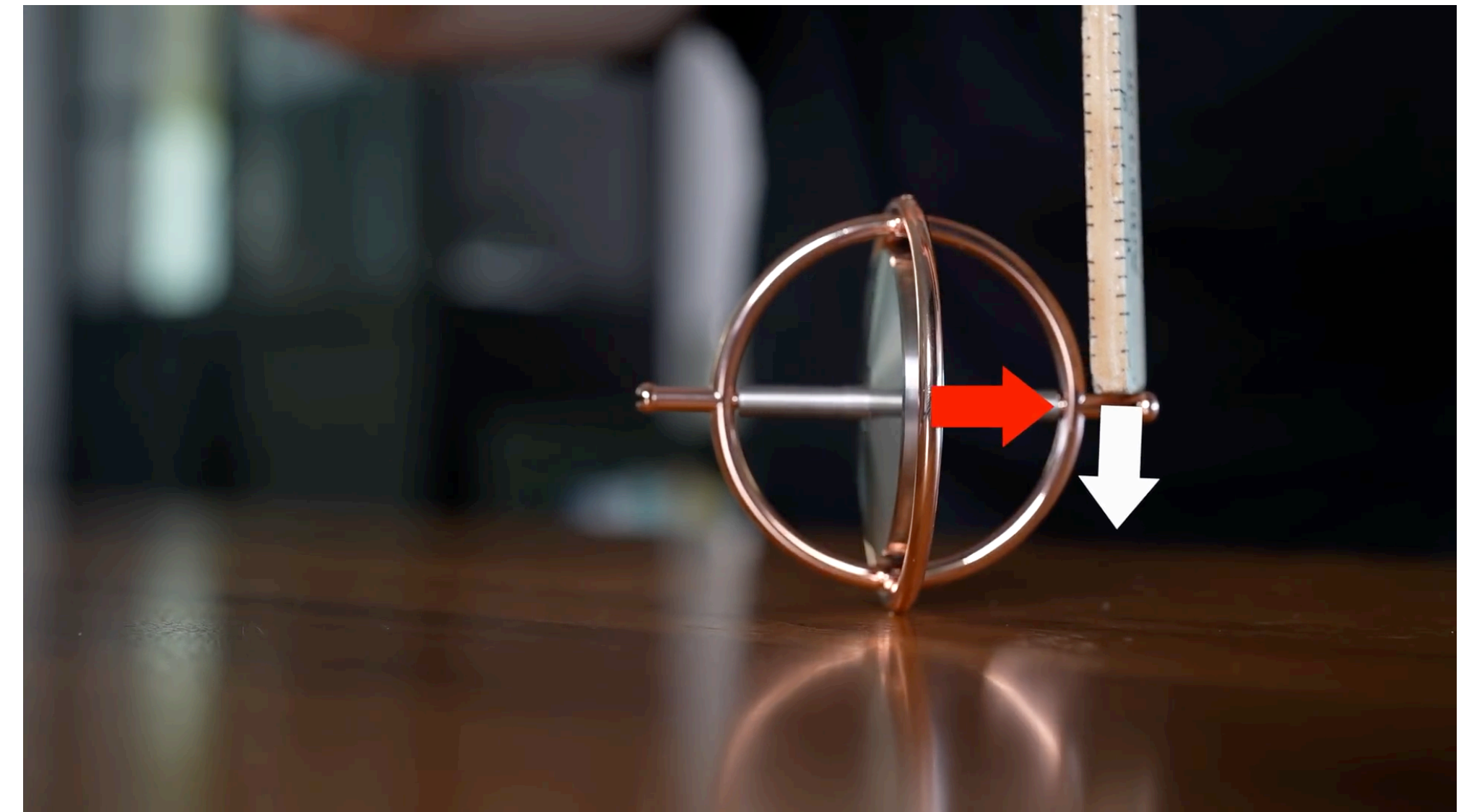


General Physics: Mechanics

PHYS-101(en)

