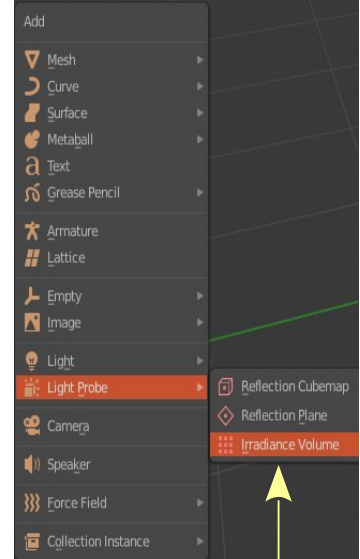## 03 Irradiance Volume

Irradience Volume, as defined in the Blender Wiki states that Diffuse indirect lighting is stored into volumetric arrays. These arrays are defined by the user using **Irradiance Volume** objects. Lighting is computed at the dot positions visible when the **Irradiance Volume** Object is selected.

To understand this definition consider the following: To limit and control how light is reflected between Objects in a Scene a volume of space, within the Scene, is defined. Inside the volume calculation points are arranged where light from an external source is captured and split or diffused. The diffused light is then cast onto Objects which are also located inside the volume of space. Having this diffusion limited to the volume of space limits the rendering process for the Scene as a whole.

In other words, the lighting effect within the Irradience Volume is rendered and the information stored in a cache.

An Irradience Volume is entered from the Add Menu - Light Probe Tab (Figure 03.1)
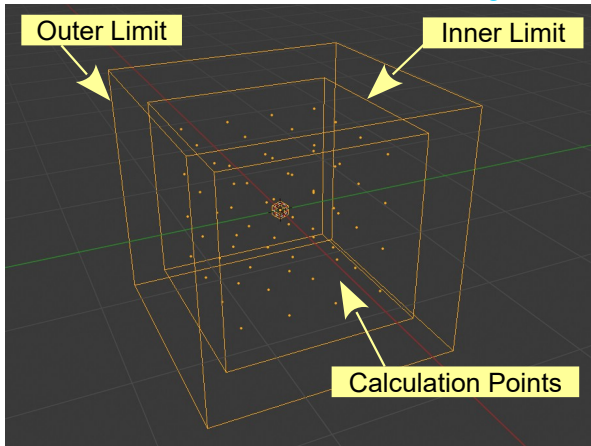
An Irradience Volume enters the Scene as two cubes (Figure 03.2) , one inside the other designating the inner and outer limits of the volume. Calculation points are arranged on an XYZ grid within the inner volume. The Irradience Volume may be translated, rotated and scaled similar to any Object in Blender.

Controls for the Irradience Volume are in the Properties Editor, Object Data buttons (Figure 03.3).

Distance: Size of the Outer Limit.

Falloff: Distance between Inner and Outer Limits.
      The lighting effect fades between the limits.

Intensity: The intensity of the light bounce.

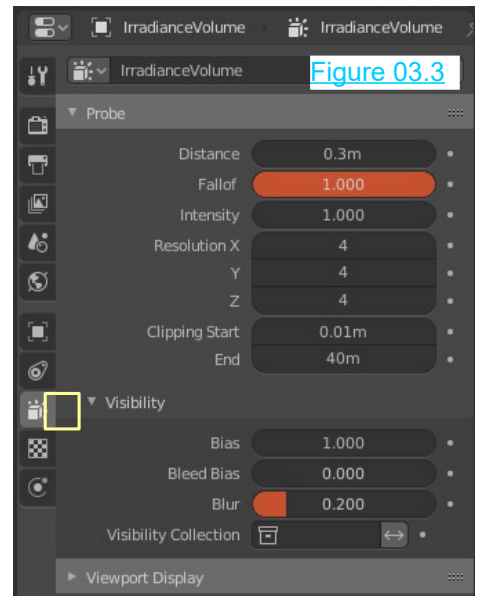**Resolution:** Increases or decreases Calculation Points.

