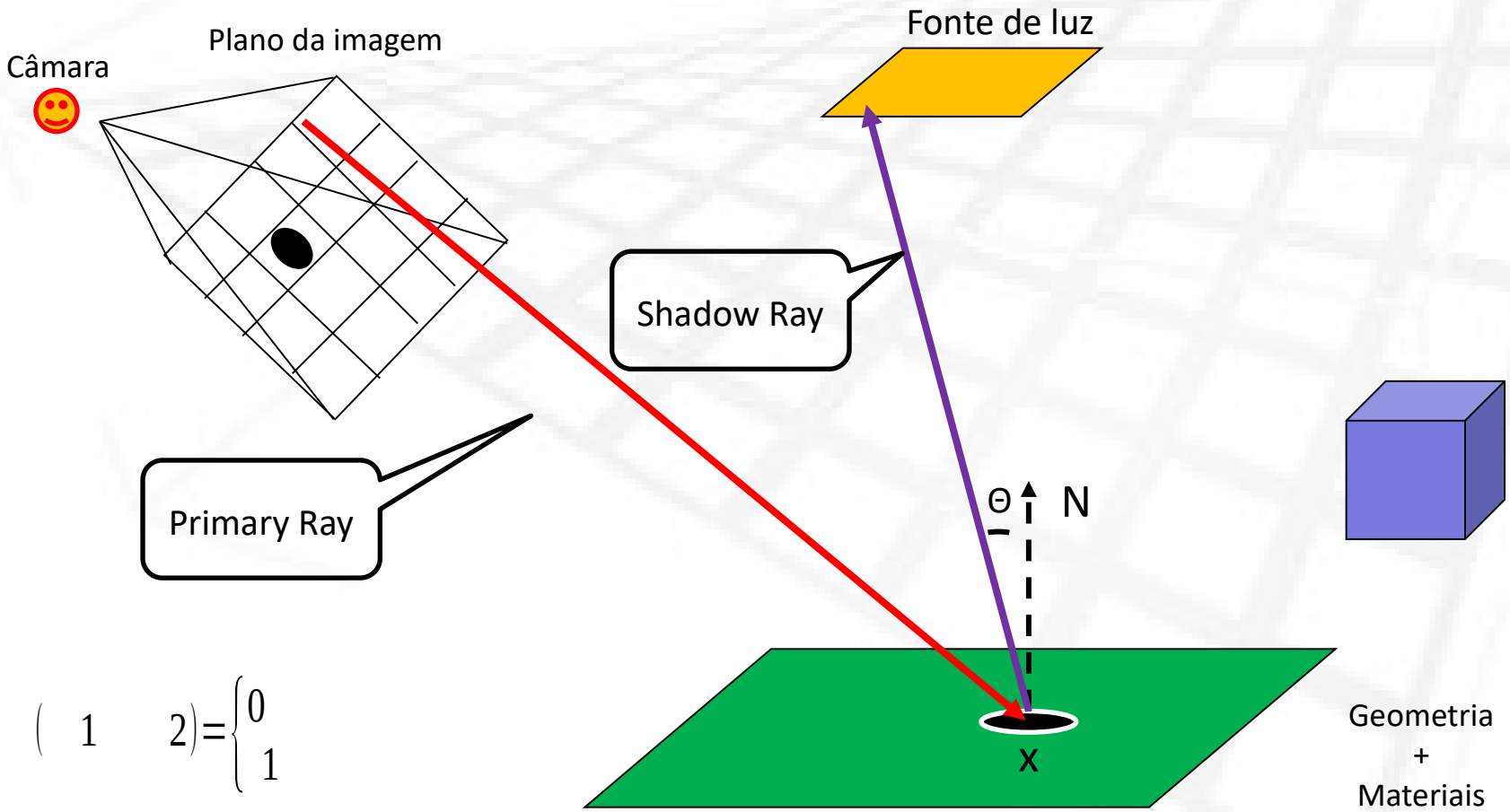


Backward Ray Tracing



