Are We Going To Fall Off?

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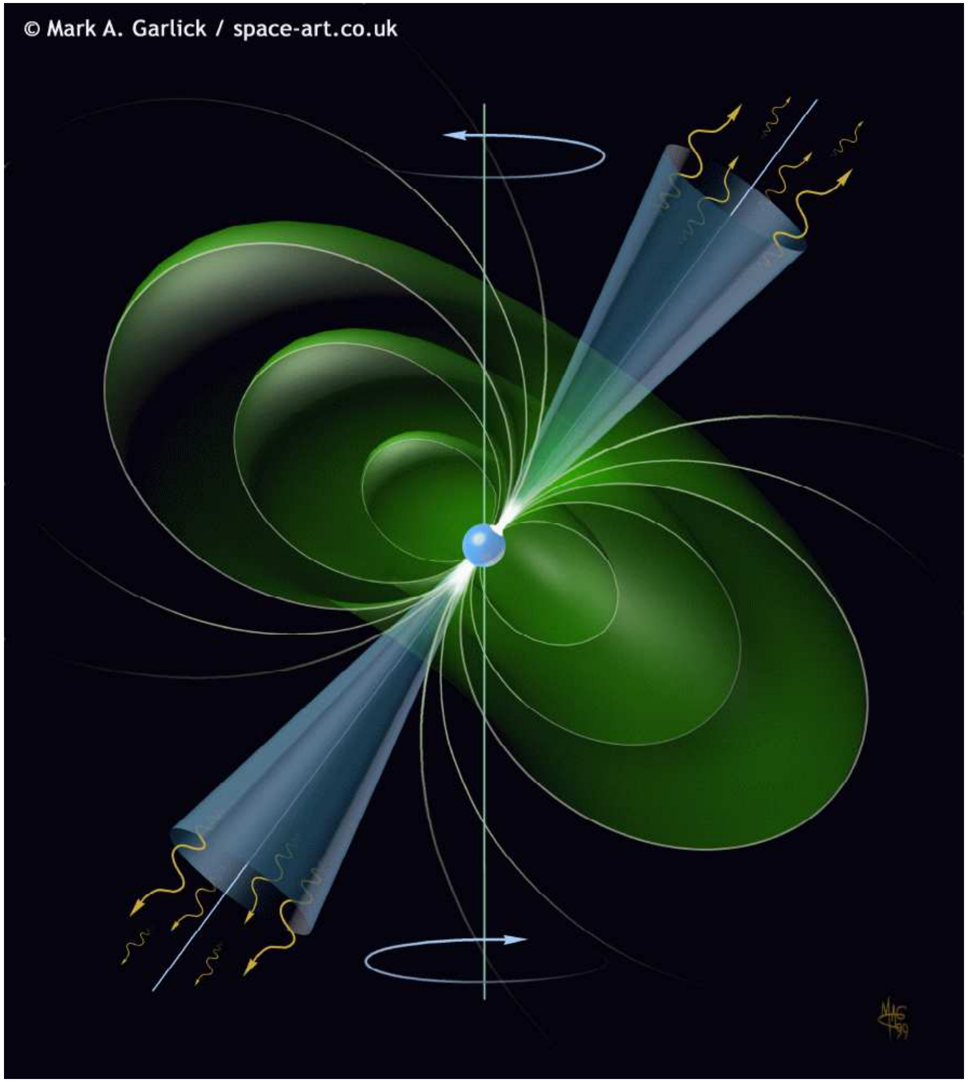
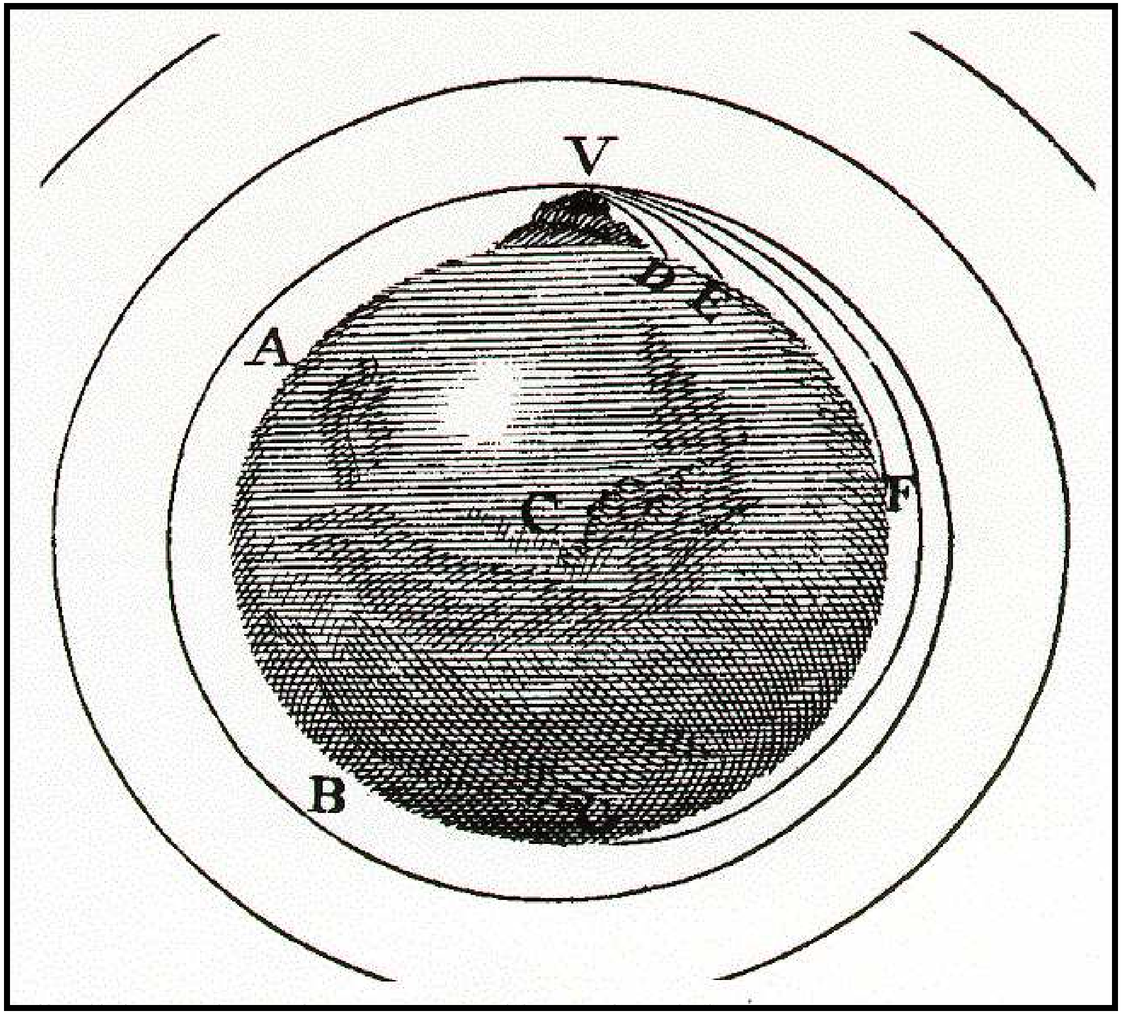
A Pulsar

