

# Elliptical Orbits

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In[1]:= r[a_, e_,  $\theta$ _] :=  $\frac{a * (1 - e^2)}{1 + e \text{Cos}[\theta]}$ 

In[2]:= xy[a_, e_,  $\theta$ _] := r[a, e,  $\theta$ ] {Cos[ $\theta$ ], Sin[ $\theta$ ]}

In[6]:=  $\theta$ f[a_, e_, t_] := Module[{ $\theta$ s, f},
  f[tt_] = NDSolveValue[{ $\theta'$ [tt] == (1/r[a, e,  $\theta$ [tt]]^2) 2  $\pi$  Sqrt[a (1 - e^2)]},
     $\theta$ [0] == 0},  $\theta$ [tt], {tt, 0, 5}];
  f[t]]

In[7]:= Manipulate[
  a = 1;
  my $\theta$ [t_] =  $\theta$ f[a, e, t];
  Show[{
    Graphics[{Yellow, Disk[{0, 0}, 0.1]}],
    Graphics[{Blue, Disk[xy[a, e, my $\theta$ [t]], 0.04]}],
    ParametricPlot[xy[1, e,  $\theta$ ], { $\theta$ , 0, 2  $\pi$ }, PlotStyle -> Green]
  }, Frame -> True,
  PlotRange -> {{-2.1, 1.2}, {-1.2, 1.2}}, AspectRatio -> 2.4 / 3.2,
  {{e, 0}, 0, 0.99, 0.02, Appearance -> "Labeled"},
  {t, 0, 4, 0.01, ControlType -> Animator,
  Appearance -> "Open", DefaultDuration -> 10, AnimationRunning -> False,
  AnimationRepetitions -> 1, DisplayAllSteps -> True}]
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Out[7]=

