



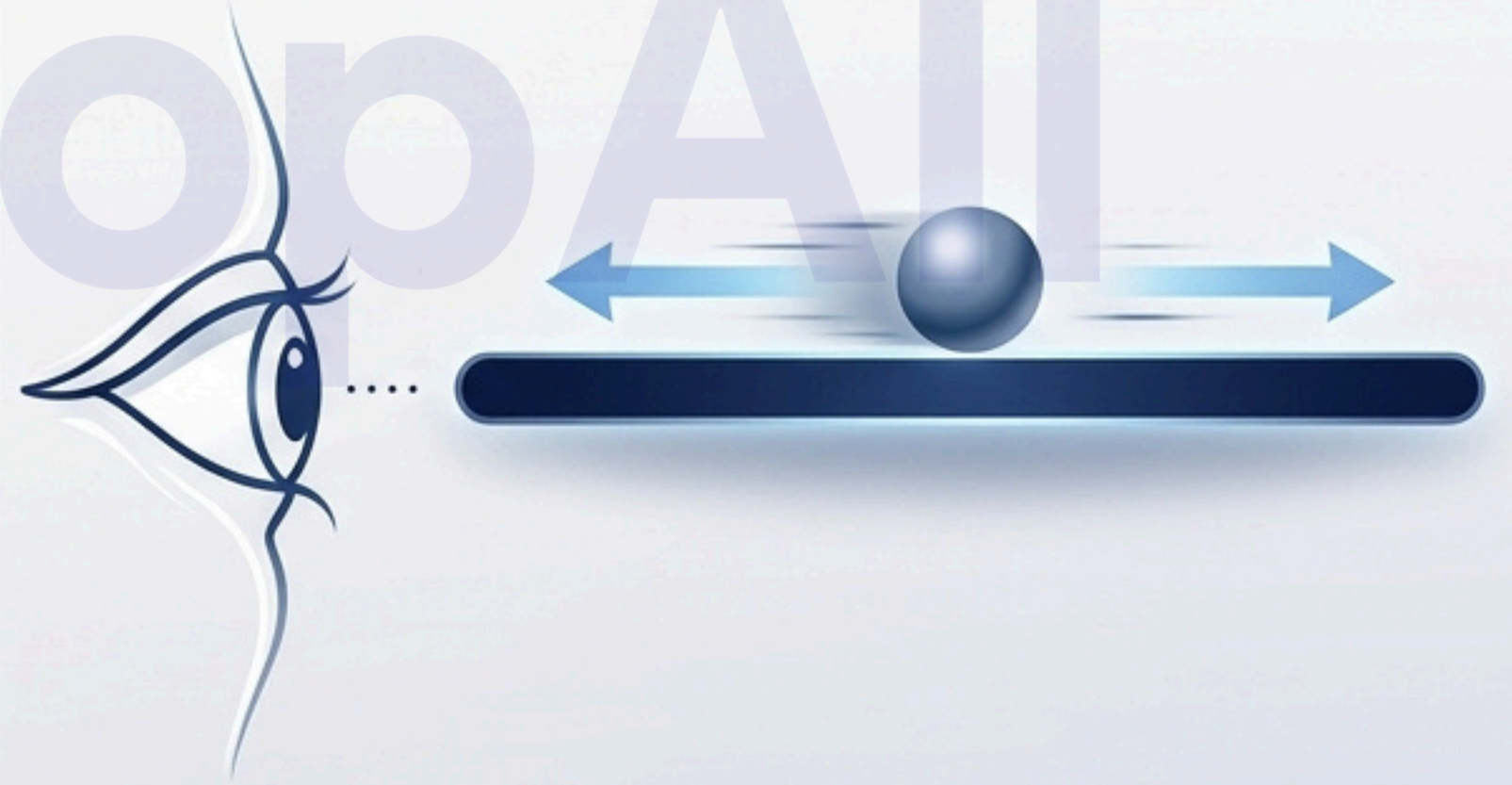
# THE CORE IDEA

Simple Harmonic Motion (SHM) is simply uniform circular motion viewed from the side. A 2D rotation hides a 1D oscillation.