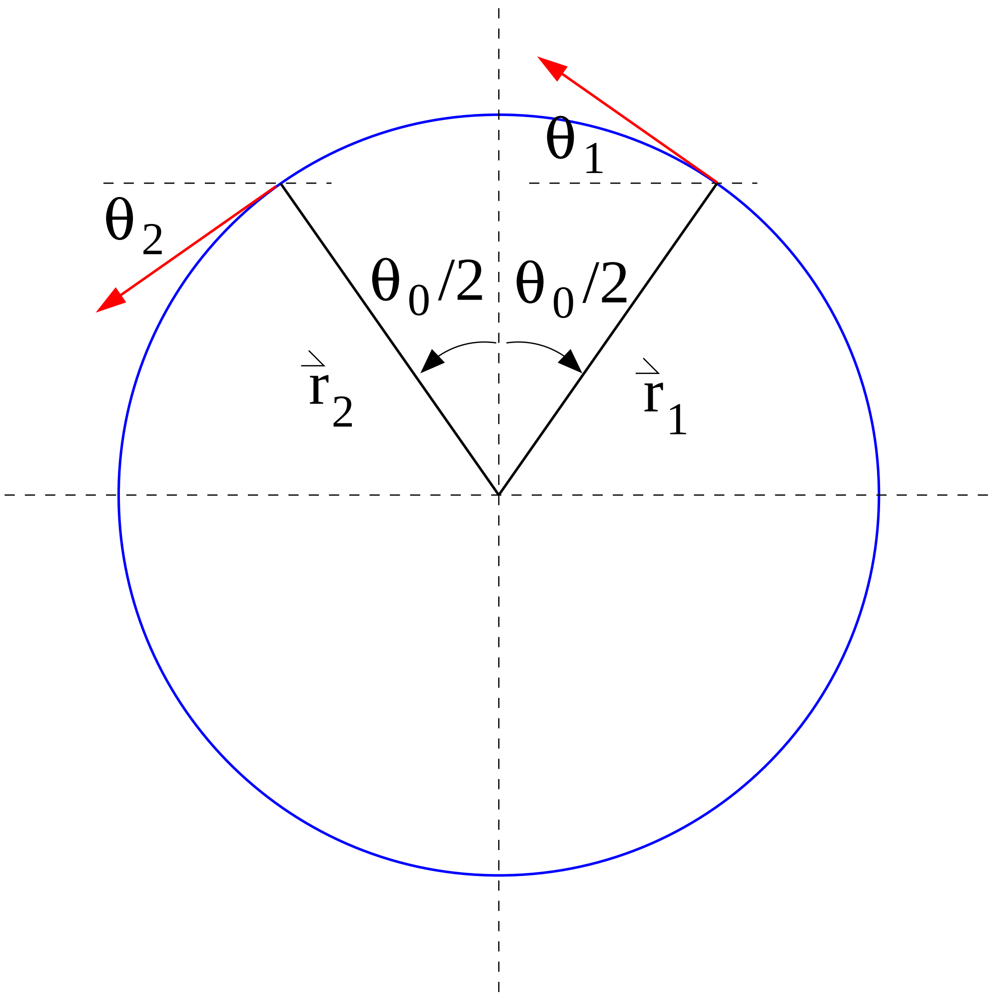


Circular Motion - 1

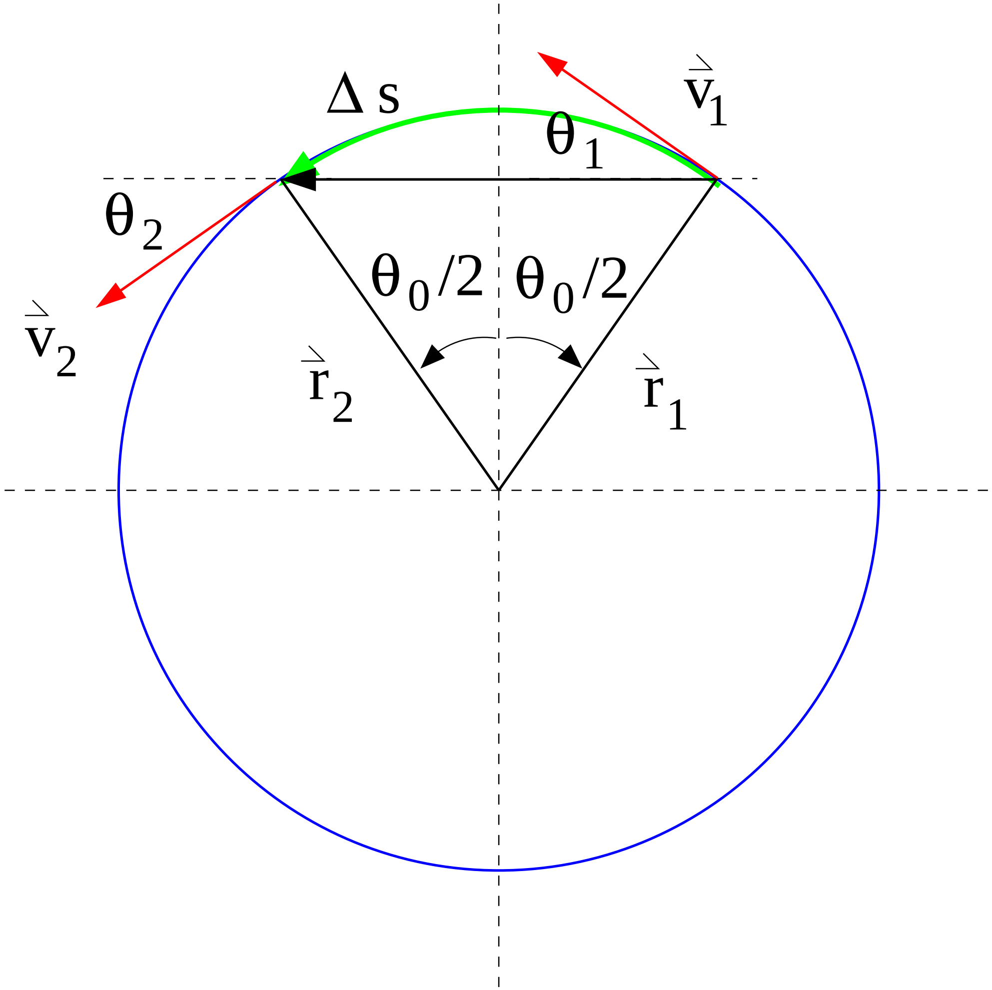
In the 17th century Isaac Newton envisioned the possibility of space flight with the picture shown below that is taken from *Principia*. He just needed to find a high enough mountain and a big enough cannon.



