```
green = {46, 204, 64} / 255 // RGBColor;
blue = {73, 167, 233} / 255 // RGBColor;
orange = {250, 177, 37} / 255 // RGBColor;
toruscol = {214, 230, 235} / 255 // RGBColor;


{z, w} = {Exp[I α] Sin[γ], Exp[I β] Cos[γ]};
SterProj[{z_, w_}] :=
 Module[{x = Re[z], y = Im[z], u = Re[w], v = Im[w]}, {x/(1 - v), y/(1 - v), u/(1 - v)}] // ComplexExpand]
σ[{z_, w_}] := {w, z}

ZW[γ_, α_, β_] := {Exp[I α] Sin[γ], Exp[I β] Cos[γ]}


p = 2;
q = 3;

m = p / q;
m2 = q / p;
f2[x_] :=
 Piecewise[
  Flatten[Table[{{m (x - 2 π k / p) - π / (2 q), 2 k π / p ≤ x ≤ (2 k + 1) π / p}, {-m (x - 2 π k / p) +
       2 π / q - π / (2 q), (2 k + 1) π / p ≤ x ≤ (2 k + 2) π / p}}, {k, 0, p}], {1, 2}]]
g2[x_] :=
 Piecewise[Flatten[
   Table[{{m2 (x - 2 π k / q) - π / (2 p), 2 k π / q ≤ x ≤ (2 k + 1) π / q}, {-m2 (x - 2 π k / q) +
       2 π / p - π / (2 p), (2 k + 1) π / q ≤ x ≤ (2 k + 2) π / q}}, {k, 0, q}], {1, 2}]]

fi2 = Interpolation[{#, f2[Mod[#, 2 π]]} & /@ RandomReal[{-10 π, 10 π}, 1000]];
gi2 = Interpolation[{#, g2[Mod[#, 2 π]]} & /@ RandomReal[{-10 π, 10 π}, 1000]];


inside = Abs[4 / π γ]^4 gi2[β - t / q] - q / p (t / q) + 2 π n / p;
outside = Abs[4 / π γ]^4 fi2[β + t / p] + p / q (t / p) + 2 π n / q;

TorusLockWashers[T_] := Module[{τ = T - 0.00001},
  (*If[τ==π,τ=π-0.00001,None];*)

  insidewashers = Table[SterProj@ZW[γ, β - π / (q 2), inside /. t → τ], {n, 0, 2}];
  insideplot = ParametricPlot3D[insidewashers, {γ, 0, π / 4}, {β, 0, 2 π},
    MeshStyle → None, PlotStyle → blue, PerformanceGoal → "Quality", PlotPoints → 40];

  outsidewashers = Table[SterProj@σ@ZW[γ, β - π / (p 2), outside /. t → τ], {n, 0, 4}];
  outsideplot = ParametricPlot3D[outsidewashers, {γ, 0, π / 4}, {β, 0, 2 π},
    MeshStyle → None, PlotStyle → orange, Exclusions → None, PlotPoints → 30];
  {insideplot, outsideplot}]
```

```
torus = ParametricPlot3D[SterProj@ZW[π / 4, α, β], {α, 0, 2 π},
    {β, 0, 2 π}, PlotStyle → {toruscol, Opacity[0.2]}, MeshStyle → None,
    PlotRange → {{-3, 3}, {-3, 3}, {-3, 3}}, Axes → False, Boxed → False];

knot = ParametricPlot3D[RotationTransform[π / 3, {0, 0, 1}] @
     SterProj@σ@ZW[π / 4,  θ, -p / q θ], {θ, 0, q 2 π}, PlotStyle → {Thick, green}];

{insides, outsides} = TorusLockWashers[π / 2];
Show[torus, knot, insides, outsides]

frames = ParallelTable[TorusLockWashers[i], {i, 0, 2 π, π / 10}];

gifframes = Show[torus, knot, #] & /@ frames;

SetDirectory["/Users/jesse/Google Drive/Master's Project Code/gifs"];

Export["torusanimate23.gif", gifframes]

Show[
 ParametricPlot3D[Table[{θ, r, Abs[r]^4 gi2[θ] + 2 π n / p}, {n, 0, q + 1}], {θ, 0, 2 π},
  {r, 0, 1}, PlotRange → {{0, 2 π}, {0, 2}, {0, 2 π}}, MeshStyle → None, Boxed → False,
  Ticks → None, AxesLabel → {"α", "γ", "β"}, LabelStyle → Directive[Bold, Large]],

 ParametricPlot3D[Table[{Abs[r]^4 fi2[θ] + 2 n π / q + π / p
    , 1 + (1 - r), θ + π / 4}, {n, 0, q + 1}], {θ, -2 π, 4 π}, {r, 0, 1},
  PlotRange → {{0, 2 π}, {0, 2}, {0, 2 π}}, PlotStyle → Blue, MeshStyle → None],

 ParametricPlot3D[{Mod[θ + π / 2 q, 2 π], 1, Mod[q / p θ, 2 π]},
  {θ, 0, p * q π - 0.01}, Exclusions → True, PlotStyle → {Thick, Green}]
]

flattorus = ParametricPlot3D[{Mod[θ + π / 2 q, 2 π], 1, Mod[q / p θ, 2 π]},
    {θ, 0, p * q π - 0.01}, Exclusions → True, PlotStyle → {Thick, Green}];

flatframes = Table[
  Show[
   ParametricPlot3D[
    Table[{θ, r, Abs[r]^4 gi2[θ - t / 3] + 2 π n / p + q / p (t / 3)}, {n, -q, q + 1}], {θ, 0, 2 π},
    {r, 0, 1}, PlotRange → {{0, 2 π}, {0, 2}, {0, 2 π}}, MeshStyle → None, Boxed → False,
    Ticks → None, AxesLabel → {"α", "γ", "β"}, LabelStyle → Directive[Bold, Large]],

   ParametricPlot3D[Table[{Abs[r]^4 fi2[θ - t / 2] + 2 n π / q + π / p + p / q (t / 2)
      , 1 + (1 - r), θ + π / 4}, {n, -q, q + 1}], {θ, -2 π, 4 π}, {r, 0, 1},
    PlotRange → {{0, 2 π}, {0, 2}, {0, 2 π}}, PlotStyle → Blue, MeshStyle → None],
   flattorus

  ], {t, 0, 2 π, π / 4}]

ListAnimate[flatframes]

SetDirectory[NotebookDirectory[]]

Export["flatanimation.gif", flatframes]
```