

DON'T LET PHD INTERFERE WITH YOUR RESEARCH

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Research Scholars Forum, 5 March 2014

CORE VALUES

PHD

RESEARCH

- Defining a topic
- Identify work elements
- Execution and report
- Publicity
- What makes the world tick
- What are the key questions one can ask
- What tools will I need?
- Persuade peers

DEDUCTIVE VS EMPIRICAL

- History of electromagnetism
- Coulomb, Ampere, Faraday
- Maxwell
- Einstein

RELEVANCE

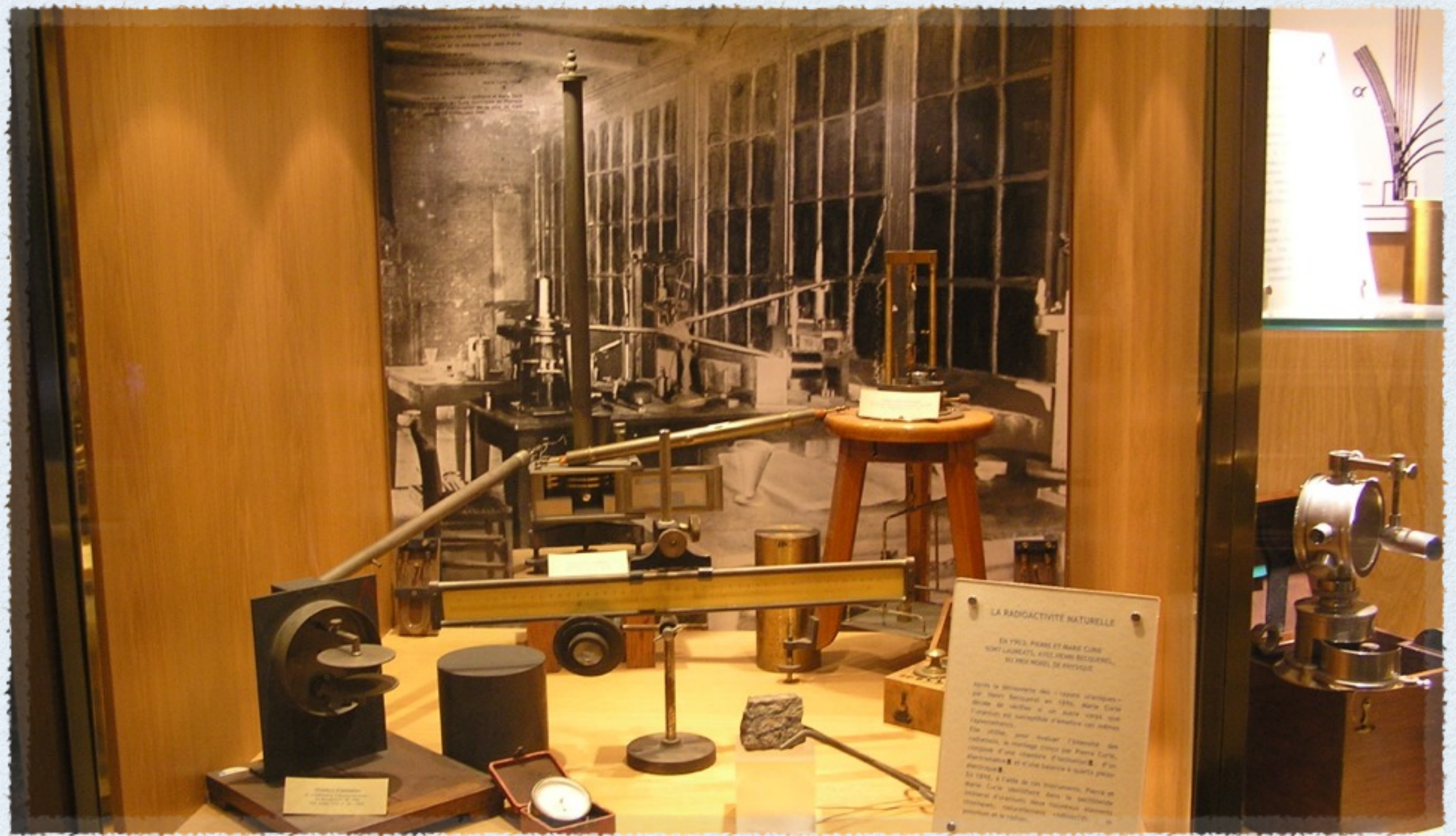
- Laughing gas
- Roentgen rays
- Thermodynamics of light
- Special Theory of Relativity

