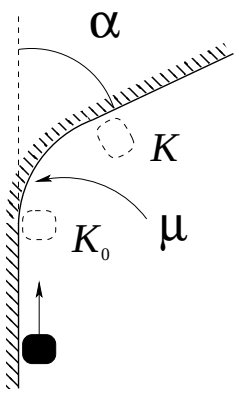
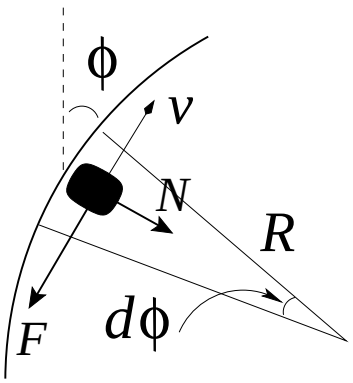
Ice hockey puck curve

An object is sliding on floor along a wall. The floor is frictionless, but there is friction between the object and the wall, and the friction coefficient is μ. The wall makes a smooth turn, by angle α. Just before the turn, kinetic energy of the object is K_0. Find the kinetic energy right after the turn is completed.



Answer of problem **Ice hockey puck curve**



Consider a point where velocity of the object makes angle ϕ with the original direction, and take the curvature radius here to be R. Relevant equations are:

$$m\frac{v^2}{R} = N \qquad and \qquad F = \mu N$$

and thus

$$d\left(\frac{mv^2}{2}\right) = -FRd\phi = -\mu m v^2 d\phi$$

giving

$$\boxed{K = K_0 e^{-2\mu\alpha}}$$

- this answer does not depend on the exact details of the curve, its shape or length, as long as there are no sharp corners anywhere. The only parameter that matters is the angle between final and initial velocities!