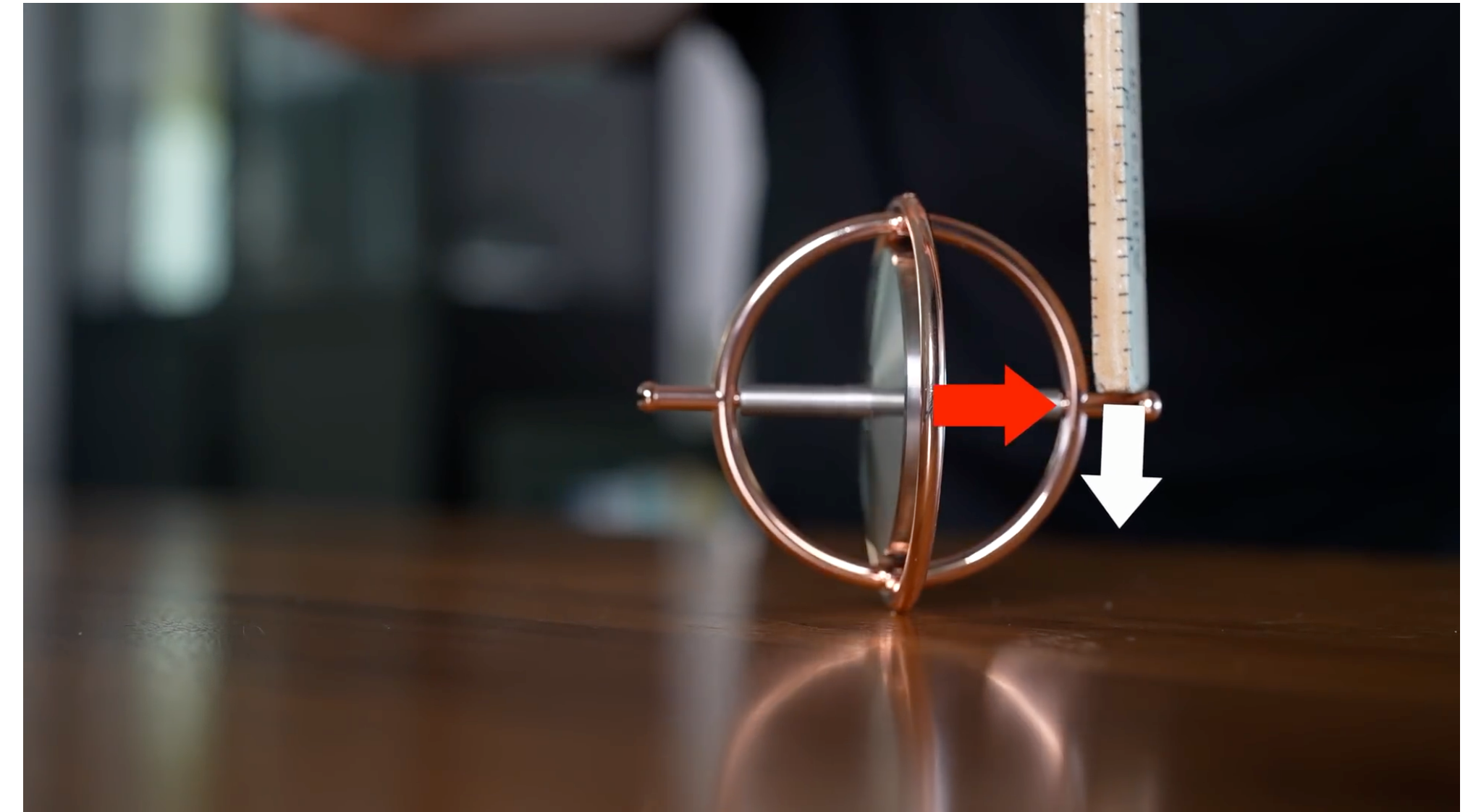


General Physics: Mechanics

PHYS-101(en)

**Lecture 13b: Gyroscopes
and harmonic motion**

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Example: Motorcycle steering

You're racing on motorcycle at a constant velocity v and are entering a turn. To stay on the road, you must turn the front wheel by an angle $\Delta\phi$ within a distance d . What torque must you apply to the axel of the wheel to make the turn? Treat the motorcycle wheel as a solid cylinder of radius R and mass m . Ignore friction/drag and assume rolling without slipping.