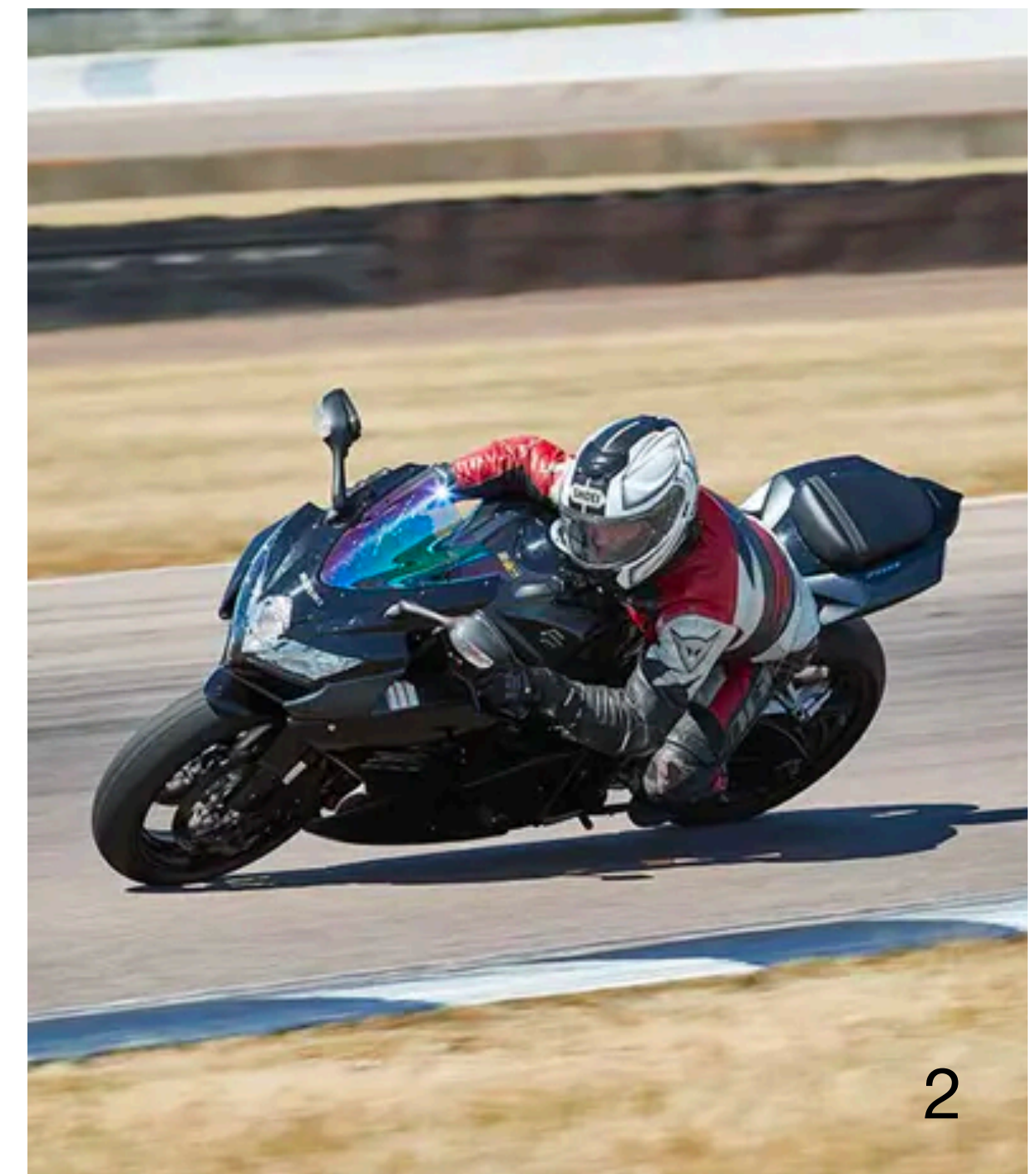
**Lecture 13b: Gyroscopes
and harmonic motion**

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Example: Motorcycle steering

You're racing on motorcycle at a constant speed 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 axle 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