MAIN POINTS

- Connection between deductive and empirical research,
- Relevance,
- Collaboration
- Funding, and intellectual property
- The need to continuously retrain and reinvent yourself



MADAME CURIE'S LABORATORY



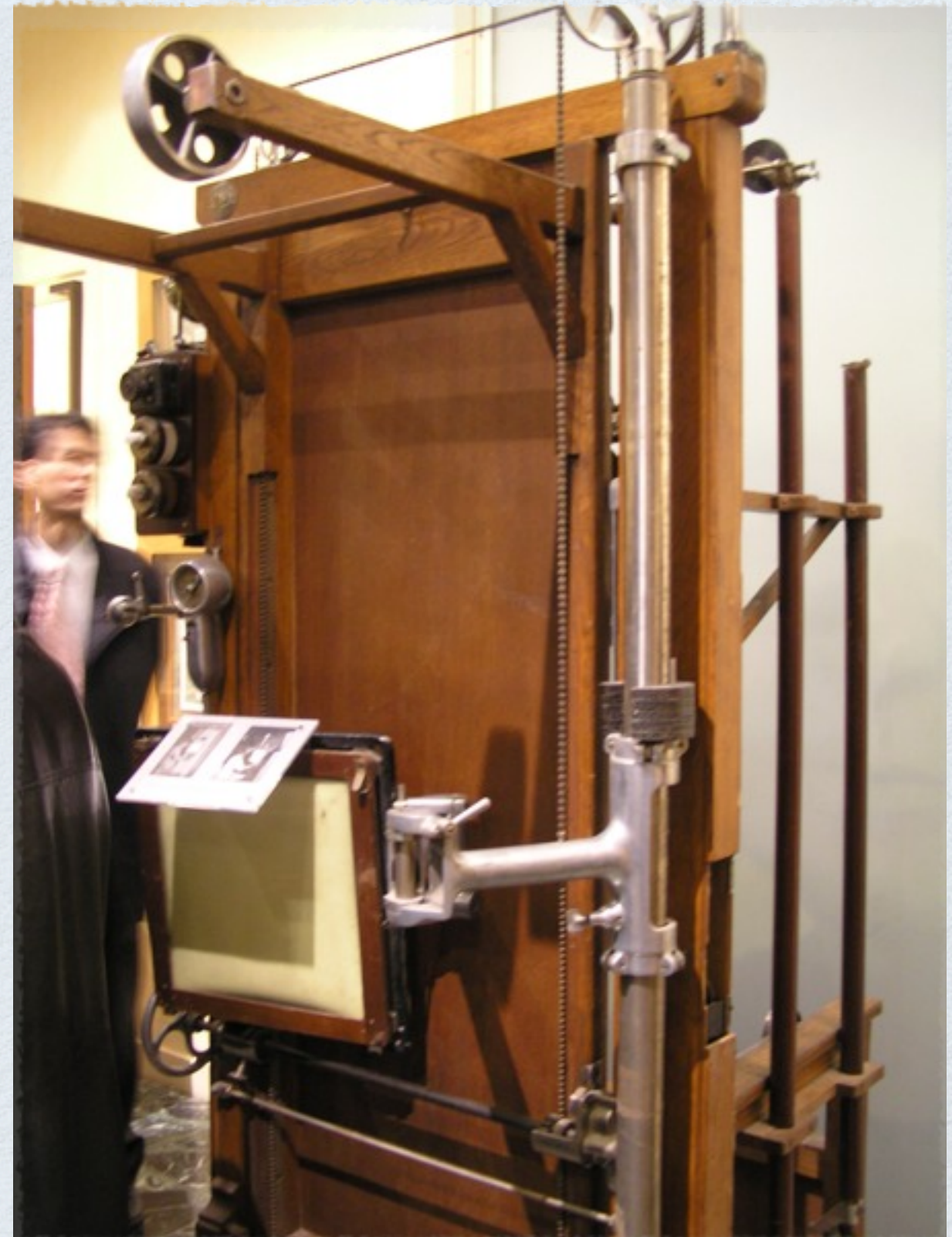
A GLIMPSE OF THE LAB

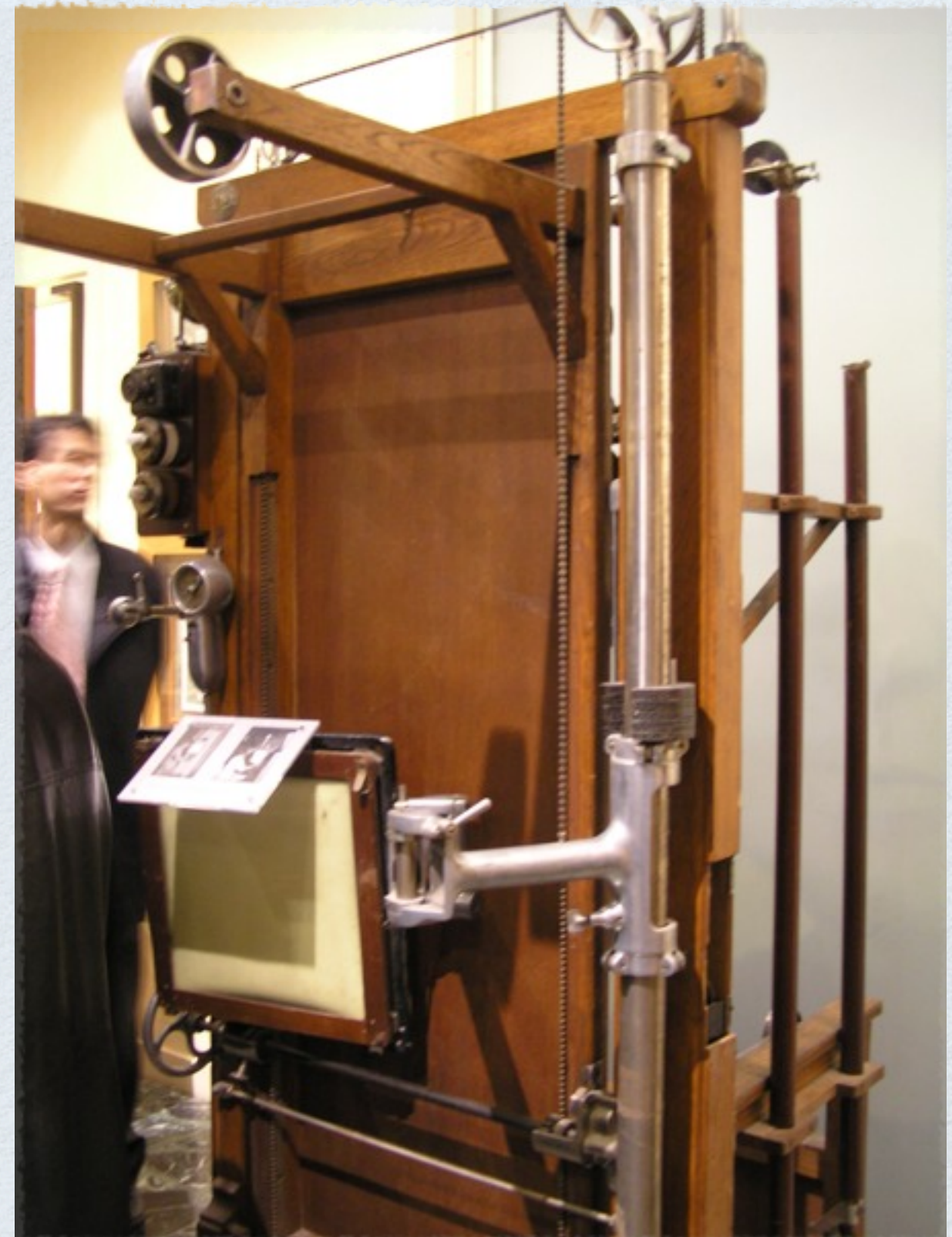


RADIUM MAKES A
SPLASH!