Example: Motorcycle steering

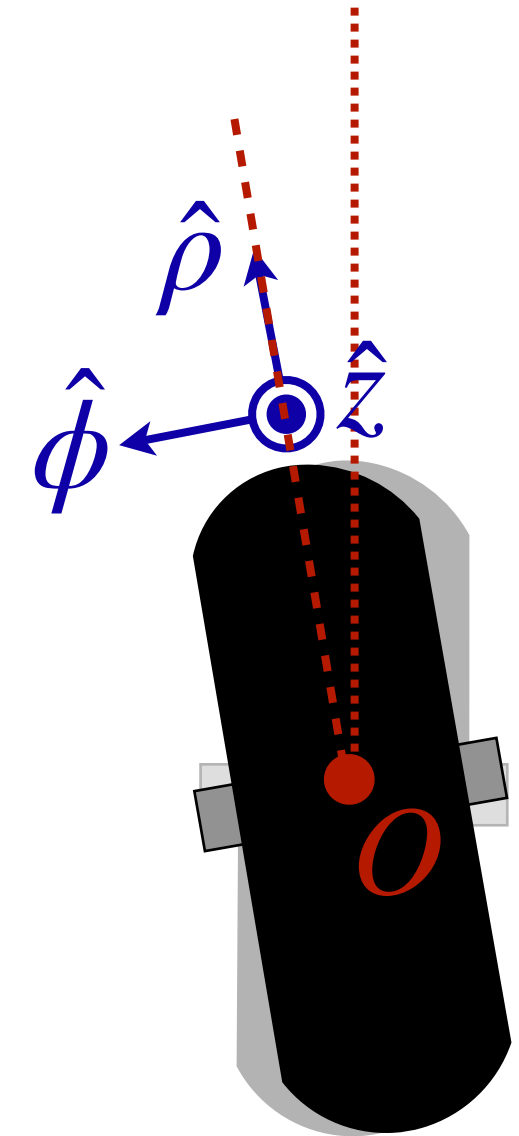
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- A. Find an expression for the angular speed of the wheel ω_w .
- B. Find an expression for the constant angular speed ω_t with which you need to turn the wheel in order to stay on the road.
- C. Find the total angular momentum of the wheel in terms of the moments of inertia, I_w and I_t , for the two types of rotation. (Let the center of the **axel's rotation** be the origin of a cylindrical coordinate system.)
- D. Find the torque. How do you create such a torque?



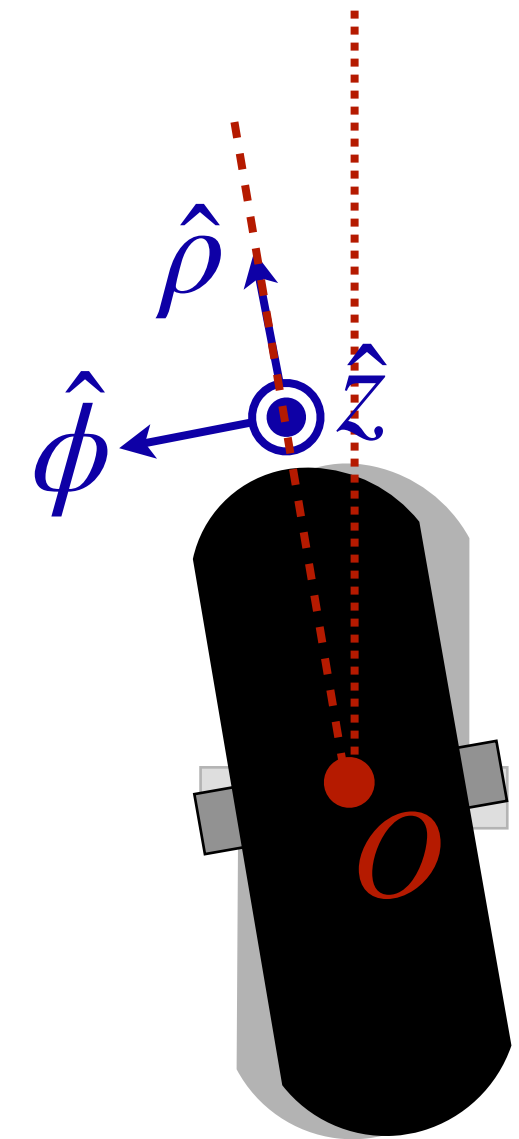
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Example: Motorcycle steering

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Conceptual question

An object can execute harmonic motion (i.e. oscillate) about...

- A. any point.
- B. any equilibrium point.
- C. any stable equilibrium point.
- D. any point, provided the forces exerted on the object obey Hooke's law.