THE 2D REALITY

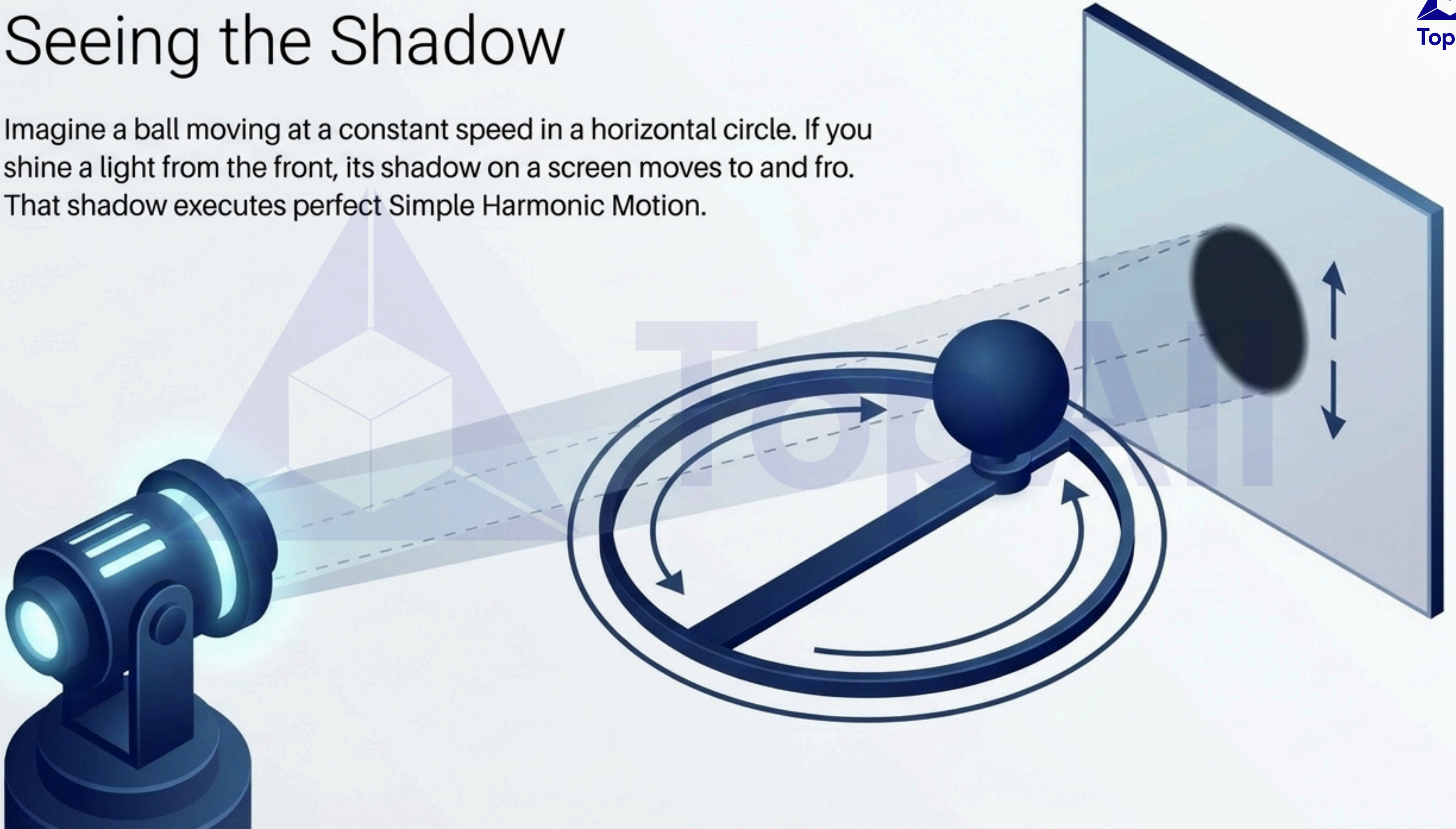


THE 1D PERCEPTION



# Seeing the Shadow

Imagine a ball moving at a constant speed in a horizontal circle. If you shine a light from the front, its shadow on a screen moves to and fro. That shadow executes perfect Simple Harmonic Motion.





