In[1]:=
```
mat = {{Sin[t] Cos[f], Sin[t] Sin[f], Cos[t]},
  {Cos[t] Cos[f], Cos[t] Sin[f], -Sin[t]}, {-Sin[f], Cos[f], 0}}
coord[{r_, t_, f_}] := mat.{r, t, f}
lam = 1 / x /. FindRoot[x == Tan[x], {x, 4}]
```

Out[1]=
```
{{Cos[f] Sin[t], Sin[f] Sin[t], Cos[t]},
 {Cos[f] Cos[t], Cos[t] Sin[f], -Sin[t]}, {-Sin[f], Cos[f], 0}}
```

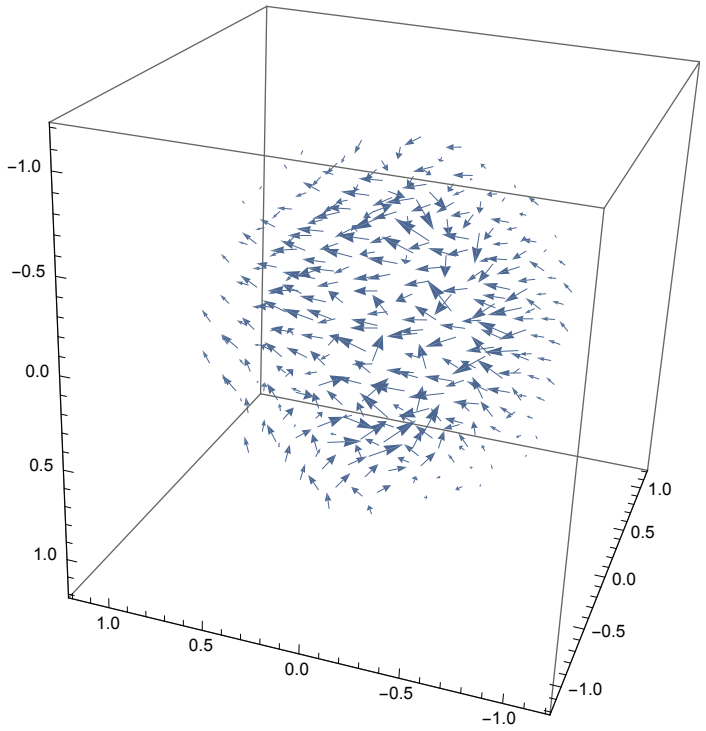
Out[3]=
```
0.222548
```

In[4]:=
```
field = {2 lam / r^2 (lam / r Sin[r / lam] - Cos[r / lam]) Cos[f],
  -1 / r (lam / r Cos[r / lam] - lam^2 / r^2 Sin[r / lam] + Sin[r / lam]) Sin[f],
  1 / r (lam / r Sin[r / lam] - Cos[r / lam]) Sin[f]}
```

Out[4]=
$$\left\{\frac{0.445096\,\text{Cos}[f]\left(-\text{Cos}[4.49341\,r]+\frac{0.222548\,\text{Sin}[4.49341\,r]}{r}\right)}{r^2},\right.$$
$$-\frac{\text{Sin}[f]\left(\frac{0.222548\,\text{Cos}[4.49341\,r]}{r}+\text{Sin}[4.49341\,r]-\frac{0.0495277\,\text{Sin}[4.49341\,r]}{r^2}\right)}{r},$$
$$\left.\frac{\text{Sin}[f]\left(-\text{Cos}[4.49341\,r]+\frac{0.222548\,\text{Sin}[4.49341\,r]}{r}\right)}{r}\right\}$$

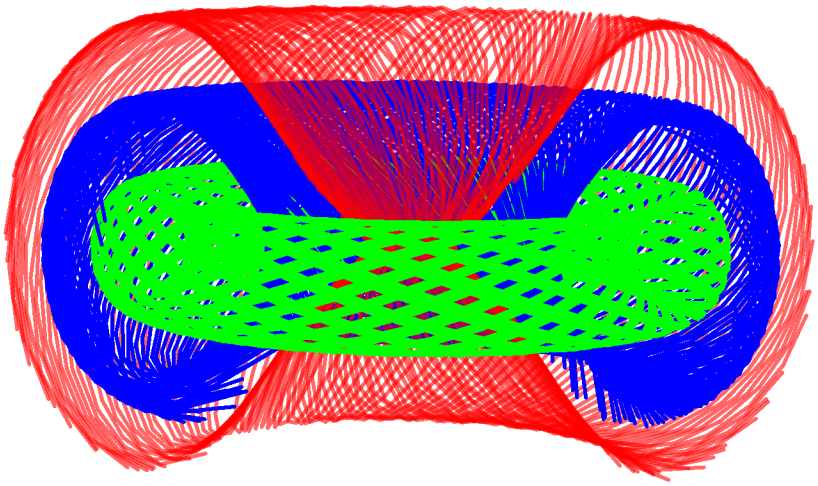
In[5]:=
```
VectorPlot3D[Evaluate[
  coord[field] /. t → ArcCos[z / r] /. f → ArcTan[x, y] /. r → Sqrt[x^2 + y^2 + z^2]],
 {x, -1, 1}, {y, -1, 1}, {z, -1, 1}, VectorPoints → 10,
 VectorScale → {Scaled[0.1], Scaled[0.6]},
 RegionFunction → Function[{x, y, z}, 1 / 4 < x^2 + y^2 + z^2 < 1]]
```

