# DISCOVERING ELECTROMAGNETIC INDUCTION: INTERACTIVE MULTIMEDIA PATH

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# Motivation

the whole story is about…

one „minus” sign

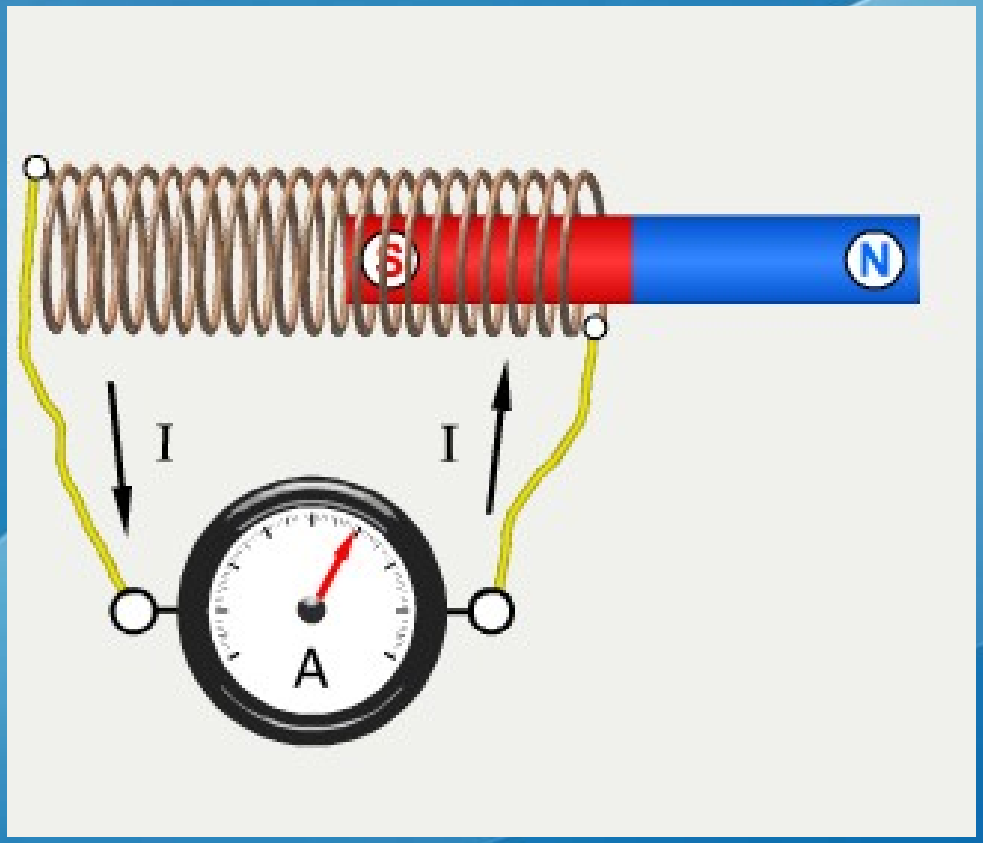
$$\mathcal{E} = - \mathrm{d}\Phi/\mathrm{d}t$$