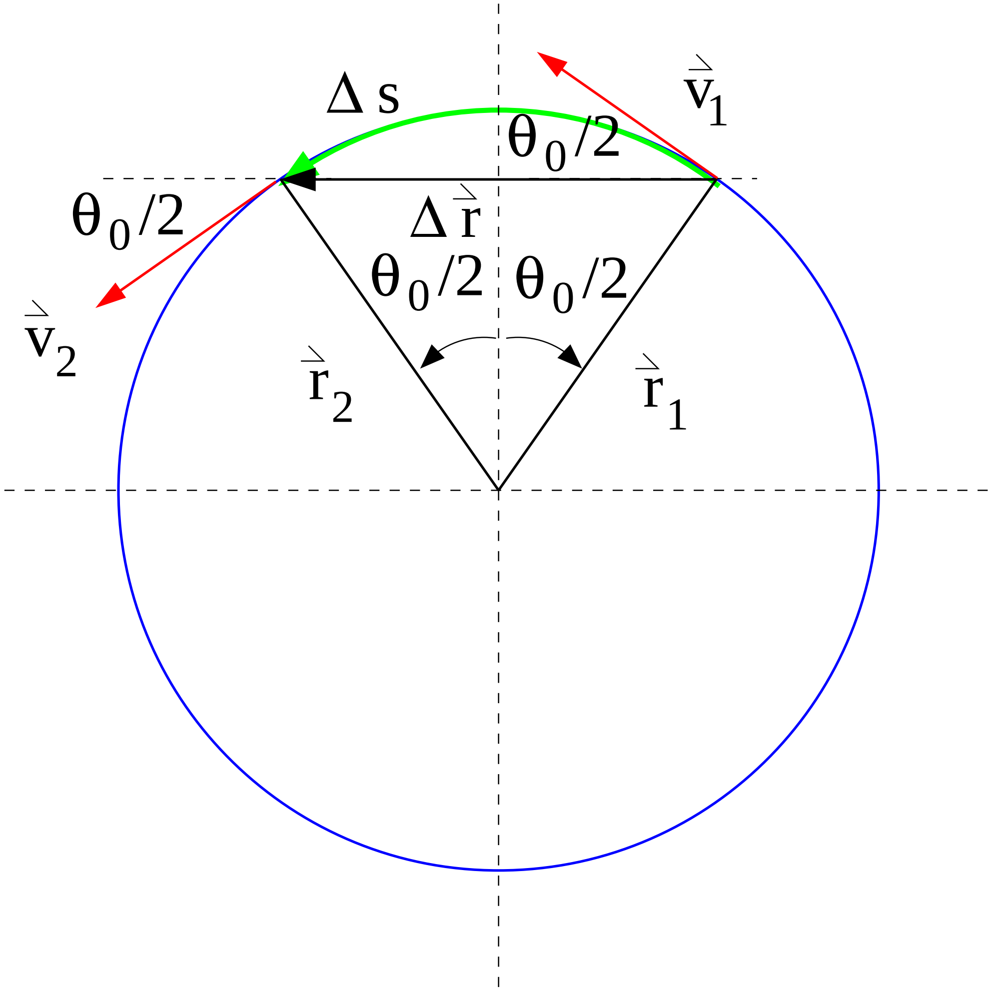
Circular Motion - 2



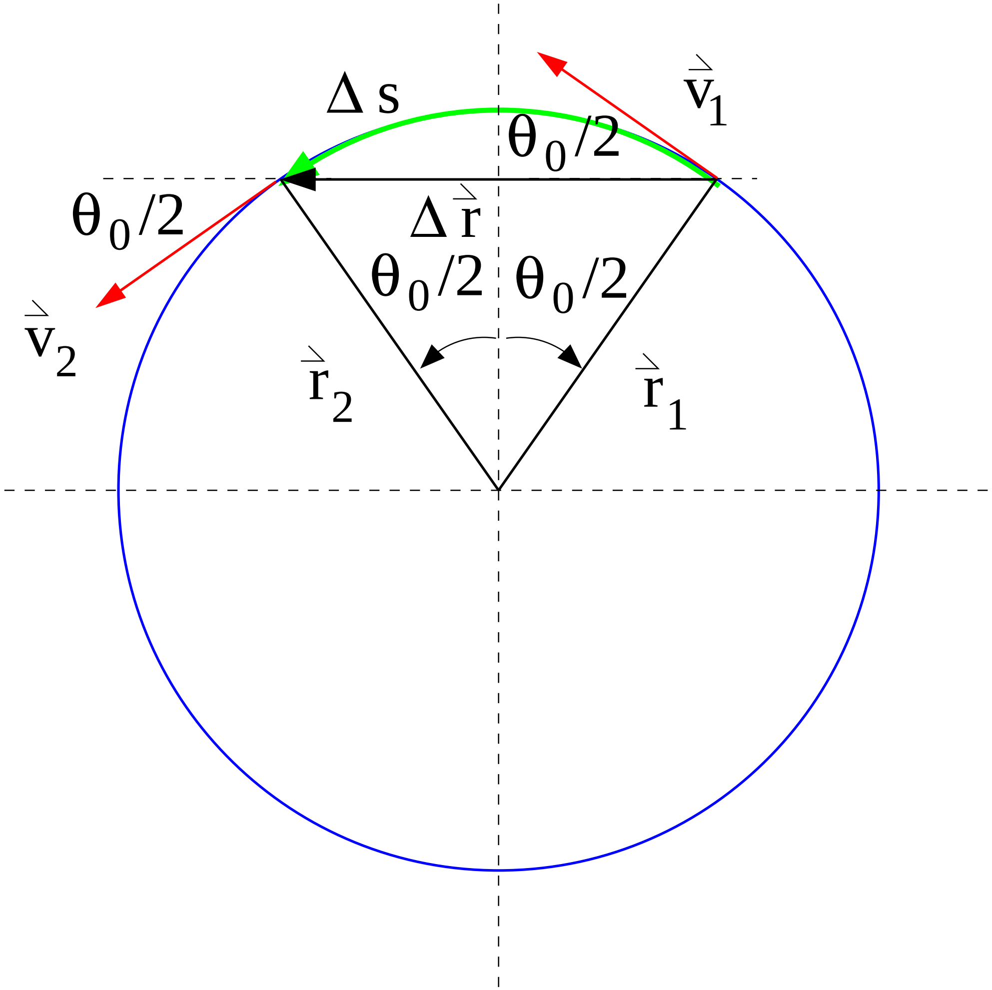
Circular Motion - 2

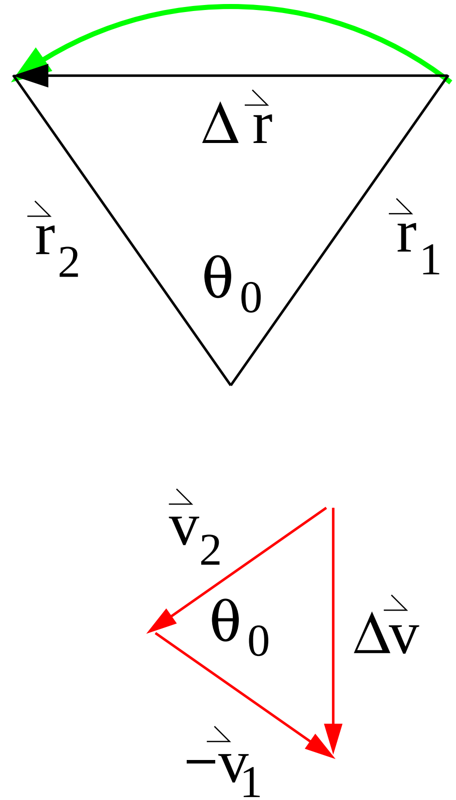


Circular Motion - 2

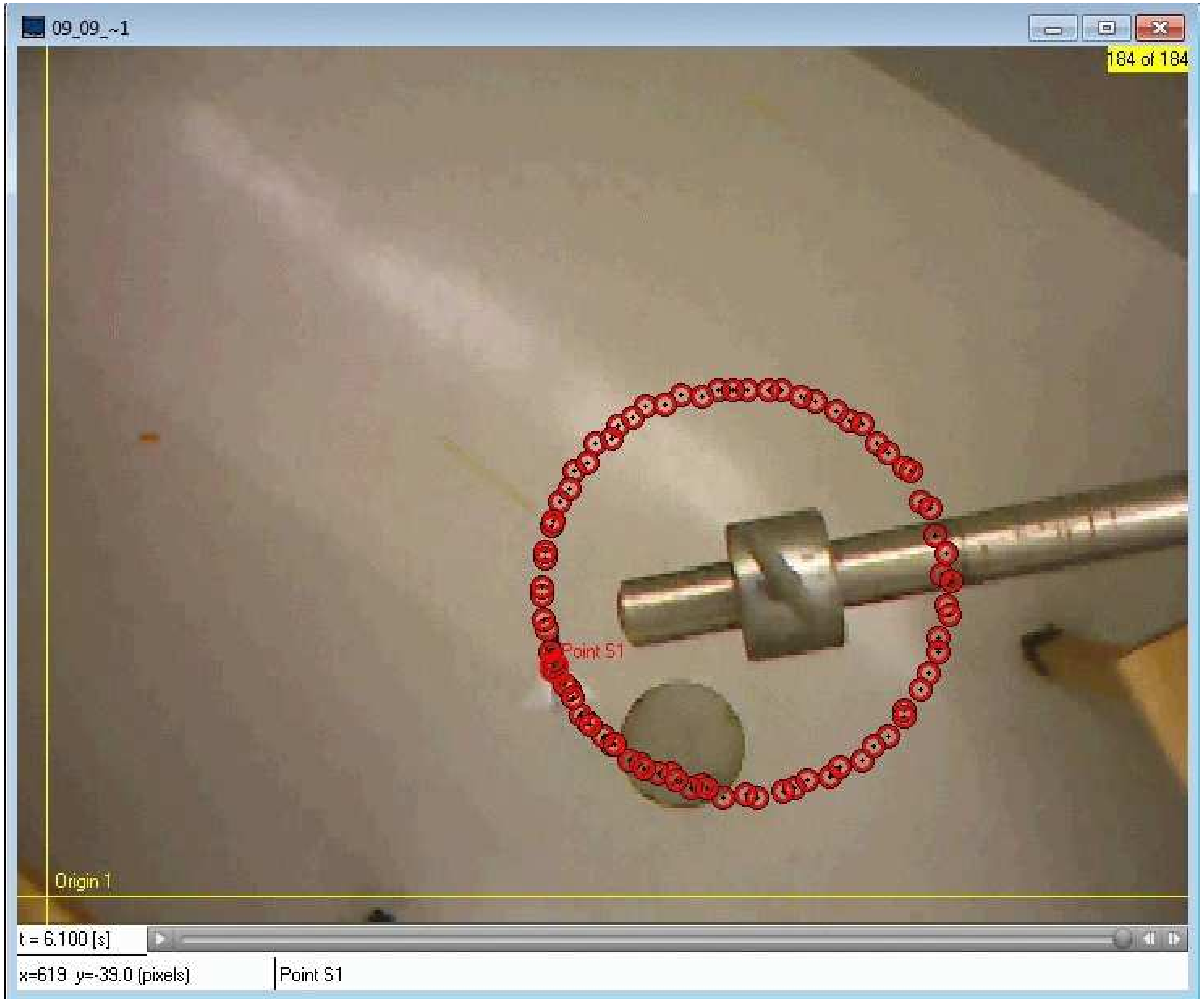


Circular Motion - 2

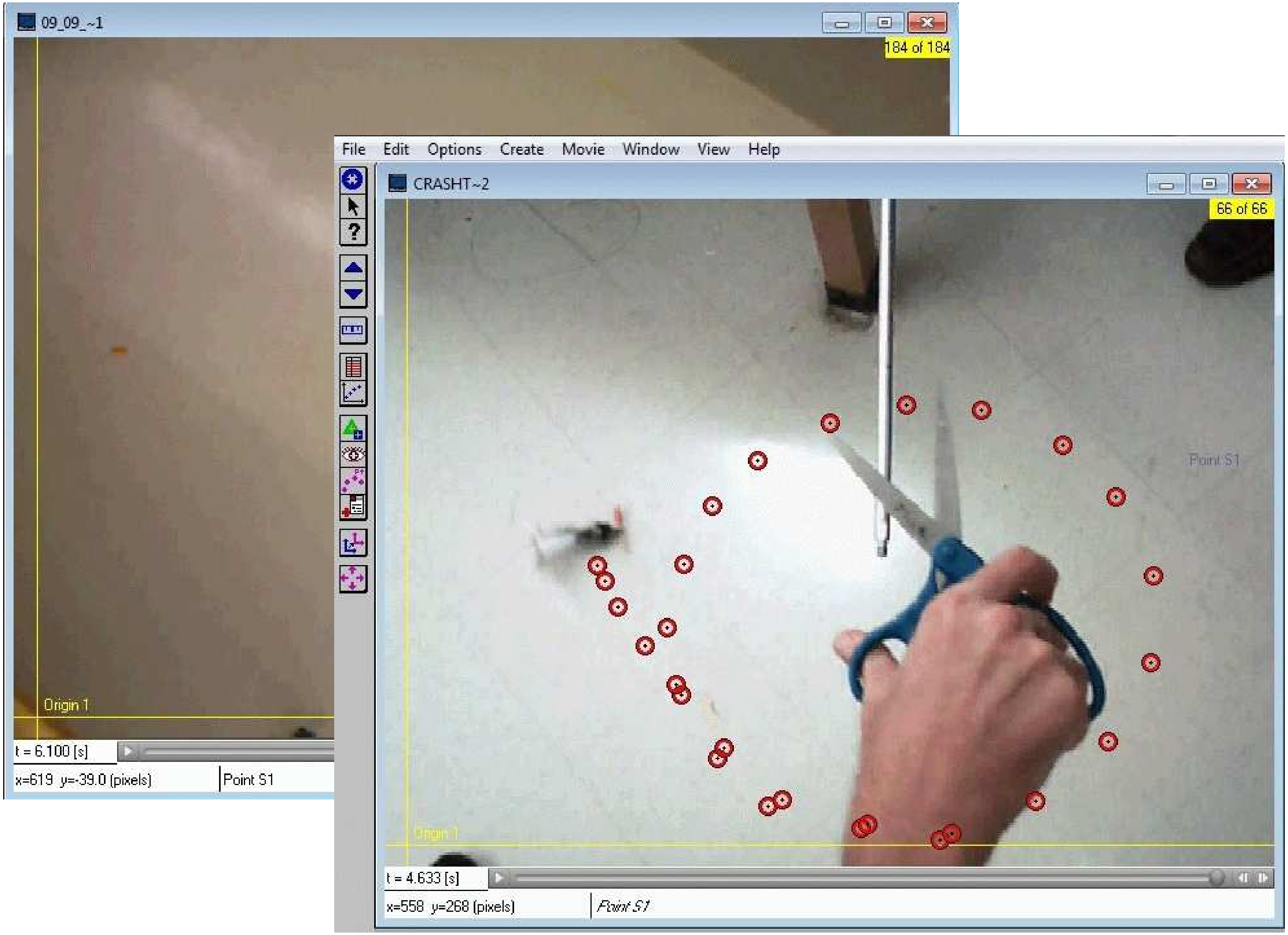




Circular Motion - 3



Circular Motion - 3



