Physics 3306

Provides an introduction to a wide variety of topics in classical (pre-quantum) physics as a bridge to prepare students for subsequent upper-level courses in physics. The topics covered include thermodynamics, fluid mechanics, mechanical waves, optics, radiation, electromagnetic phenomena, atoms, and laboratory techniques. Prerequisites: C- or better in PHYS 1106; and in PHYS 1304 or PHYS 1308.

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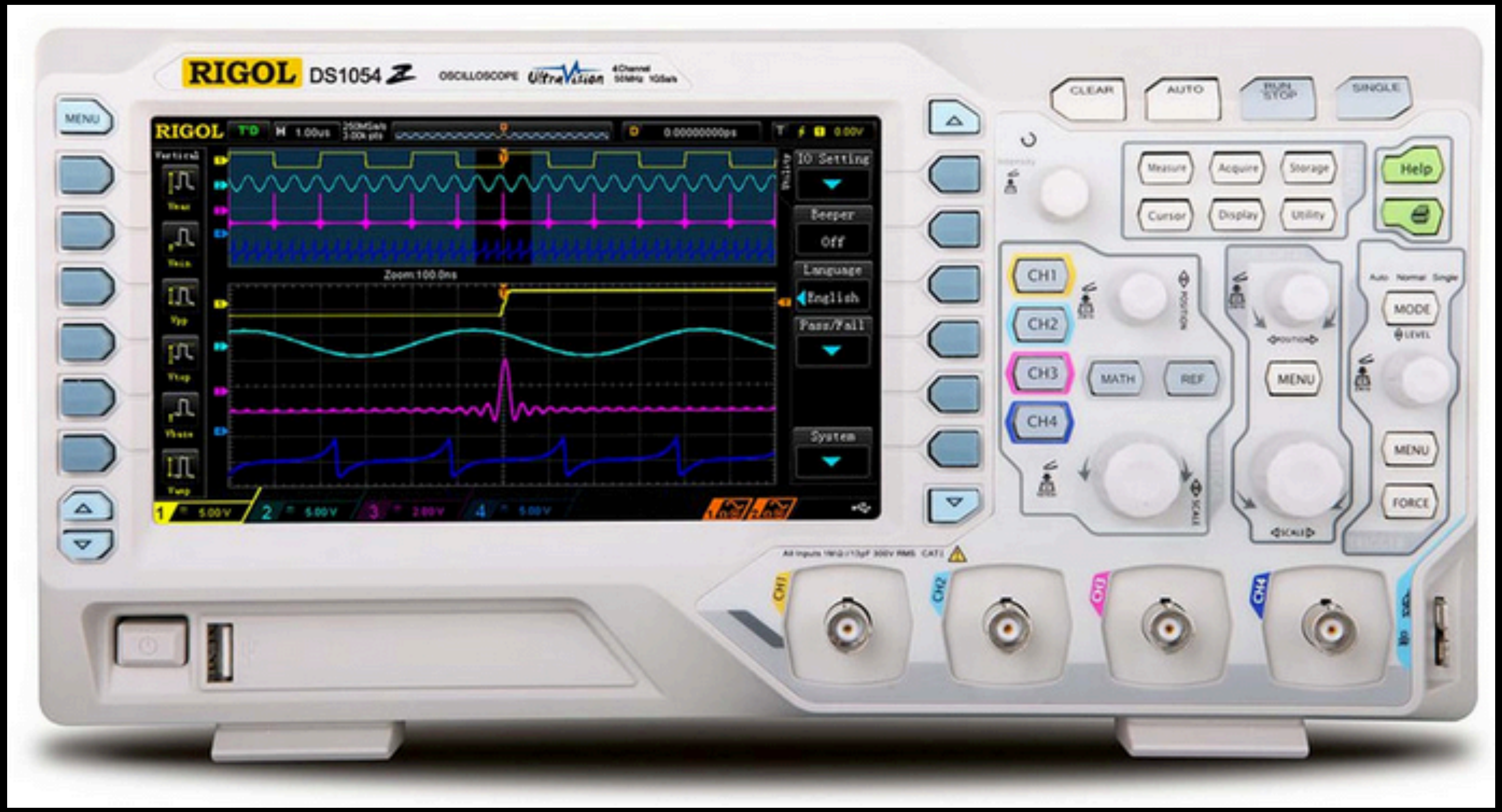
March 26th, 2025