To demonstrate lighting effects created by an **Irradience Volume** construct a Scene as shown in Figure 03.4. The Scene consists of a Plane with two Cubes and a UV Sphere sitting just above the Plane. An Irradience Volume has been scaled such that the inner limit surrounds the Plane and the two Cubes. The Cubes and the Plane have simple diffuse Material colors using the default Principled BSDF Shader.
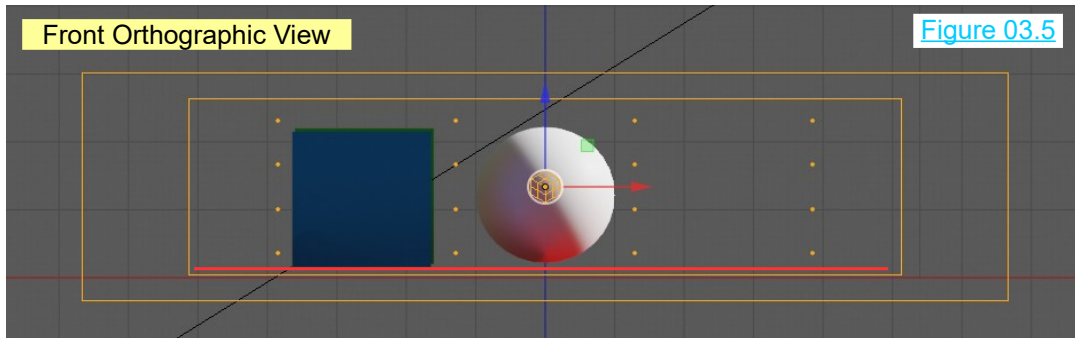
The UV Sphere is positioned **outside** the Irradience Volume and has white diffuse Material. The surface of the UV Sphere has been set smooth.

There is a single Point Lamp in the Scene.

Irradience Volume

Point Lamp

UV Sphere Outside the Irradience Volume

User Perspective View
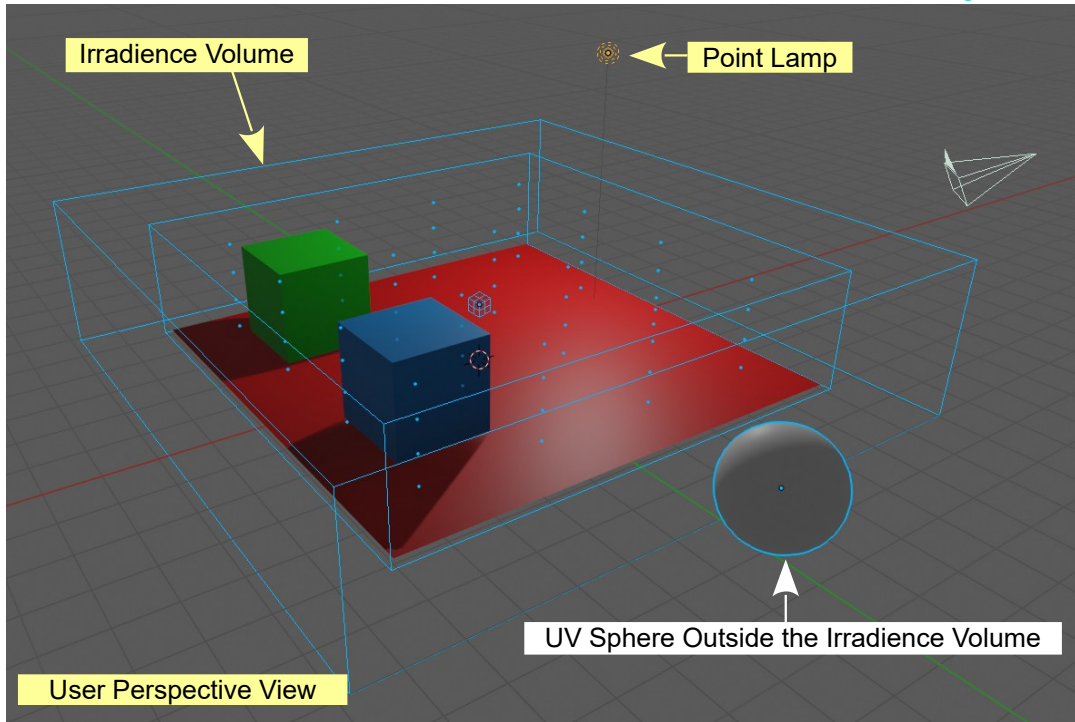
The Irradience Volume is scaled and positioned to surround the Cubes and the Plane.