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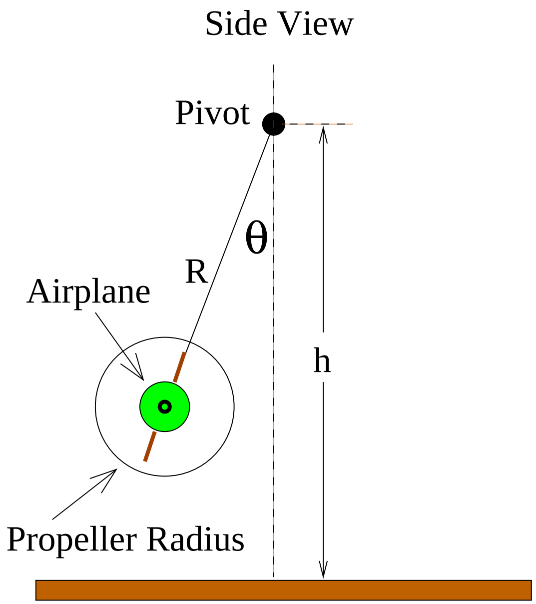
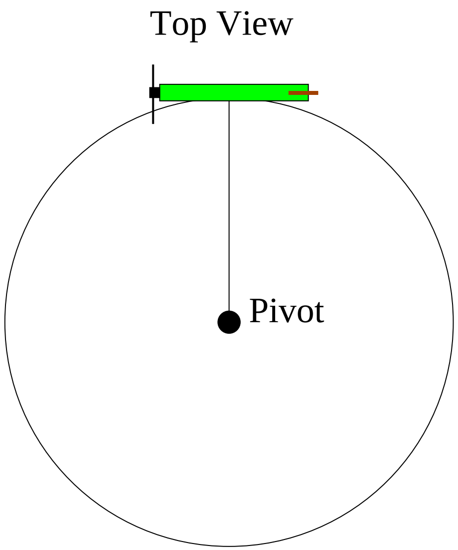
Are We Going To Crash?

Consider the model airplane hanging from a string and flying in a circle as shown in the figure. The centripetal acceleration is $1.5\ \mathrm{m/s^2}$. If the string suddenly breaks, then how long does it take for