Out[5]=



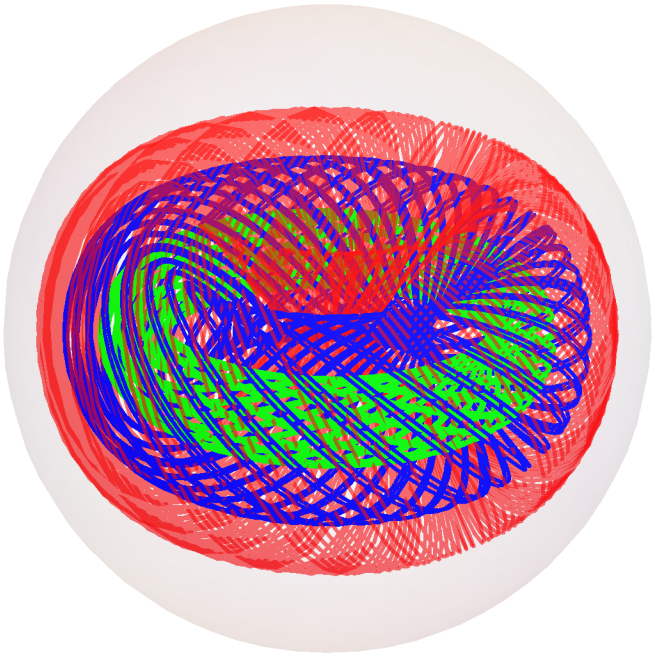
In[6]:=
```
fi[r_, t_, f_] = {2 lam / r^2 (lam / r Sin[r / lam] - Cos[r / lam]) Cos[t],
    -1 / r (lam / r Cos[r / lam] - lam^2 / r^2 Sin[r / lam] + Sin[r / lam]) Sin[t],
    1 / r (lam / r Sin[r / lam] - Cos[r / lam]) Sin[t]};
sol[r_, t_, f_] := {R[time], T[time], F[time]} /.
    NDSolve[{D[R[time], time] == fi[R[time], T[time], F[time]][[1]],
       D[T[time], time] == fi[R[time], T[time], F[time]][[2]],
       D[F[time], time] == fi[R[time], T[time], F[time]][[3]],
       R[0] == r, T[0] == t, F[0] == f}, {R[time], T[time], F[time]},
      {time, 0, 500}, MaxSteps → 100 000, PrecisionGoal → 12][[1]];
fun[R_, T_, F_, t] := sol[R, T, F][[1]] {Sin[sol[R, T, F][[2]]] Cos[sol[R, T, F][[3]]],
      Sin[sol[R, T, F][[2]]] Sin[sol[R, T, F][[3]]],
      Cos[sol[R, T, F][[2]]]} /. time → t;
p1 = ParametricPlot3D[Evaluate[fun[0.5, 1.1, 0, t]], {t, 0, 500}, RegionFunction →
     Function[{x, y, z}, x^2 + y^2 + z^2 <= 1 && -2 π / 3 < ArcTan[y, x] < 2 π / 3],
    PlotRange → All, PlotStyle → Blue];
p2 = ParametricPlot3D[Evaluate[fun[0.5, 0.8, 0, t]], {t, 0, 500},
    PlotStyle → {Red, Opacity[0.6]}, RegionFunction → Function[{x, y, z},
      x^2 + y^2 + z^2 < 1 && -π / 2 < ArcTan[y, x] < π / 2], PlotRange → All];
p3 = ParametricPlot3D[Evaluate[fun[0.5, 1.6, 0, t]], {t, 0, 300}, PlotStyle → Green,
    RegionFunction → Function[{x, y, z}, x^2 + y^2 + z^2 < 1 && -π < ArcTan[y, x] < π],
    PlotRange → All];
Show[p1, p2, p3, Axes → False, Boxed → False, ImageSize → 500]
```

Out[12]=



In[13]:=
```
p1 = ParametricPlot3D[Evaluate[fun[0.5, 1.1, 0, t]], {t, 0, 200}, RegionFunction →
     Function[{x, y, z}, x^2 + y^2 + z^2 <= 1], PlotRange → All, PlotStyle → Blue];
p2 = ParametricPlot3D[Evaluate[fun[0.5, 0.8, 0, t]],
    {t, 0, 500}, PlotStyle → {Red, Opacity[0.6]},
    RegionFunction → Function[{x, y, z}, x^2 + y^2 + z^2 < 1], PlotRange → All];
p3 = ParametricPlot3D[Evaluate[fun[0.5, 1.6, 0, t]], {t, 0, 200}, PlotStyle → Green,
    RegionFunction → Function[{x, y, z}, x^2 + y^2 + z^2 < 1], PlotRange → All];
Show[Graphics3D[{Opacity[0.1], Sphere[{0, 0, 0}, 1]}], p1, p2,
 p3, Axes → False, Boxed → False, ImageSize → 500]
Show[Graphics3D[{Opacity[0.1], Sphere[{0, 0, 0}, 1]}], p1,
 p2, p3, Axes → False, Boxed → False, ImageSize → 500]
```

Out[16]=



Out[17]=