Front Orthographic View

To create the Irradience lighting effect, the data for the effect has to be **Baked** (saved to a Cache).
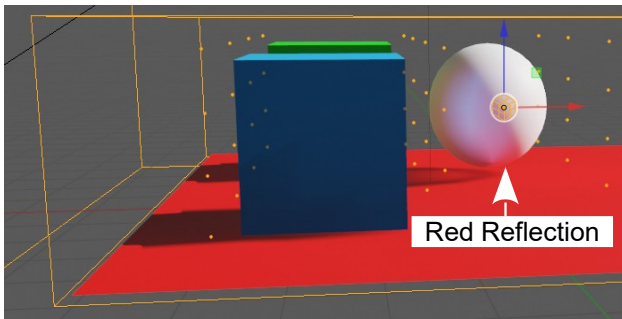
In the Properties Editor, Render buttons, Indirect Lighting Tab, click on **Bake Indirect Lighting** (Figure 03.6).

The **Bake Lighting** progress bar displays at the bottom of the Screen during the Bake process.

When the Bake is complete, move the UV Sphere inside the Irradience Volume to see the reflection from the red Plane cast on the underside of the Sphere.
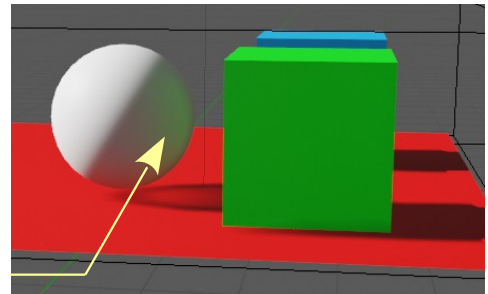

Red Reflection

By rotating the Scene and moving the UV Sphere in proximity to the Cubes you will observe the colors of the Cubes reflected on the surface of the Sphere.
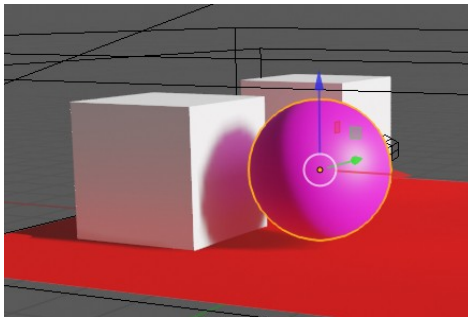
Note: The reflections are very subtle. All Objects in the Scene have simple Diffuse Materials.

Green Reflection

Experiment with different Material colors on different Objects.
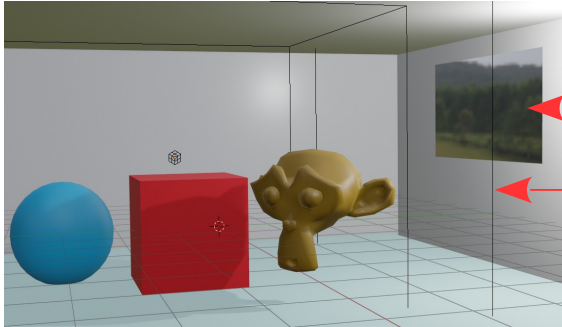

Remember: With each change made to the Scene you have to Re-Bake the Indirect Lighting.