# You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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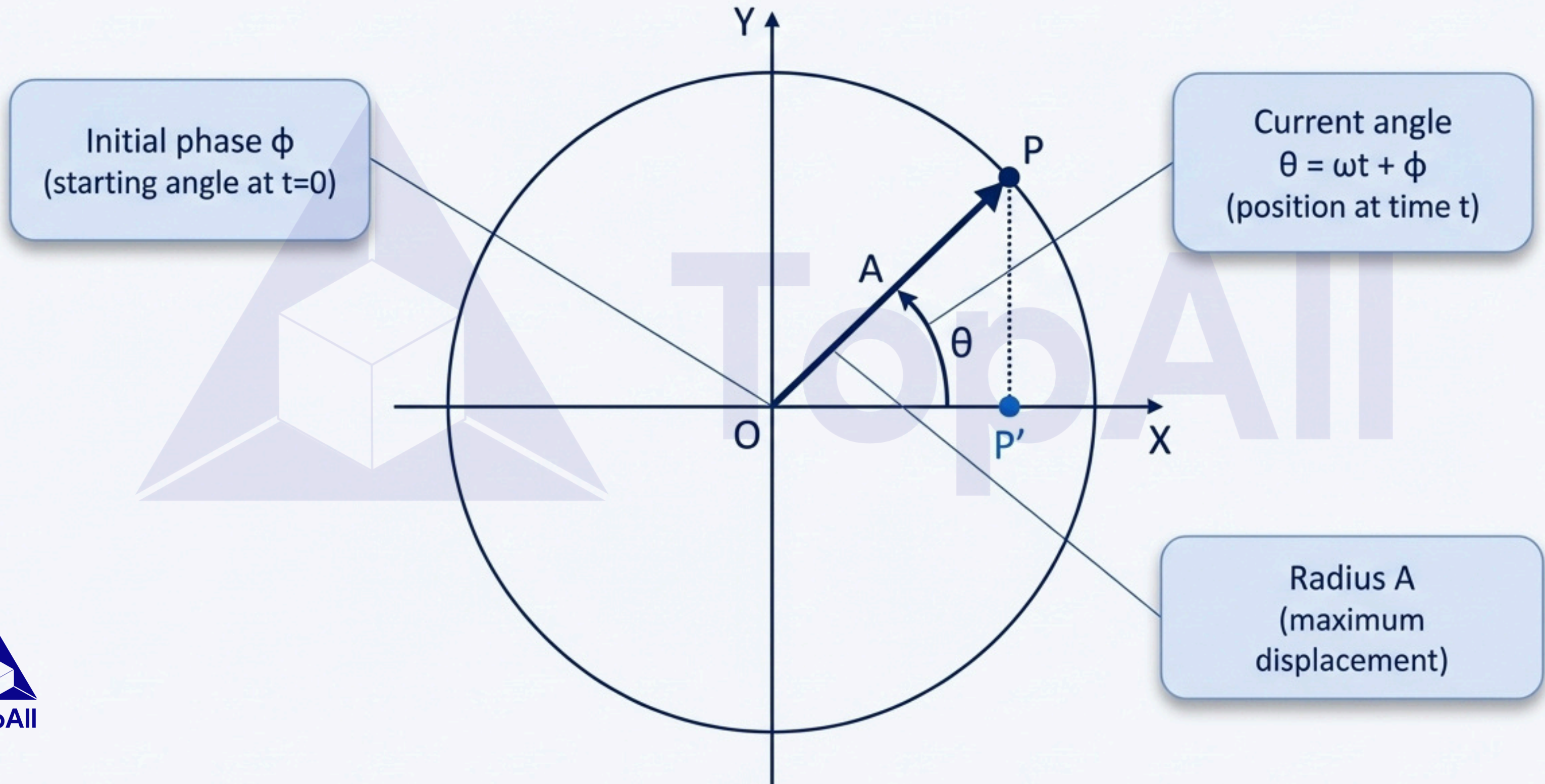
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# The Reference Circle

Let a reference particle  $P$  move on a circle of radius  $A$  with constant angular speed  $\omega$ . Its projection  $P'$  on the diameter oscillates.

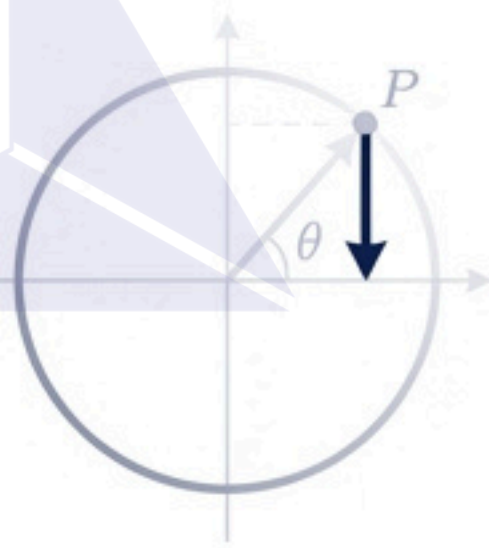


# The Mathematics of the Shadow

Depending on which diameter we project the motion onto, we extract the standard trigonometric equations of SHM.