# SPEA:

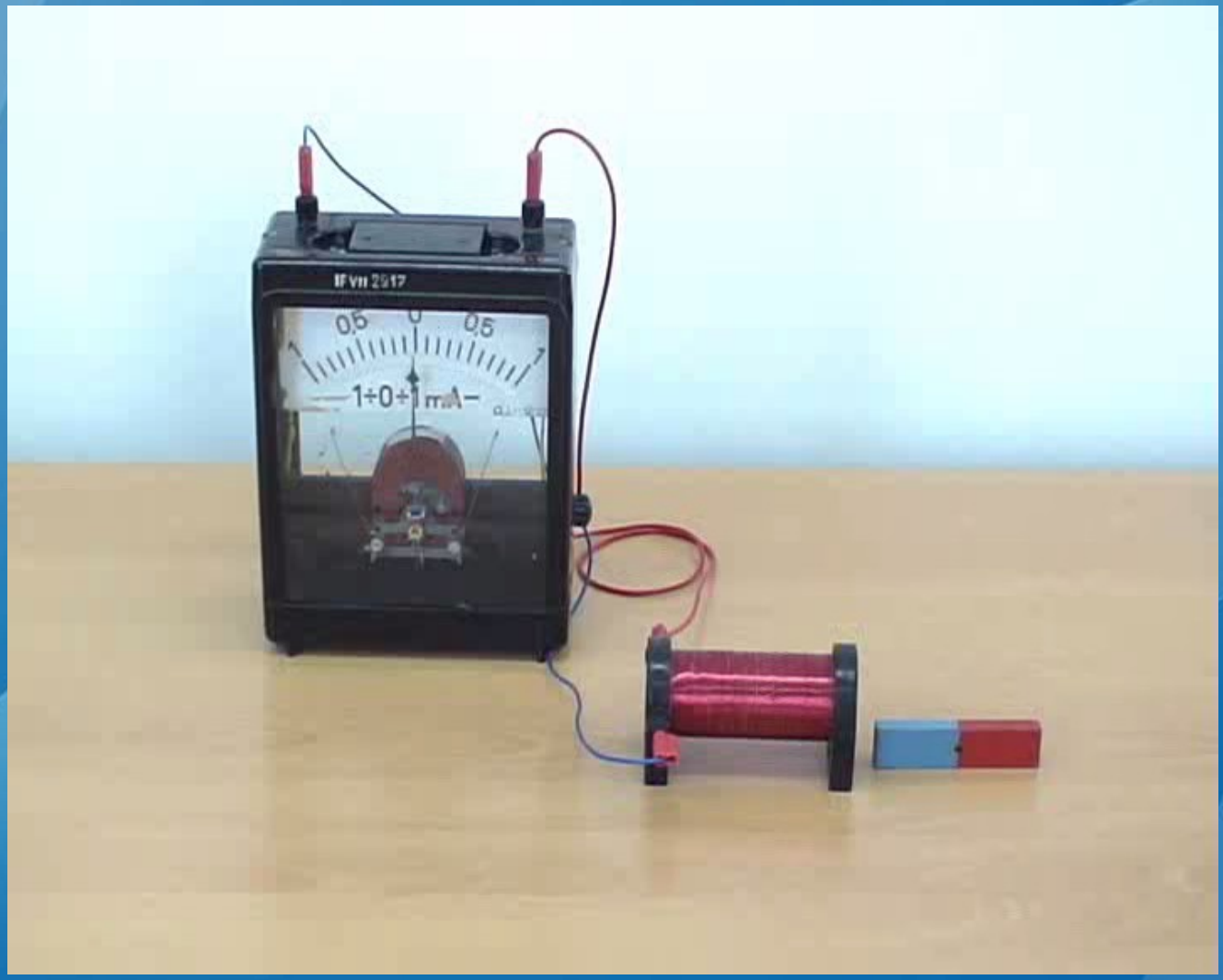
## 1) situation

How to teach FvNL law?

# 2) prevision



# 3) experiment



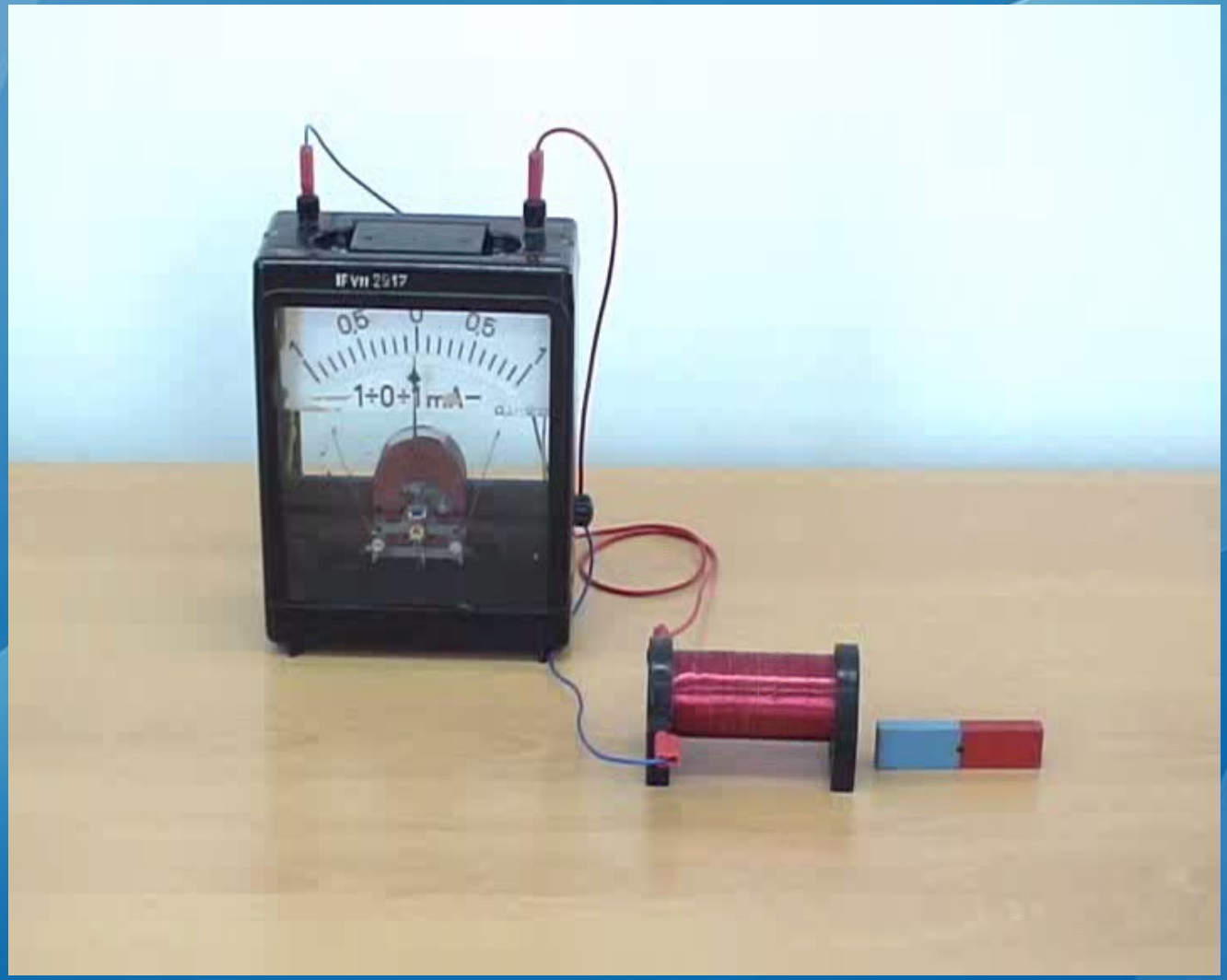
# 4) analysis

$\mathcal{E} = - d\Phi/dt$

**F= *i* L x B**


**Bruno Touschek**

# 4) or: inserting the blue end, the arrow goes left



Do we really need to teach everything we know?

Do we really need to teach in a way in which we learned?

Statistical chance for a correct answer is 1/8? 1/16? ??

