

### 1 Air table (string)

Consider an air hockey puck of mass  $m$  tethered to a peg in the middle of an air hockey table.



The tether is made from a small piece of thread of length  $L$ . You give the puck a push so that its initial angular momentum is  $\ell$ ,

- (a) Briefly explain why this is a central force system.
- (b) A central force problem involves two objects. Find an approximate formula for the reduced mass of this central force system and explain briefly, in words, why this makes sense.
- (c) Make a sketch of the potential energy of this system plotted vs.  $r$ , the distance from the peg.
- (d) Recall that the effective potential is the SUM of the potential (the one you just plotted!!!) and the kinetic energy due to the angular part of the motion.

$$U_{\text{eff}} = U(r) + \frac{\ell^2}{2\mu r^2}$$

Make a sketch of the effective potential.

- (e) Briefly discuss the possible orbit shapes that can arise from this effective potential.
- (f) How should you push the puck to establish a circular orbit? (i.e. give the initial position and direction of push).