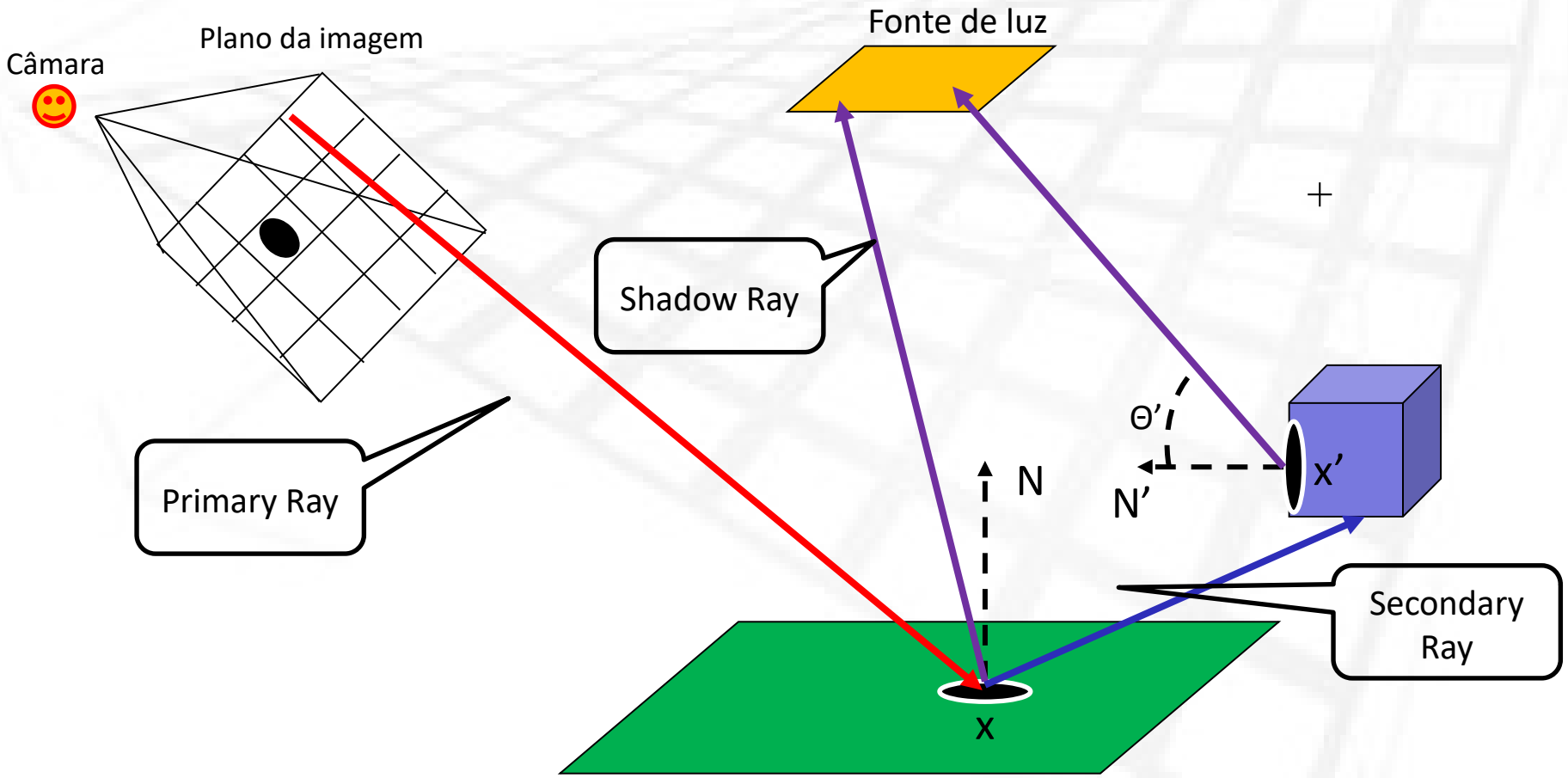
Gathering radiance,
rather than
scattering radiant power