# What happens?

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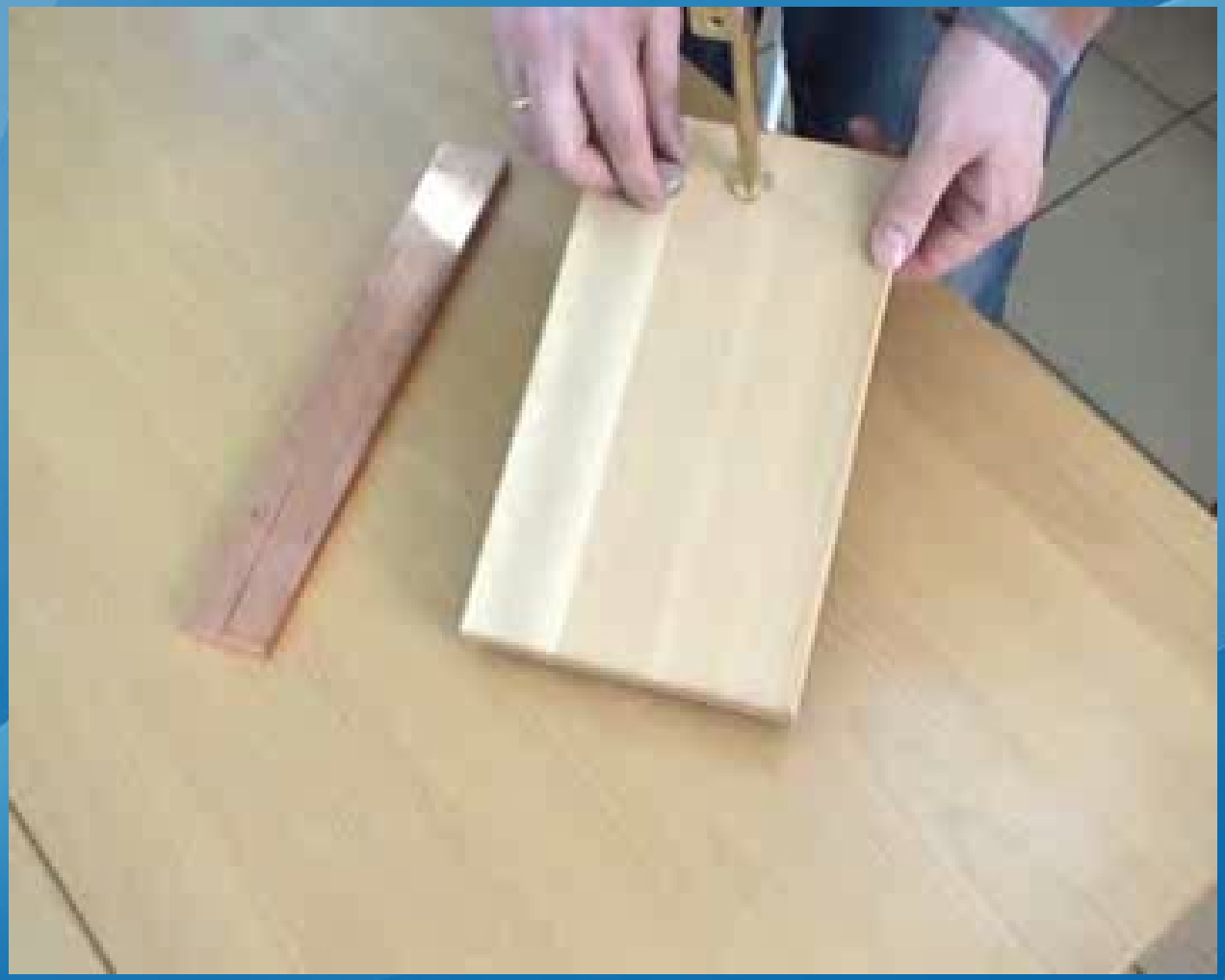
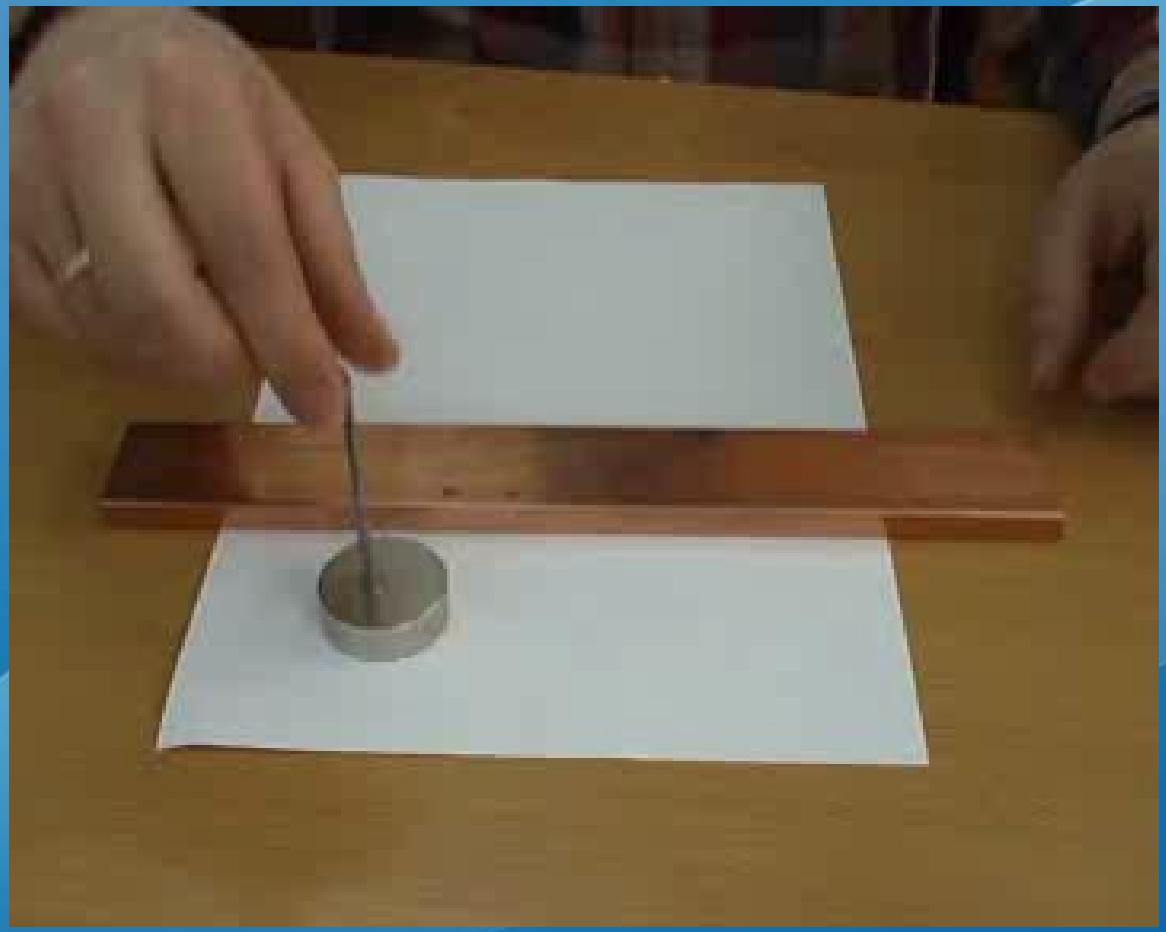
# What happens (again)