X-RAY MACHINE FOR THE WAR FRONT

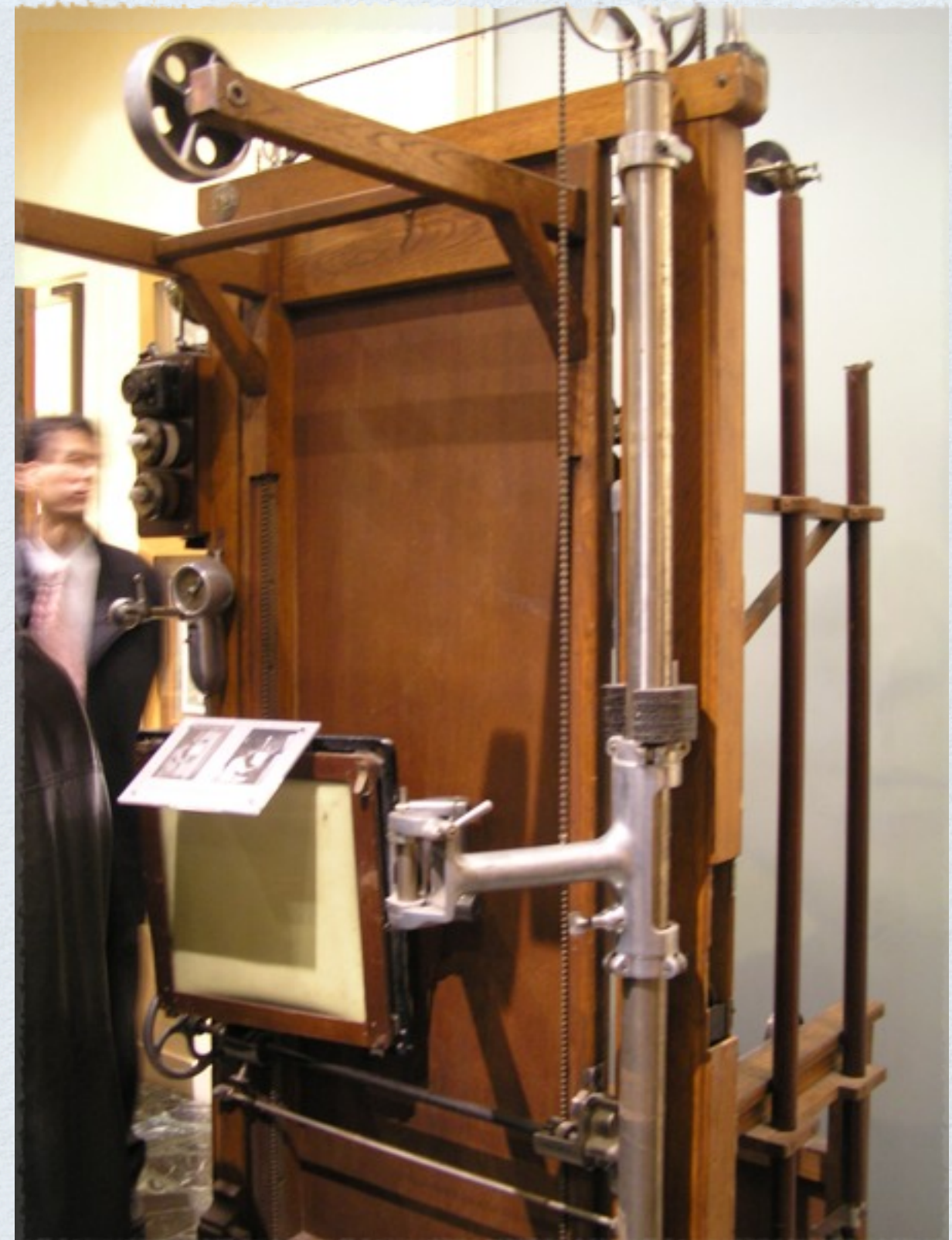
- Designed and made by Madame Curie, sent to the WWI front
- Refused to patent the discoveries in Radium -- science in the service of humanity





FROM WIKIPEDIA :

After a quick study of radiology, anatomy, and automotive mechanics she procured X-ray equipment, vehicles, auxiliary generators, and developed mobile [radiography](#) units, which came to be popularly known as petites Curies



ERNEST RUTHERFORD

2

To determine the number of alpha particles per second from a known quantity of radium.

Alpha particles from a thin layer of radium bromide passing through the aluminum foil window were collected in the copper box, and the resulting current to the collector was measured.

Using a powerful magnetic field and a high vacuum inside the apparatus it was possible to eliminate the effects due to ionization of the gas and due to secondary electrons.

Conclusion

1 gm. of radium emits 6.2×10^{10} alpha particles per second, assuming the alpha particle carries a single positive charge.

Assuming, as Rutherford later proved, that the alpha particle carries two positive charges, the above value becomes 3.1×10^{10} alpha particles per gm. per second, remarkably close to the accepted value of 3.7×10^{10} .

3

To determine the velocity and ratio of charge to mass of alpha particles.

The apparatus was used to study the deflection produced by a strong electric field.

Alpha rays from a radium-coated wire passing upward between the deflecting plates struck a photographic plate. When an electric field of about 20,000 volts per centimetre was produced between the plates, the beam of alpha rays was deflected to strike the photographic plate at A.

The field was then reversed and the beam deflected to B, and when the photographic plate was developed the total deflection was easily measured.