Backward Ray Tracing



$$\left(\quad 1 \quad 2 \right) = \begin{cases} 0 \\ 1 \end{cases}$$

Backward Ray Tracing



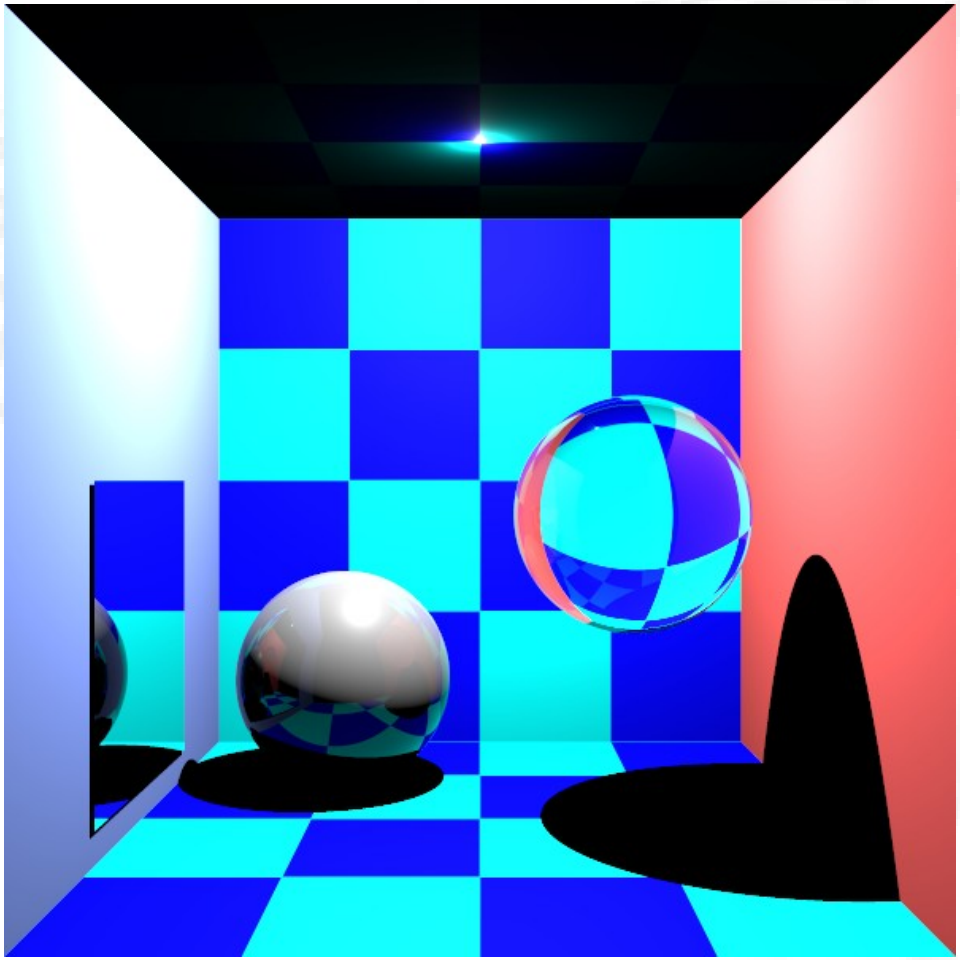
Ray Tracing: Algoritmo

```
// main loop
computeImage (viewPoint) {
  para cada ponto p in plano_imagem {
        ray = camera.GetRay (p)
        radiance[p] =  rad (ray)
  }
}

rad (ray) {
  primitive, x = scene.trace (ray)
  shade (x, ray, primitive)
}
```

Ray Tracing: Algoritmo

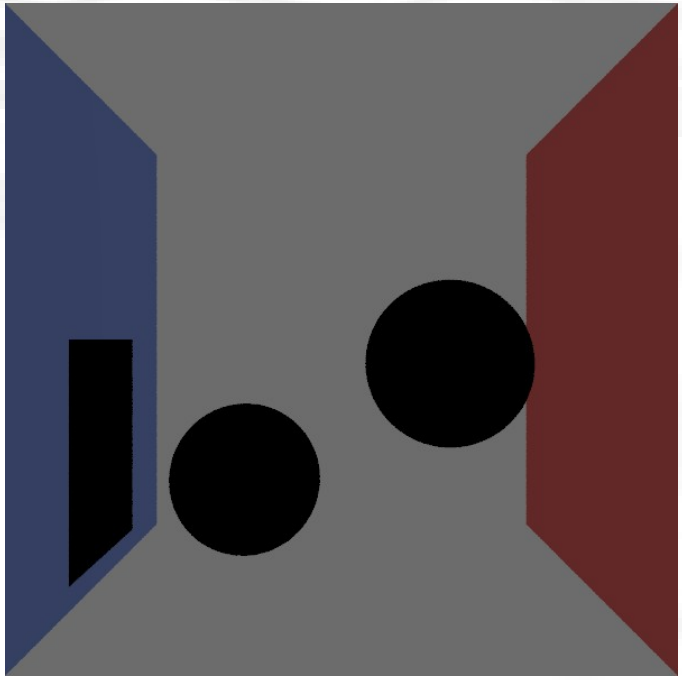
```
// intersecção mais próxima da origem do raio

Scene::trace (ray)  {
   tmin = Max_dist
   while (primitive = scene.nextPrim())  {
         x = primitive.geom.intersect (ray)
         dist = x.distance (ray.origin)
         if (dist < tmin) {
               tmin = dist
               p = x
               prim = primitive          }
   }
   return (prim, p)
}
```

Ray Tracing: Cornell Box



shading: diffuse BRDF

```
shade (x, ray, prim){  // BRDF
  return (prim.BRDF(x, ray.dir))
}
```