# What happens (check)



# Does it attract/ repel?



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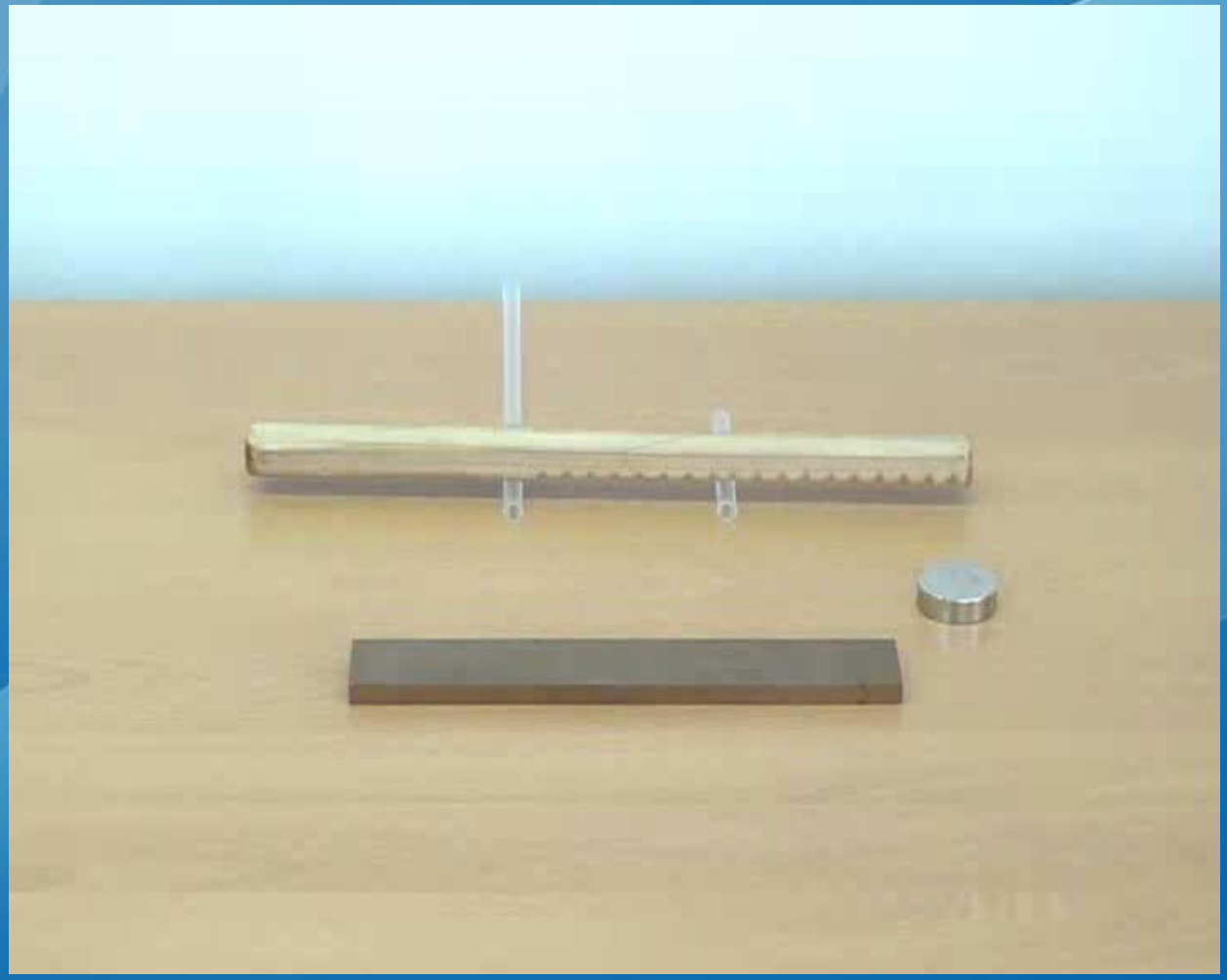
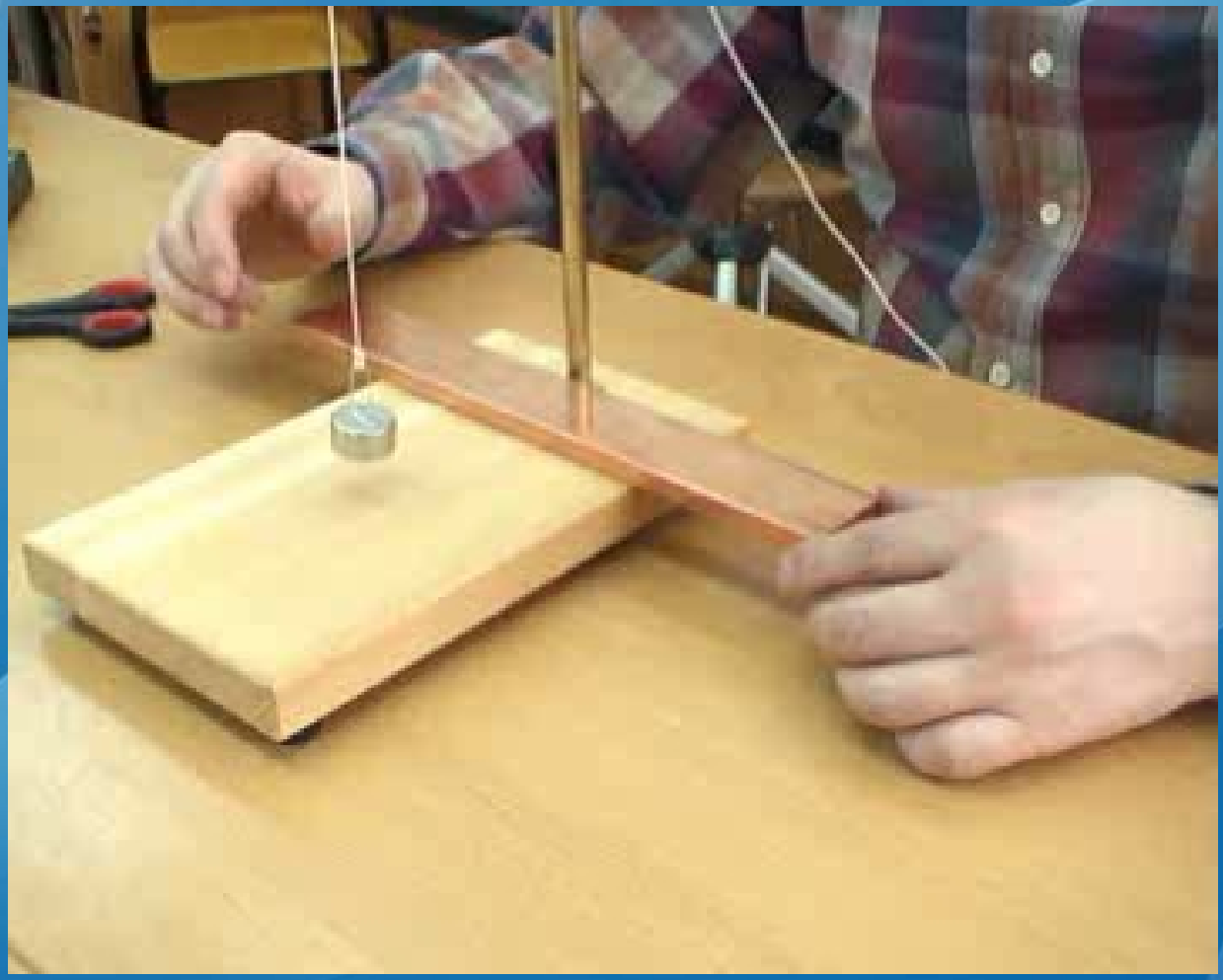
# Does it attrack/ repel?