Speed of light in a coaxial cable

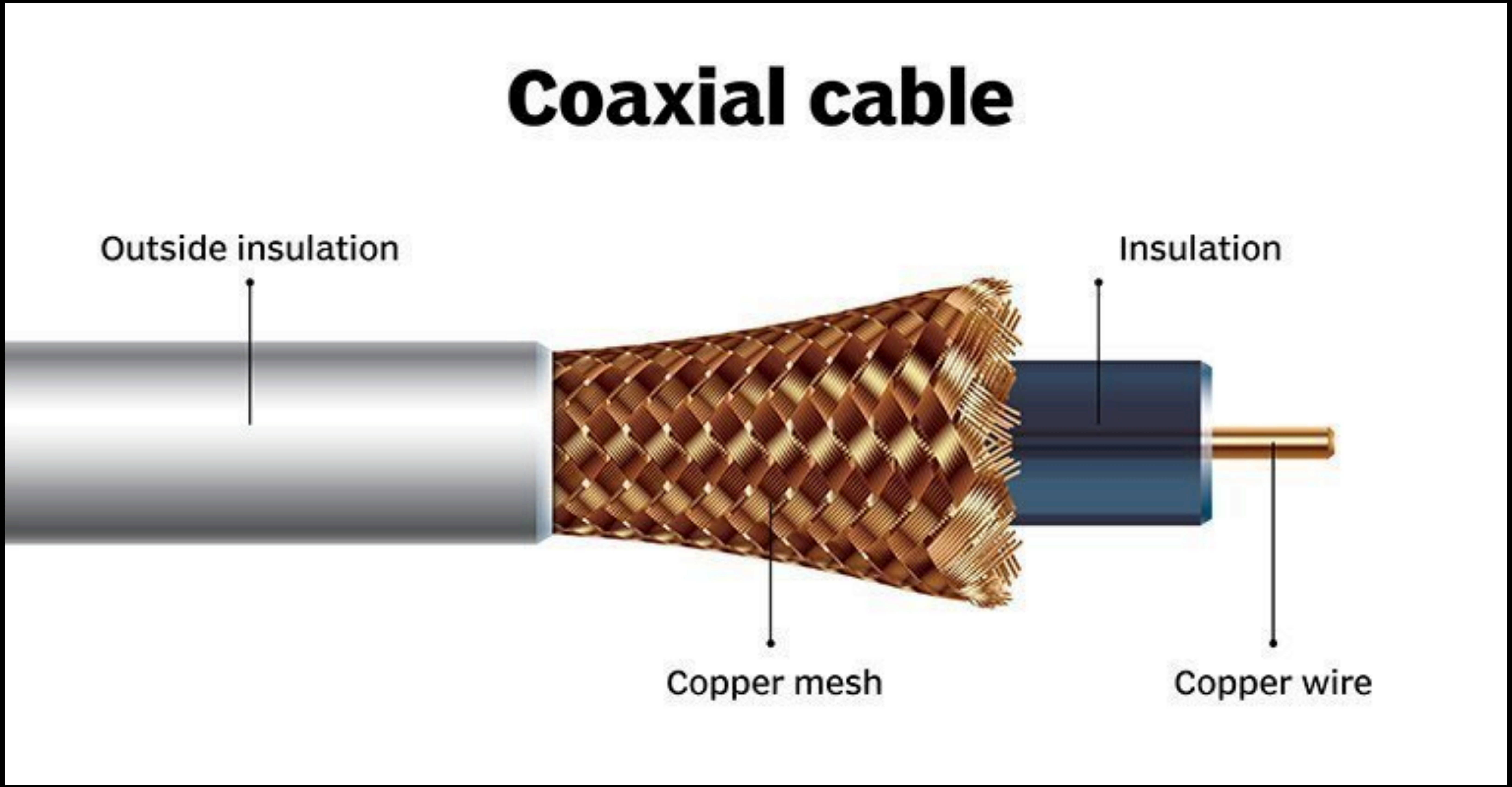
Oscilloscopes and waveform (or function) generators are back!



Oscilloscope

Waveform (function) generator

Coaxial cable



Coaxial cable: speed of light

- The velocity of a signal in free space is the speed of light or 2.997925 x 10^8m/s (we often approximate it to 3 x 10^8 m/s)
- A theoretical loss less coaxial cable working at high frequencies has a velocity of propagation that can be calculated from: $v_p = \frac{1}{\sqrt{LC}}$, where v_p is the velocity of propagation in m/s, C is the distributed capacitance per unit length in pF, L is the distributed inductance per unit length in μH
- The velocity of a signal in a medium is less than that in free space and is dependent on the permeability and permittivity of the materials used as in: $v_p = \frac{c}{\sqrt{\mu_r \epsilon_r}}$, c is the speed of light in m/s, μ_r is the relative permeability, ϵ_r is the relative permittivity
- In a coaxial cable it is normal practice to use materials that are non-magnetic with μ_r = 1 and the velocity of propagation then becomes almost completely dependent on the properties of the dielectric
- Velocity factor in a coaxial cable is a function of the dielectric constant of the cable (ϵ_r), $v_r = \frac{1}{\sqrt{\epsilon_r}}$

Source: https://chemandy.com/technical-articles/sitting-waves/standing-waves-article6.htm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