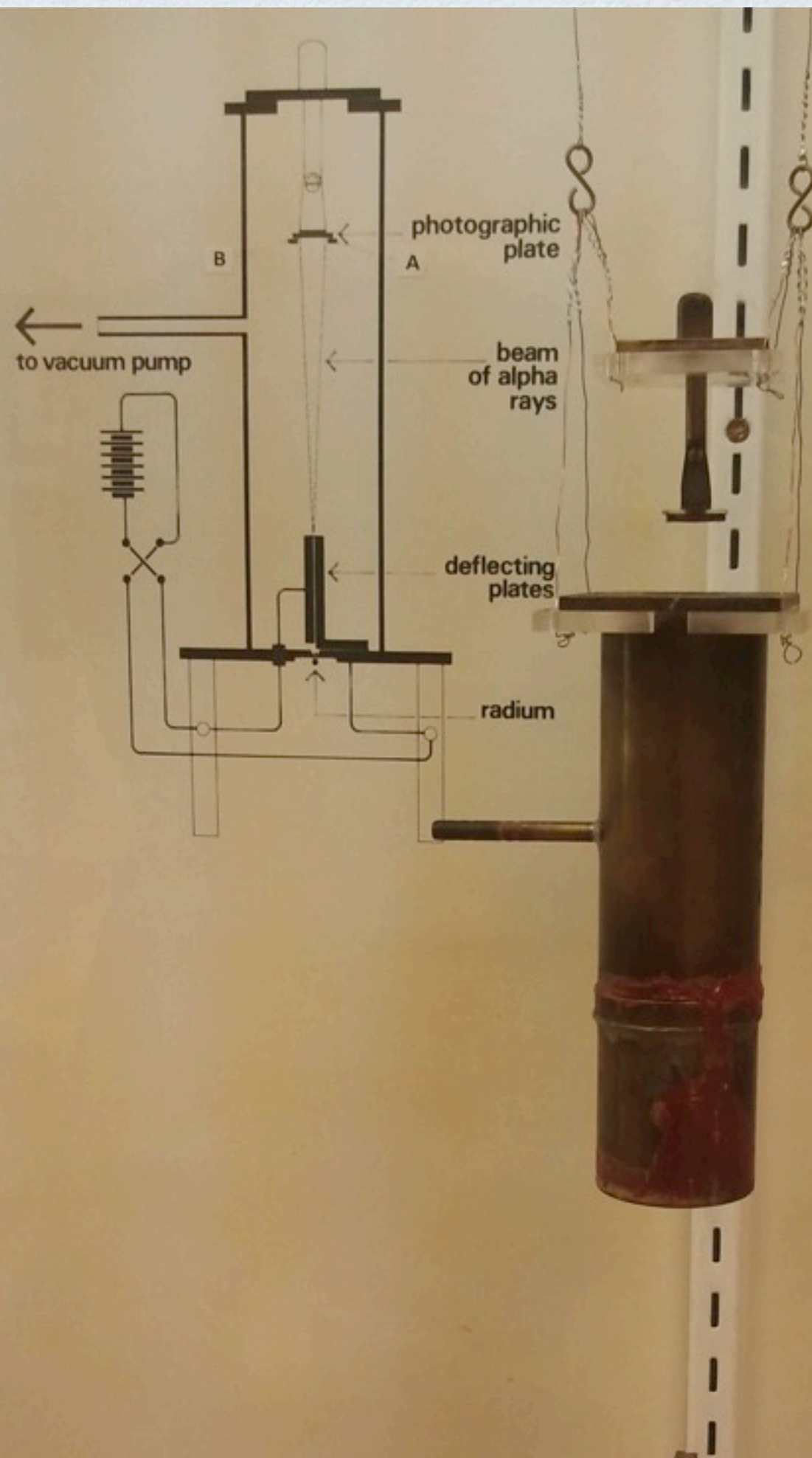
From the measured deflections, the dimensions and the strength of the field the following results were obtained for alpha particles from Radium C.

Velocity = 2.06 cm. per second $\times 10^9$
(accepted value = 1.92 cm. per second) $\times 10^9$

Ratio of charge to mass = 5,000 e.m. units per gm.
(accepted value = 4,826 e.m. units per gm.)

Rutherford concluded that the alpha particle was probably a doubly-charged atom of helium.

to vacuum pump





CALCULATING MACHINE

EINSTEIN AND LIGHT
QUANTA --> OTHER SLIDES



THANK YOU!