# It opposes!



# Variable **field** ↔ current

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# Induced current, simpler

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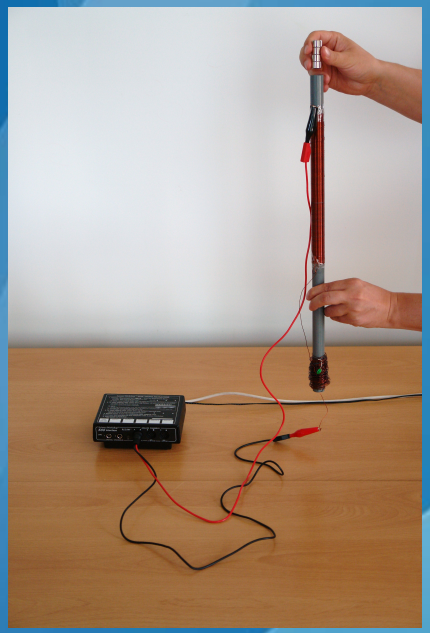
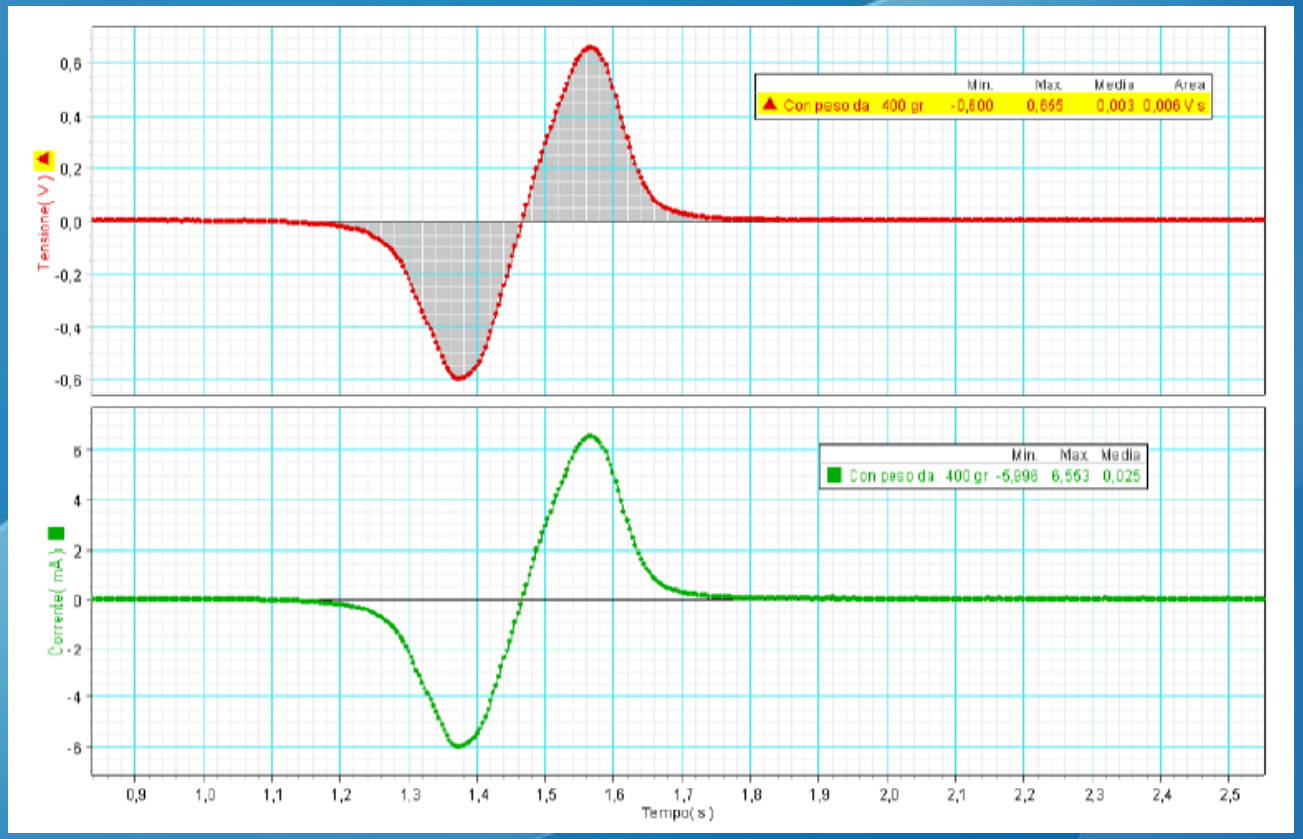
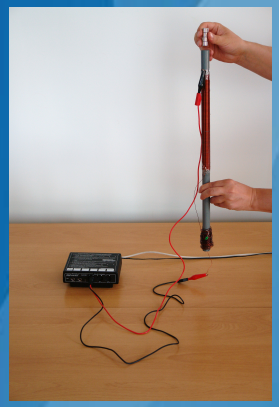
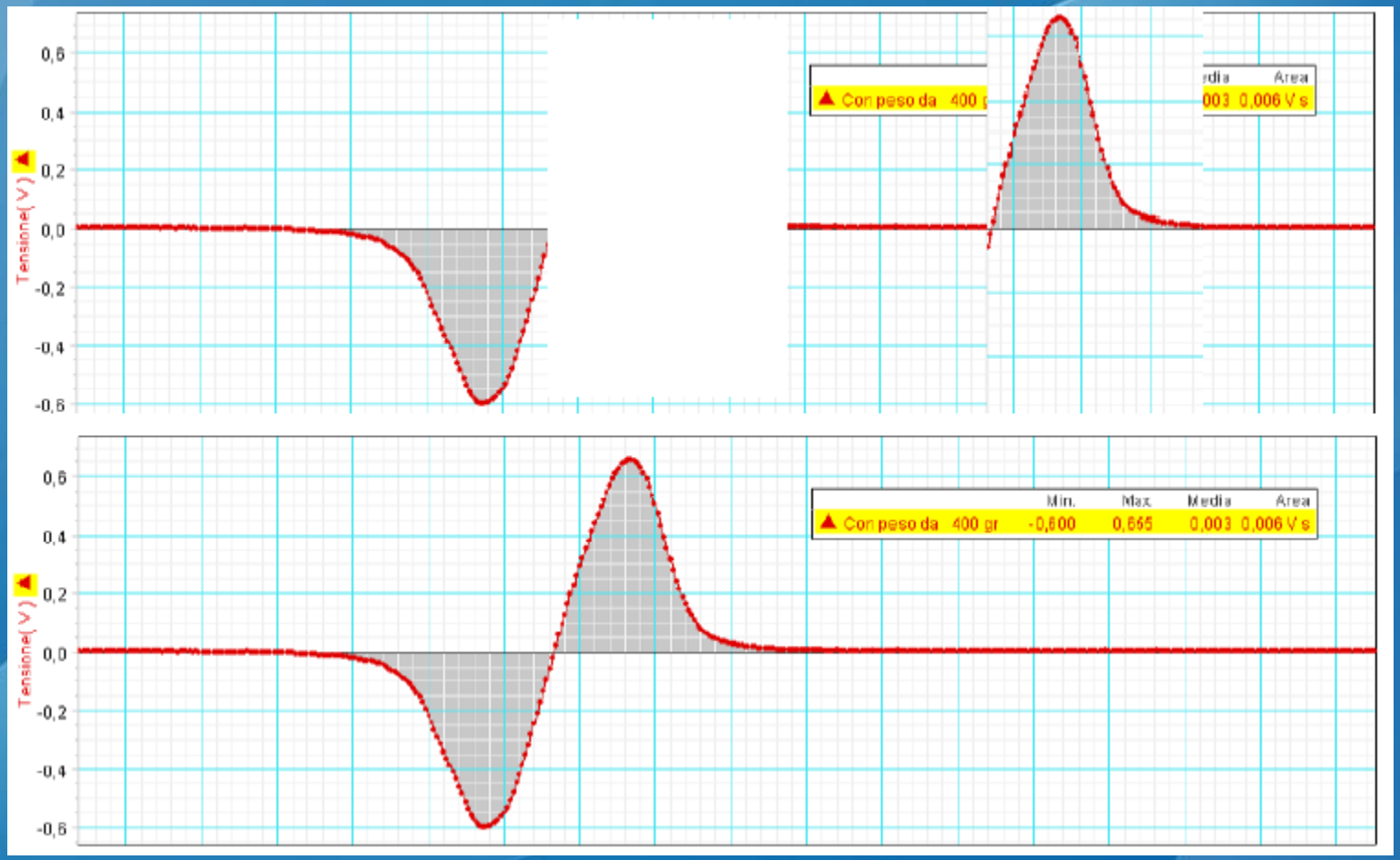
# Induced current, more precise