In the examples the Objects are placed in the Scene with illumination provided by a single Point Lamp. Irradience Volumes also work in interior Scenes with other light sources such as HDRI Image Maps as the World Surface Background Color.
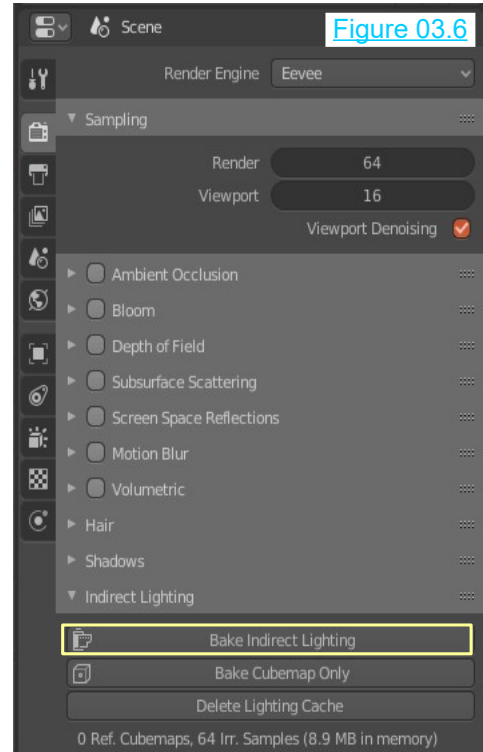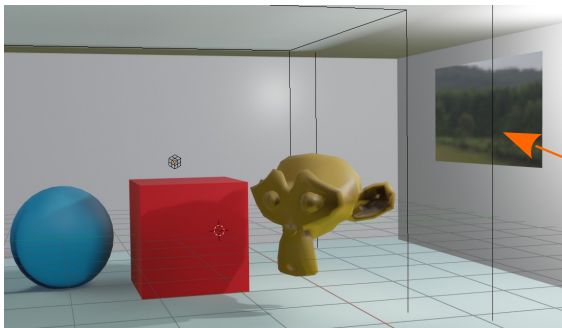
Interior Scene with a single Point Lamp inside a room and an HDRI Image Map as the World Background Color showing through a window.

An Irradience Volume surrounds the Objects in the Scene.

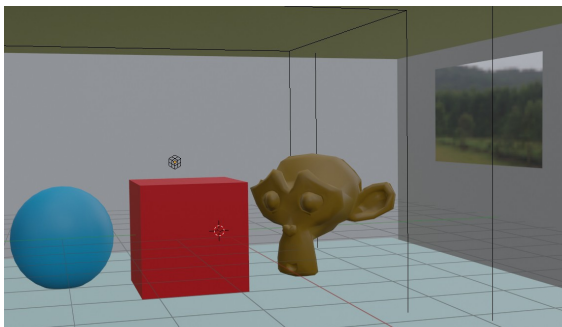In Figure 03.11 the Indirect Lighting has NOT been Baked.

Figure 03.11

After Baking the lighting is improved as seen by more pronounced shadows and the Monkeys face being better illuminated (Figure 03.12).
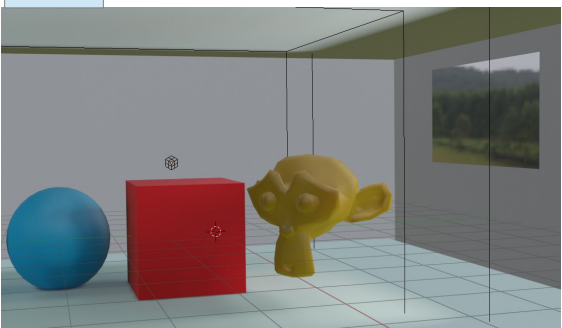
HDRI Background Image in the Scene outside the room.

Figure 03.12

With the Point Lamp cancelled, illumination is provided only from the HDRI Background through the window. Figure 03.13 shows Camera View before Baking.

Figure 03.13

After Baking there is an improved illumination.

The Figures show Camera View (Figure 03.14). The black lines are the Irradience Volume surrounding the Objects in the room.

