



SPEED GUN: SCIENCE & TECHNOLOGY

NEWS: How does a speed gun work?

WHAT'S IN THE NEWS?

The Doppler effect is a phenomenon where wave frequency changes due to the relative motion between the source and observer. It is applied in speed guns, astronomy, and medical imaging to measure motion, distance, and blood flow.

What is a Speed Gun?

- Measures speed of moving objects without physical contact.
- Uses electromagnetic radiation (radio waves) and the Doppler effect.
- Commonly used in law enforcement, sports, and industries.

The Doppler Effect

- Discovered by Christian Doppler.
- Describes frequency change in waves due to relative motion between source and observer.
 - Frequency increases as object approaches (higher pitch).
 - Frequency decreases as object moves away (lower pitch).
- Used in speed guns to calculate speed based on frequency shift.

How Speed Guns Work

- Emit radio waves; these waves reflect off moving objects.
- Speed calculated using:
$$\text{Speed} = \frac{\text{frequency difference} \times \text{speed of light}^2}{\text{emitted frequency}}$$

$$\text{Speed} = 2 \times \text{emitted frequency difference} \times \text{speed of light}$$
- The speed of light is constant, enabling accuracy over long distances.

Limitations of Speed Guns

- Radio waves diverge, leading to inaccuracies when multiple objects are present.
- Continuous-wave radar may cause errors from reflections off multiple vehicles.



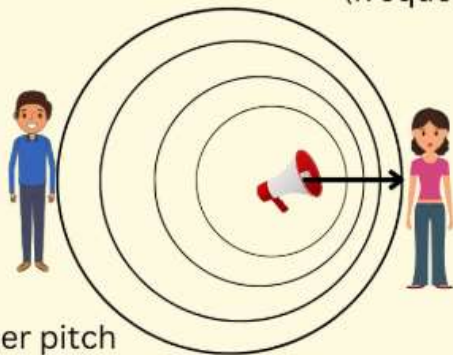
- LIDAR technology (laser-based) minimizes beam divergence, improving accuracy.

Doppler Effect

The Doppler effect is the shift in the frequency of a wave in relation to an observer due to relative motion of the wave source and observer.

SOUND

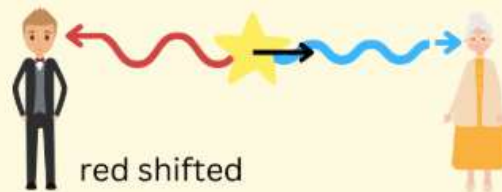
higher pitch
(frequency)



lower pitch
(frequency)

LIGHT

blue shifted



red shifted

Source: <https://www.thehindu.com/sci-tech/science/how-does-a-speed-gun-work/article69015592.ece#:~:text=A%20speed%20gun%20is%20a,to%20infer%20the%20object's%20speed.>

