# Physics 623:
# Transmission Lines and Characteristic Impedance: Lab Worksheet

In this lab, we are going to build the circuit of Figure 1 to investigate propagation characteristics of transmission lines. From reflection measurements, we will determine the propagation speed of waves inside a transmission line, and measure its impedance.

Noting Figure 1, consider a transmission line of length $L$, impedance $Z_0$. Let's denote the propagation speed of electromagnetic waves inside the line as $u_0$. We supply a voltage pulse with time duration of $T$ at point **C** of the circuit. When the pulse hits point **B**, due to impedance mismatch, part of the wave is reflected. This reflected wave encounters a similar phenomenon when it reaches point **A**. As a result, multiple reflections can be observed at points **A** and **B**
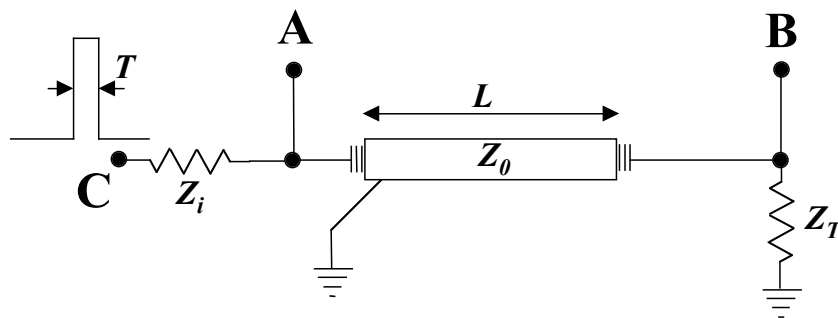


Figure 1: The circuit diagram for the transmission line experiment

1) Assume that $T << L/u_0$, and $Z_T, Z_i >> Z_0$. Plot what you would expect to see on points **A** and **B** (if we look on a scope for example).

2) Repeat (1), but now assume that $Z_T = 0$ (short circuit). What would you expect to see on points **A** and **B**.

3) Repeat (1), but now let's introduce some loss to our system (in reality every circuit is lossy). Let's assume that, while propagating from **A** to **B**, 10% of the wave is attenuated. What would you expect to see on points **A** and **B**.