Curies and Becquerel’s Rays

C Puxley
Timeline

- 7 Nov 1867: Born Maria Skłodowska in Warsaw to Wladislaw Skłodowski and Bronislawa Skłodowska
- May 1878: Bronislawa Skłodowska dies from TB
- 1 Mar 1881: Czar Alexander II assassinated
- 1883: Graduates from High School but without laboratory instruction
- 1891: “Marie” moves to Paris to study at university
- 1893: Achieves Masters in Physics
- Spring 1894: Introduced to Pierre Curie
- 25 Jul 1895: Marries Pierre Curie at a civil ceremony
Timeline

- Nov 1895  Wilhelm Röntgen discovers X-rays (1st Nobel Prize in Physics 1901)
- Feb 1896  Antoine Henri Becquerel discovers “Becquerel rays” emitted from potassium uranyl sulphate
Maria and Pierre begin processing waste pitchblende ore from Bohemia which is analysed using a Curie Electrometer (piezoelectric device)

Curie electrometer for the measurement of faint currents in air
Timeline

- **1898** Separation techniques used by the Curies on the “Bismuth” and “Barium” fractions of the processed Pitchblende ores lead to the discovery of the new elements Polonium and Radium respectively

- **1903** Completion of doctoral thesis
Timeline

- 1903  
  Awarded a share of the Nobel prize for Physics for the discovery of “radioactivity” (Maria, Pierre and Antonine Henri Bequerel)

- 19 Apr 1906  
  Pierre killed in RTA in rainy Paris involving horse-drawn waggon. Maria fills “dead man’s shoes” for the vacant professorship

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  Work continues on the “Bismuth” and “Barium” fractions of the processed Pitchblende ores in order to try and isolate pure Polonium and Radium

- 25 Aug 1908  
  Antonine Henri Bequerel passes away
Timeline

- **1910** Definition of the “Curie”
- **1911** Awarded Nobel prize in Chemistry for isolation of radium and the Curie but marred by press scandal involving alleged liaison with Prof. Paul Langevin
Timeline

- 1914 Volunteers as an X-ray technician to aid soldiers suffering from shrapnel etc.
- 1919 Poland becomes an independent country
- 4 Jul 1934 Dies from “aplastic pernicious anaemia” whereby the bone marrow ceases production of blood cells
- Laboratory notebook legacy
Hazardous Investigations

- Turn of the 20th Century. O Ruff prepares OsF$_6$ in 1913
- Degree of hazard experienced by Marie and Pierre (and Becquerel) aggravated by the emission of invisible “rays” by the sample
“Rays” Emitted by Uranium

- $^{235}\text{U}$ party
- Relaxation by
  - (i) A & E
  - (ii) First Aid
- $^{231}\text{Th}$ gatecrasher of $^{235}\text{U}$ party

![Diagram](attachment:image.png)

A & E ($\gamma$) $\rightarrow$ $^{231}\text{Th}$

$^{231}\text{Th}^*$ $\rightarrow$ $^{231}\text{Th}$

First Aid (X-rays) $\rightarrow$ $^{231}\text{Th}$
Detection of $\gamma$-Rays emitted by $^{235}\text{U}$

- 143.8 keV
- 163.4 keV
- 185.7 keV
- 205.3 keV
Detection of X-Rays emitted by $^{235}$U

- **Th $L_{\beta 1}$**
  - 16.2 keV
- **Th $L_{\alpha 1}$**
  - 13.0 keV
Investigations of Increased Hazard

- Research into the pitchblende ore, besides its toxic properties, resulted in exposure to “Becquerel’s” rays and “Röntgen’s” rays
- “Hands-on” manipulations of the ore and its extracted fractions resulted in significant burns to the hands of both Pierre and Marie
- Although both the short-term and long-term detrimental effects of exposure to “Becquerel’s” rays were not known at that time, these were incurred in the name of the advancement of scientific knowledge