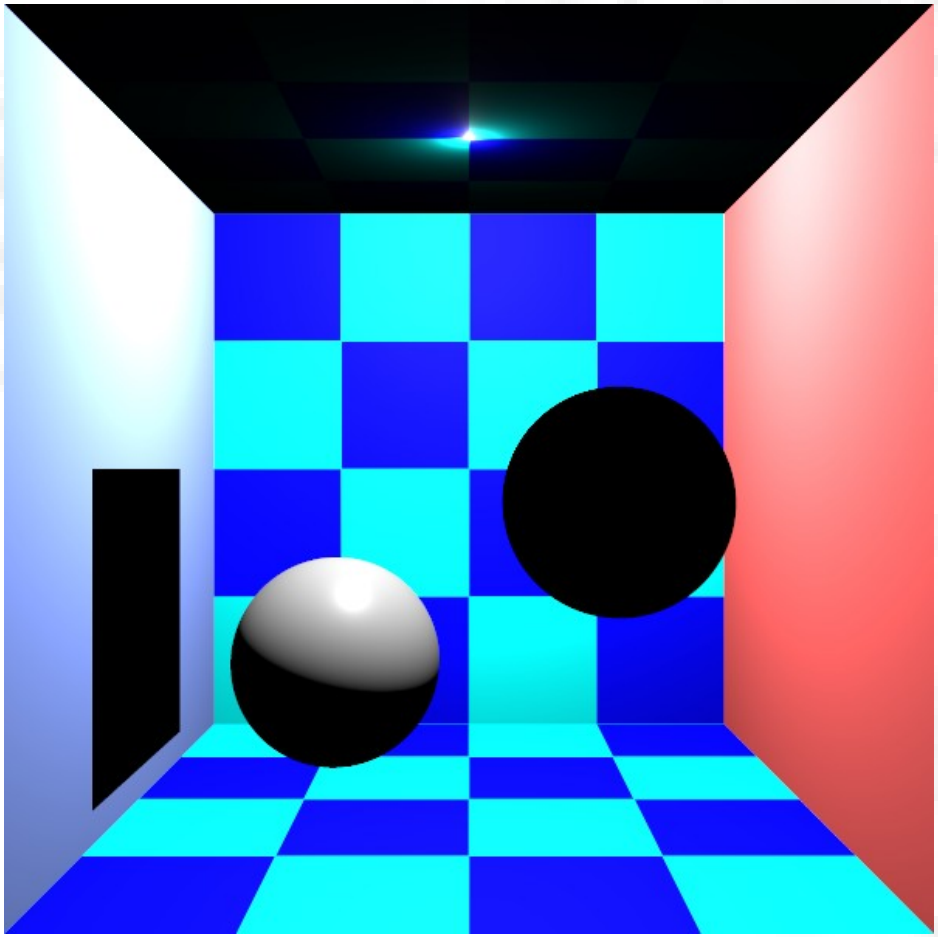


Ray Tracing: Iluminação Directa

- Se os *shadow rays* não forem disparados assume-se V(x,y)=1
- O algoritmo não calcula sombras (**NÃO** é fisicamente plausível)

```
shade (x, ray, prim) {
  radiance = directIllum_NoShadows (x, ray.dir, prim)
  return (radiance)
}

directIllum_NoShadows (x, dir, prim) {
   rad = 0;
    while (l = scene.nextLight()) {
       pl = l.Sample(); dir_l = x.vec2Point (pl);
      rad += prim.brdf (dir, dir_l)* l.L * cos (x.N, dir_l)
   }
   return (rad)
}
```

Ray Tracing: Iluminação Directa



Ray Tracing: Iluminação Directa

```
shade(x, ray, prim) {
  radiance = directIllum (x, ray.dir, prim)
  return (radiance)
}

directIllum (x, dir, prim) {
   rad = 0;
   while (l = scene.nextLight()) {
         pl = l.Sample(); dir_l = x.vec2Point (pl);
         ray = GenerateRay (x, l, SHADOW)
         if (scene.visibility (ray, pl))
            rad += prim.brdf (dir, dir_l)* l.L * cos (Nx,
   dir_l)
   }
   return (rad)
}
```

Ray Tracing: Iluminação Directa

```
// visibilidade da fonte de luz

Scene::visibility (ray,  pl)  {          // V(x,y)
   tmin = distance (ray.origin, pl)
   while (primitive = scene.nextPrim())  {
         x = primitive.geom.intersect (ray)
         dist = x.distance (ray.origin)
         if (dist < tmin) {
        return 0
       }
   }
   return 1
}
```

Ray Tracing: Iluminação Directa