Irradience Volumes provide subtle lighting effects. You will have to experiment to fully appreciate what can be achieved.
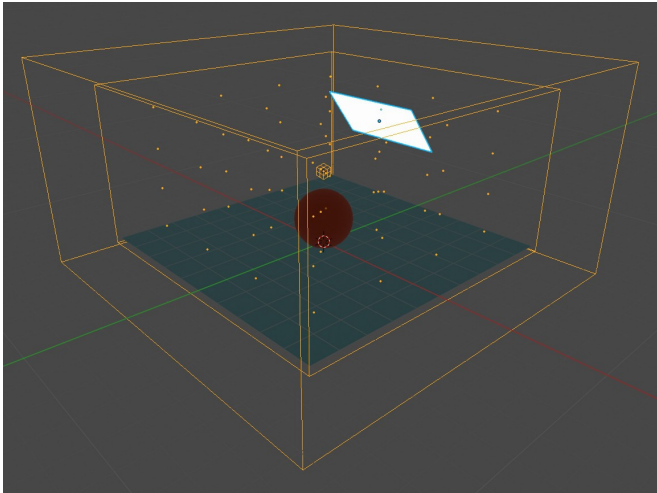
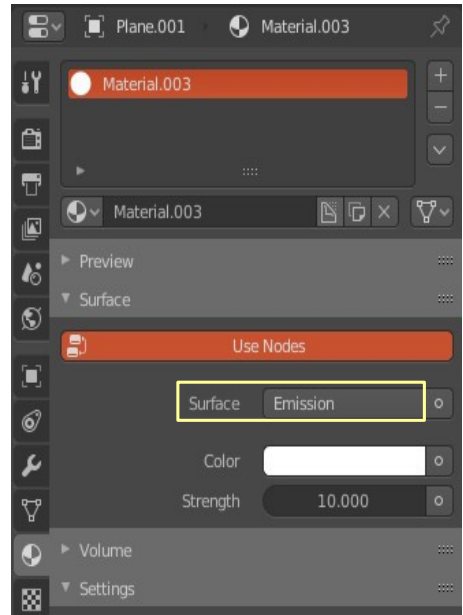Figure 03.14

Light Emitter Objects

As you have seen, Scene Lighting is provided by Lamps, Background Colors and HDRI Images as the World Background. With the Cycles Render System engaged, Objects in a Scene can emit light when an Emission Shader is applied. To produce this effect with the Eevee Render engine you employ an Irradience Volume Lightprobe.

Figure 03.16

Figure 03.16 shows a Plane Object positioned above a floorplane and a UV Sphere. All three Objects are surrounded by an Irradience Volume.
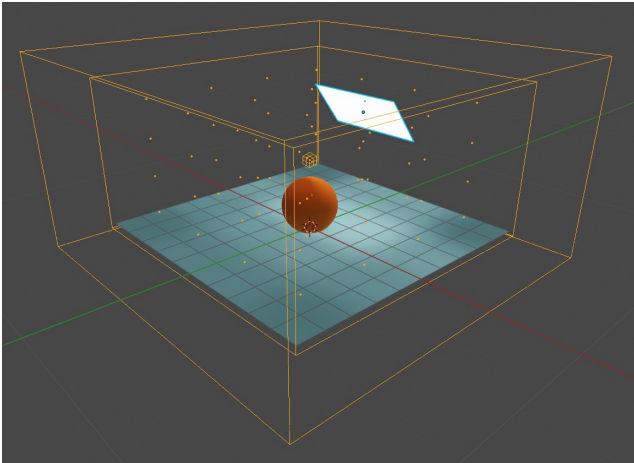
To employ the Plane as a Light Emitter change the Surface, Principled BSDF Shader in the Properties Editor, Materials buttons to an Emission Shader (Figure 03.16).

When Indirect Lighting is Baked in the Properties Editor, Render buttons, the Plane emits light and illuminates the Scene (Figure 03.17).

Figure 03.17