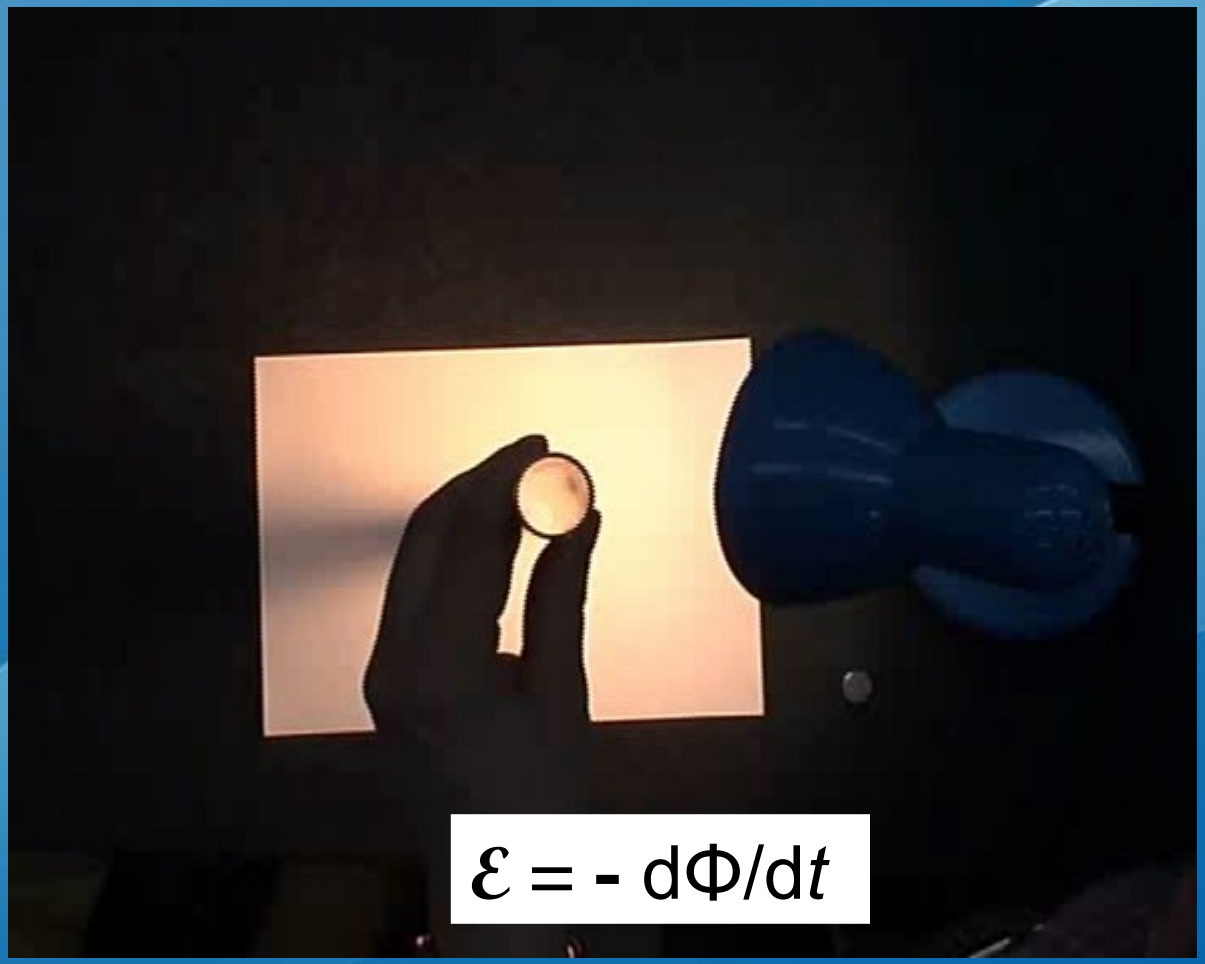
# Induced current, more precise





# Induced current = magnet

# Induced current = opposite magnet



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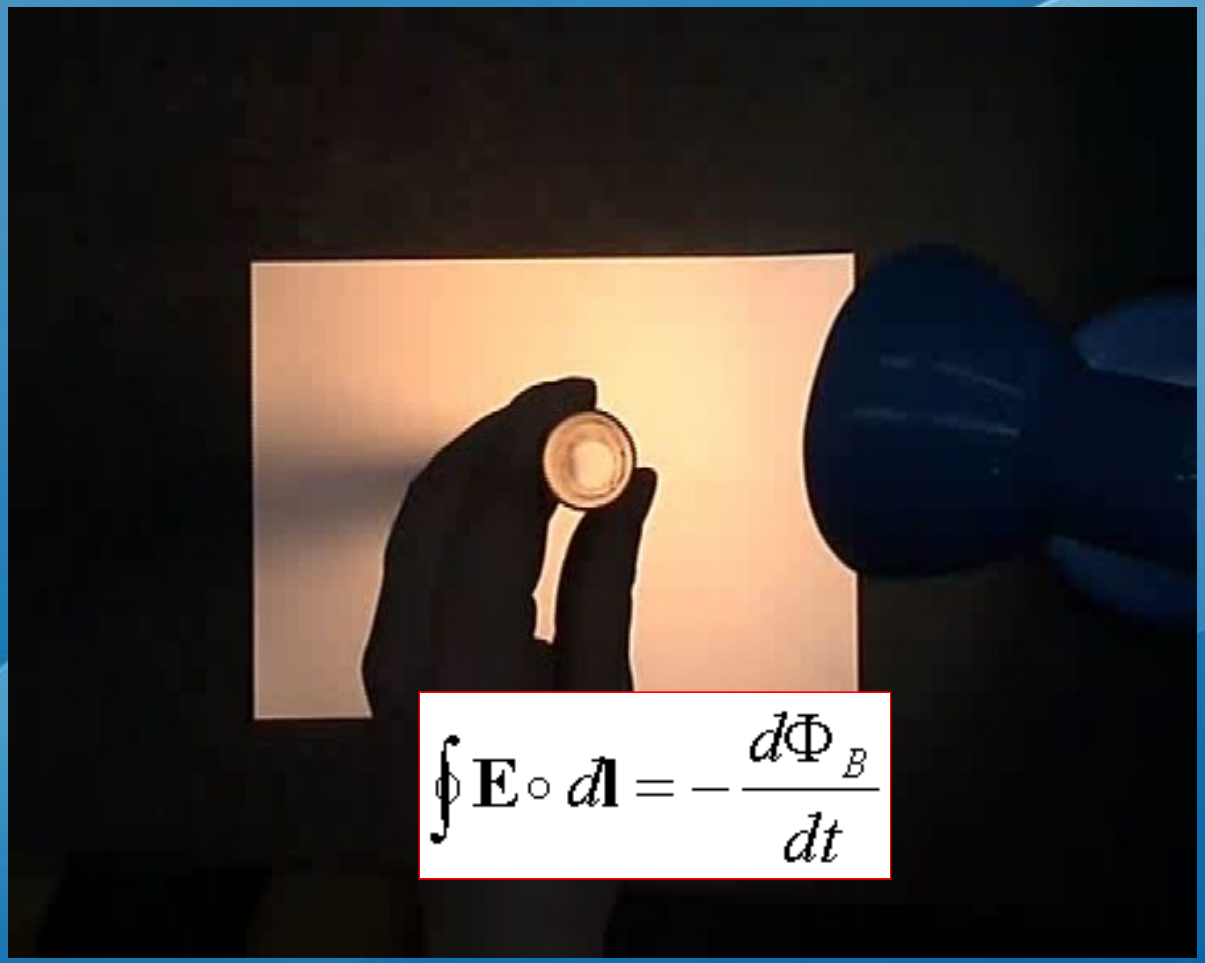
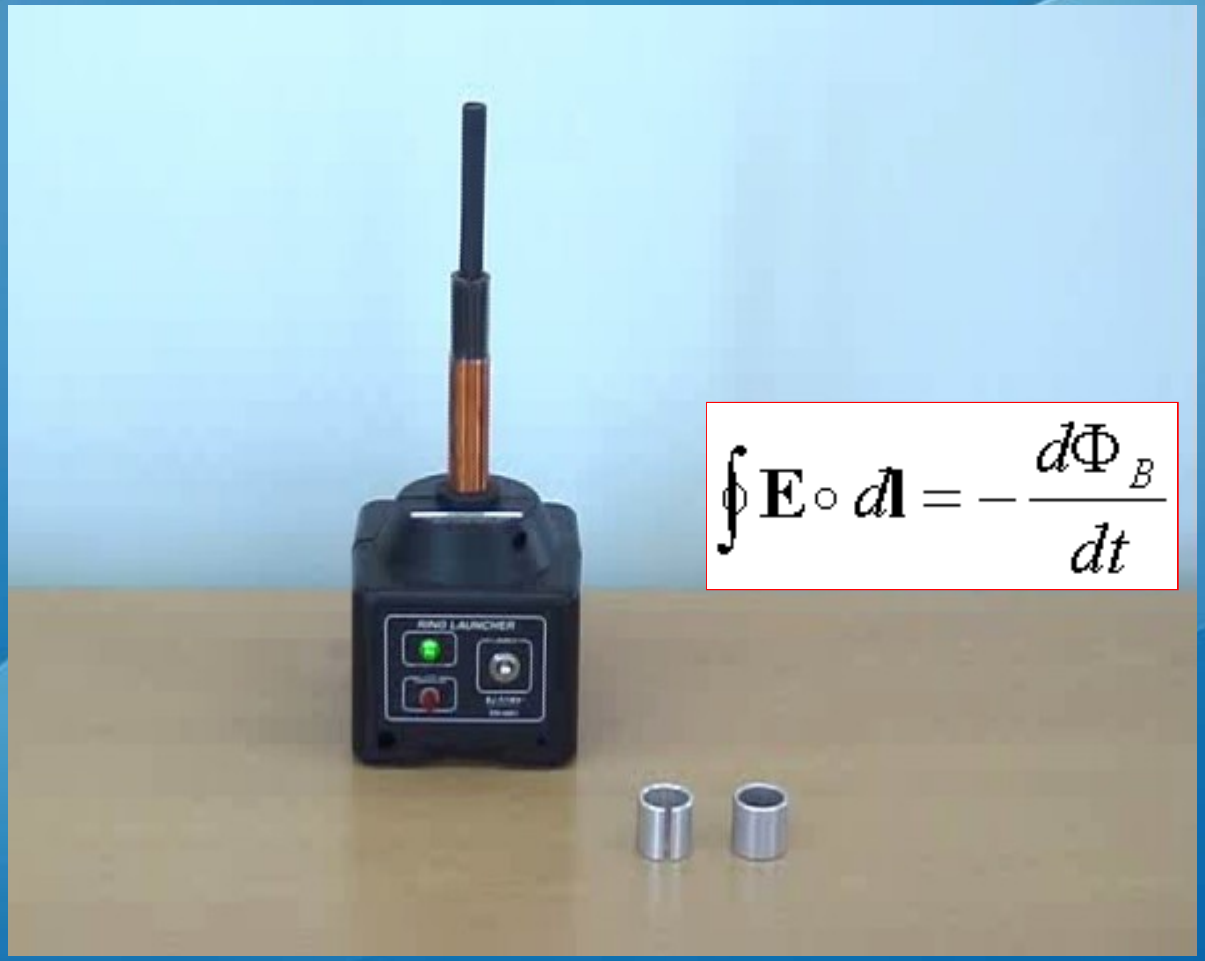


# Induced current = magnet




$$\oint \mathbf{E} \circ d\mathbf{l} = -\frac{d\Phi_B}{dt}$$

# FvNL law?

- Saves energy!

- e.g. does not allow the falling magnet to fall
- does not allow the rising magnet to be risen
- does not allow the magnet to be inserted
- does not allow the magnet to be withdrawn

It is always opposite!

# Interactive teaching
# e.g. magnets, magnetic fields, Earth

- Descartes' experiments with flowing magnets

# Interactive discovering…

**Udine, 12.03.2009**

# EM multimedia textbook


„TPSS” - Teaching Physics in Secondary School, EEA Grants

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