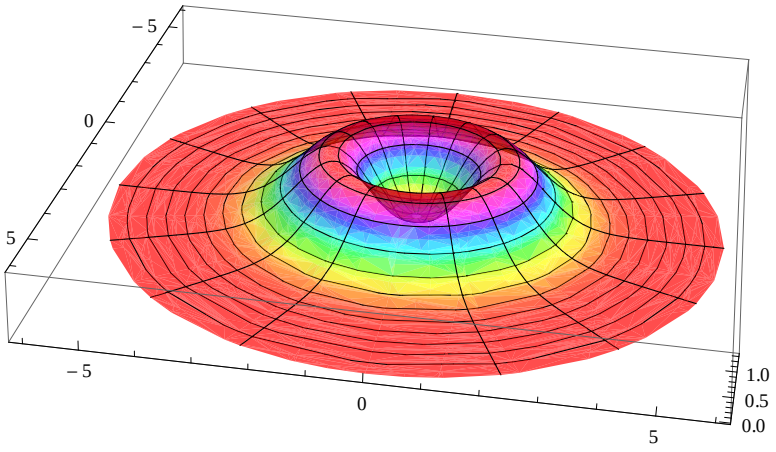
Cohen – Tannoudji S .734

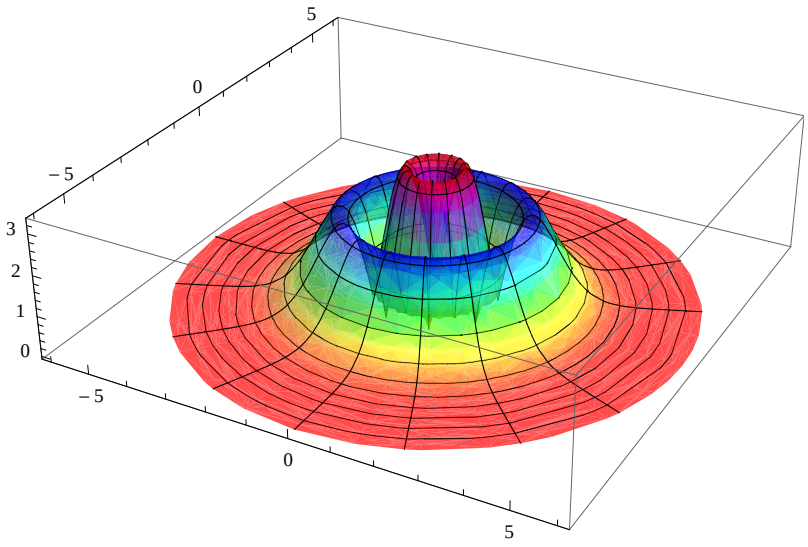
```
b = 1;

ag := Exp[-I phi] / 2 (b rho # - 1 / b D[#, rho] + I / b / rho D[#, phi]) &
ad := Exp[I phi] / 2 (b rho # - 1 / b D[#, rho] - I / b / rho D[#, phi]) &
X[rho_] := b / Sqrt[Pi] Exp[-b^2 rho^2 / 2]

X[ng_, nd_, r_, p_] :=
 Simplify[1 / Sqrt[ng! nd!] Nest[ag, Nest[ad, X[rho], nd], ng]] /. rho → r /. phi → p

ng = 1; nd = 4;
ParametricPlot3D[{r Cos[p], r Sin[p], 10 / Sqrt[ng! nd!] Abs[Z[[nd, ng]]]},
 {r, 0.1, 6}, {p, 0, 2 Pi}, ColorFunction → Hue, PlotStyle → Directive[Opacity[0.7]]]
```





```
Z = Simplify[NestList[ag, NestList[ad, X[rho], 10], 10]] /. rho → r /. phi → p
```

$Aborted

Z

$$\left\{\left\{\frac{e^{-\frac{r^2}{2}}}{\sqrt{\pi}}, \frac{e^{i p-\frac{r^2}{2}} r}{\sqrt{\pi}}, \frac{e^{2 i p-\frac{r^2}{2}} r^2}{\sqrt{\pi}}, \frac{e^{3 i p-\frac{r^2}{2}} r^3}{\sqrt{\pi}}\right\},\right.$$

$$\left\{\frac{e^{-i p-\frac{r^2}{2}} r}{\sqrt{\pi}}, \frac{e^{-\frac{r^2}{2}}\left(-1+r^2\right)}{\sqrt{\pi}}, \frac{e^{i p-\frac{r^2}{2}} r\left(-2+r^2\right)}{\sqrt{\pi}}, \frac{e^{2 i p-\frac{r^2}{2}} r^2\left(-3+r^2\right)}{\sqrt{\pi}}\right\},$$

$$\left\{\frac{e^{-2 i p-\frac{r^2}{2}} r^2}{\sqrt{\pi}}, \frac{e^{-i p-\frac{r^2}{2}} r\left(-2+r^2\right)}{\sqrt{\pi}}, \frac{e^{-\frac{r^2}{2}}\left(2-4 r^2+r^4\right)}{\sqrt{\pi}}, \frac{e^{i p-\frac{r^2}{2}} r\left(6-6 r^2+r^4\right)}{\sqrt{\pi}}\right\},$$

$$\left\{\frac{e^{-3 i p-\frac{r^2}{2}} r^3}{\sqrt{\pi}}, \frac{e^{-2 i p-\frac{r^2}{2}} r^2\left(-3+r^2\right)}{\sqrt{\pi}},\right.$$

$$\left.\left.\frac{e^{-i p-\frac{r^2}{2}} r\left(6-6 r^2+r^4\right)}{\sqrt{\pi}}, \frac{e^{-\frac{r^2}{2}}\left(-6+18 r^2-9 r^4+r^6\right)}{\sqrt{\pi}}\right\}\right\}$$