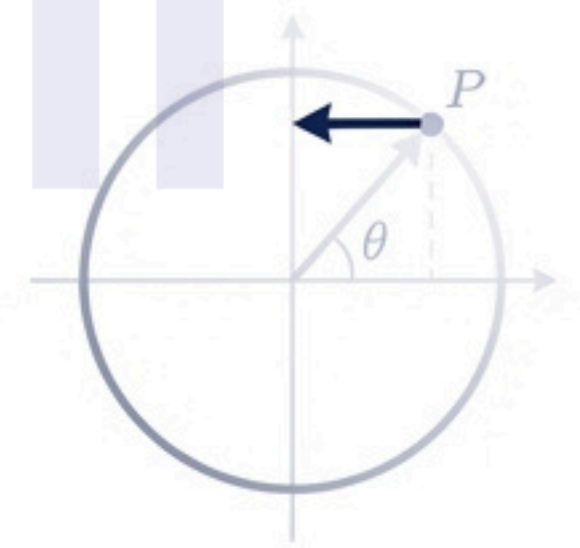
X-Axis Projection

$$x(t) = A \cos(\omega t + \varphi)$$



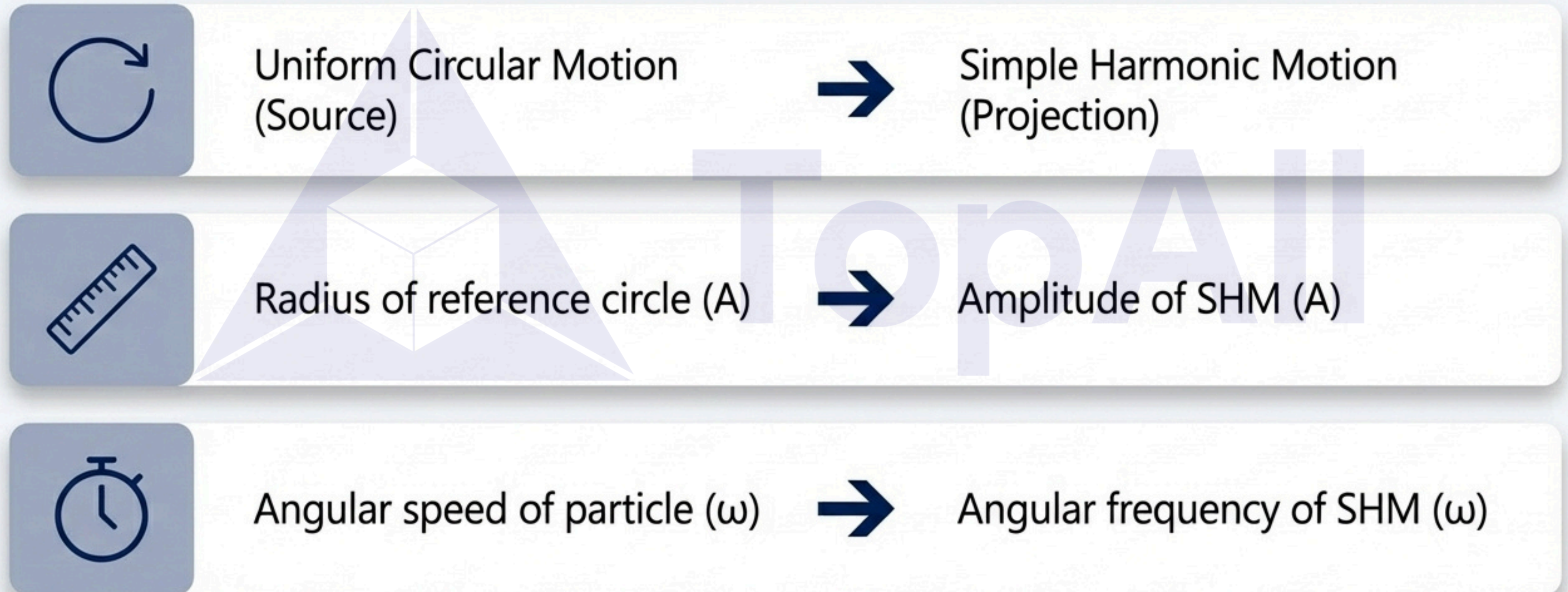
Y-Axis Projection

$$y(t) = A \sin(\omega t + \varphi)$$



# Unifying the Concepts

The language of circular motion translates directly into the language of oscillation.





# You've Learned the Theory.

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