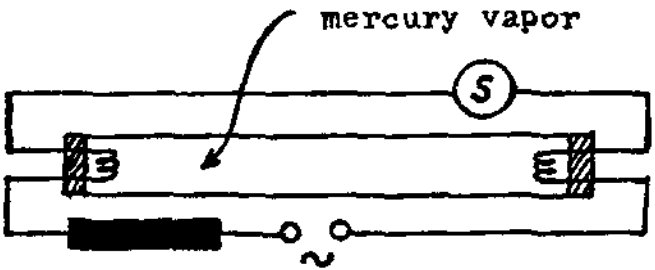
Theoretical Problems

Problem 1: Fluorescent lamp

An alternating voltage of 50 Hz frequency is applied to the fluorescent lamp shown in the accompanying circuit diagram.



The following quantities are measured:

overall voltage (main voltage)	$U = 228.5$ V
electric current	$I = 0.6$ A
partial voltage across the fluorescent lamp	$U' = 84$ V
ohmic resistance of the series reactor	$R_d = 26.3\Omega$

The fluorescent lamp itself may be considered as an ohmic resistor in the calculations.

a) What is the inductance L of the series reactor?

b) What is the phase shift φ between voltage and current?

c) What is the active power P_w transformed by the apparatus?

d) Apart from limiting the current the series reactor has another important function. Name and explain this function!

   Hint: The starter —(s)— includes a contact which closes shortly after switching on the lamp, opens up again and stays open.

e) In a diagram with a quantitative time scale sketch the time sequence of the luminous flux emitted by the lamp.

f) Why has the lamp to be ignited only once although the applied alternating voltage goes through zero in regular intervals?

g) According to the statement of the manufacturer, for a fluorescent lamp of the described type a capacitor of about 4.7 μF can be switched in series with the series reactor. How does this affect the operation of the lamp and to what intent is this possibility provided for?

h) Examine both halves of the displayed demonstrator lamp with the added spectroscope. Explain the differences between the two spectra. You may walk up to the lamp and you may keep the spectroscope as a souvenir.