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MICHIGAN STATE
U N I V E R S I T Y

PHY422/820: Classical Mechanics

FS 2020
Exam Preparation

December 1, 2020

Problem P8 – Isotropic Oscillator

A particle of mass m with angular momentum l is bound by a central force $\vec{F}(\vec{r}) = -k\vec{r}$ with $k > 0$. This force causes the particle to behave as an *isotropic* oscillator because the spring constant k is independent of the direction.

1. Sketch the potential energy $V(r)$ and the effective potential $V_{\text{eff}}(r)$.

2. Find the radius of a circular orbit for this potential. Will this orbit be stable or unstable?

3. Describe the possible orbits of the mass m in *Cartesian* coordinates.