the airplane to hit the floor? How far does it travel in the horizontal direction before it hits the floor?

Some useful information

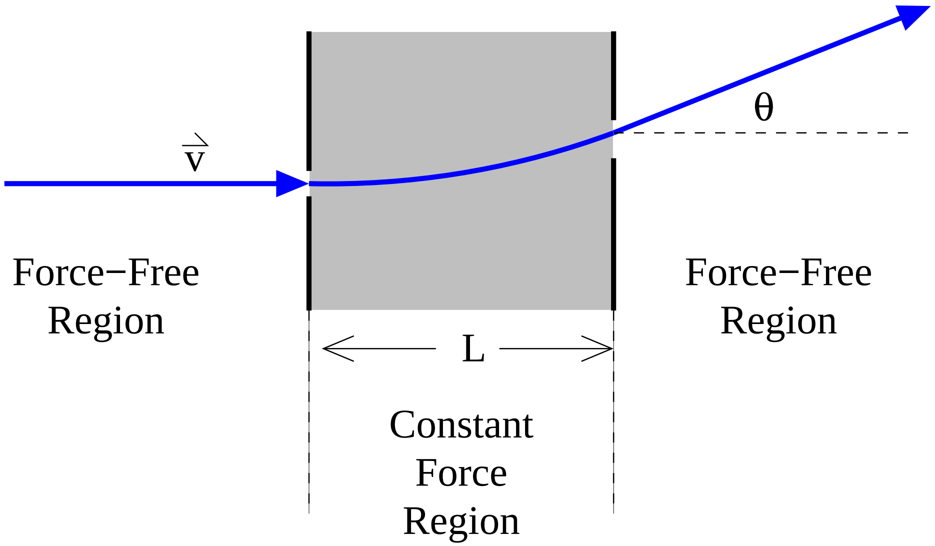
Pivot height(h)	$1.3\ m$
Vertical Angle(θ)	$25°$
String length(R)	$0.7\ m$





Weighing The Invisible

A spectrometer is a device for determining the mass of atomic and subatomic particles like protons, mesons, *etc*. Consider the spectrometer below. Two different particles enter the device with the same speed $v = 3.0 \times 10^7\ m/s$. They pass through it and 'feel' the same centripetal force exerted on them of $F = 1.3 \times 10^{-12}\ N$. The constant-force region has a width $L = 0.5\ m$. They are deflected by different amounts so one particle is bent through an angle $\theta_1 = 21^\circ$ while the other one is bent by $\theta_2 = 19^\circ$. What are the masses of the two particles? Identify them from the list of particles below.



Particle	Mass (kg)
Proton	1.67×10^{-27}
Deuteron	3.34×10^{-27}
π meson	2.49×10^{-28}
η meson	9.74×10^{-28}
Λ baryon	1.98×10^{-27}
Δ baryon	2.19×10^{-27}