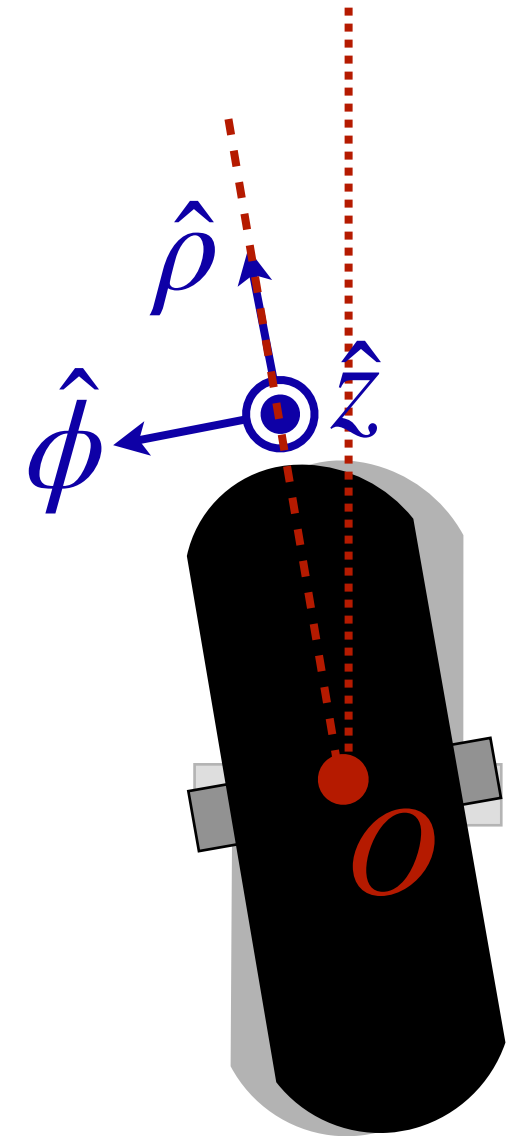
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- Find an expression for the angular speed of the wheel ω_w .
- Find an expression for the constant angular speed ω_t with which you need to turn the wheel in order to stay on the road.
- Find the total angular momentum of the wheel in terms of the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



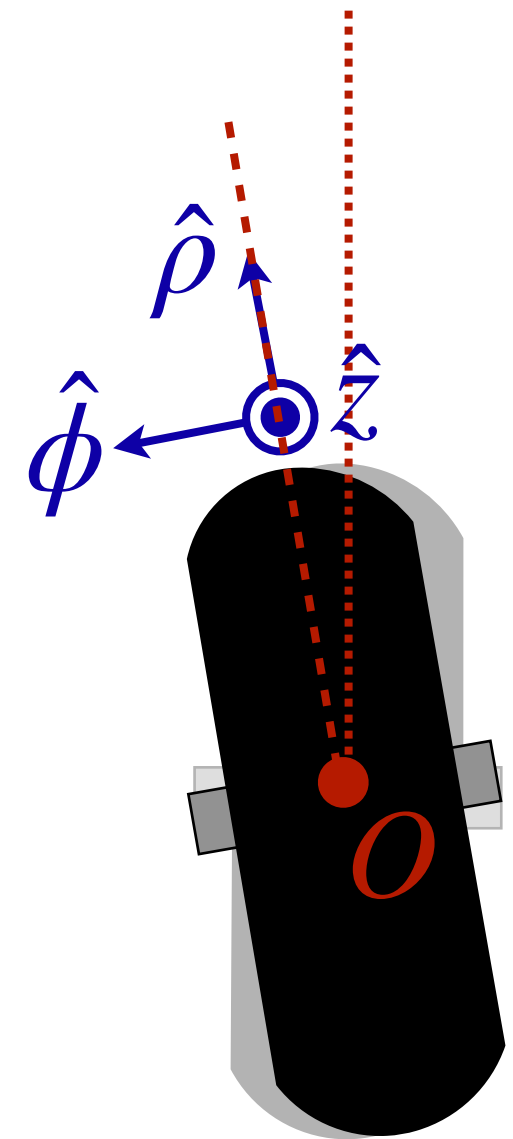
Example: Motorcycle steering

- 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.



Example: Motorcycle steering

- 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 **axle's rotation** be the origin of a cylindrical coordinate system.)



Example: Motorcycle steering

D. Find the torque. How do you create such a torque?

Conceptual question

A mass is oscillating back and forth on a spring about point A as shown. Point A is the equilibrium (unstretched) position of the mass. At which position is the magnitude of its acceleration the largest?

- A. Point A
- B. Point B
- C. Point C

