

# Freedom and constraint in the life of Lise Meitner



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CSAAPT Spring Meeting 2015

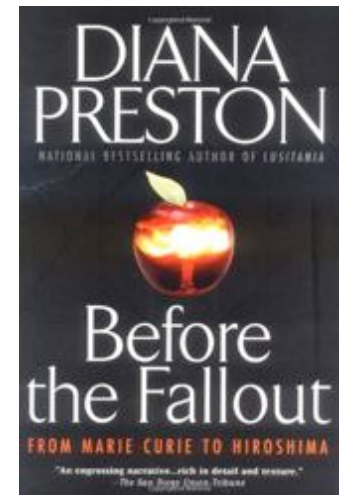
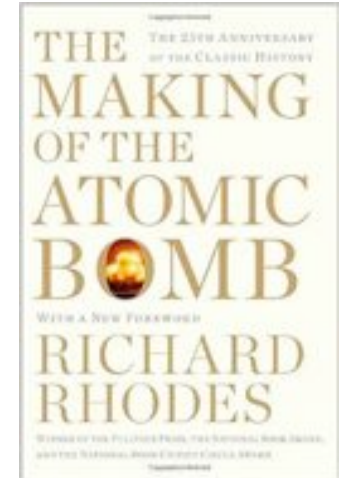
March 28, 2015



**RANDOLPH-MACON**  
COLLEGE

# Freshman Seminar at Randolph- Macon

- “Building the Bomb: Freedom and constraint in the dawn of the atomic age.”
- Learning objectives
  - Learn the story of the development of the first atomic bombs (text: “Before the Fallout: From Marie Curie to Hiroshima”)
  - Think critically about science, technology, and scientists
  - Consider the themes of freedom and constraint in the context of the bomb history



# Freedom and constraint

## Freedom

- Collective intellectual freedom
- Personal freedom: empowerment to achieve one's goals
- Liberation of atomic energy

## Constraints

- Social, political, economic constraints
- Moral constraints
- Physical/ scientific constraints

# Lise Meitner

- Meitner flourished as a physicist despite many hardships.
- Discovered fission
- Moral objections to working on the bomb



# Lise flourishes despite constraints



# Vienna

“Girl students, ‘blue stockings’, were rare freaks in those days, and she had to take some rudeness from the boys...”

-Otto Frisch, 1978

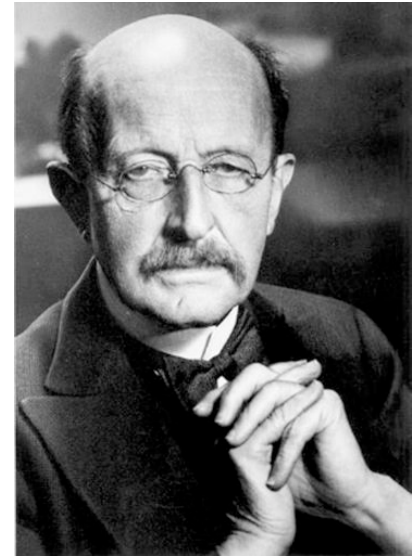
- Austrian born of Jewish heritage
- Stopped school at age 14.
- Compressed 8 years of high school into 2.
- 2<sup>nd</sup> woman to earn a PhD in physics from U. of Vienna.



# Berlin (1907-1938)

“But you are a Doctor already! What more do you want?”

Max Planck to Lise Meitner upon her arrival in Berlin (Meitner, 1964)



- University of Berlin
- Otto Hahn collaboration
- First paid position in 1912



~1930



# Wilhelm Kaiser Institute

- Associate (1913), founder of physics department (1917), first female Professor at U. of Berlin (1926)
- Discovery of Protactinium (with Hahn)
- Internationally recognized for her independent work





“There was really a very strong feeling of solidarity between us, built on mutual trust, and this made it possible for the work to continue quite undisturbed even after 1933, although the staff was not entirely united in its political views.”

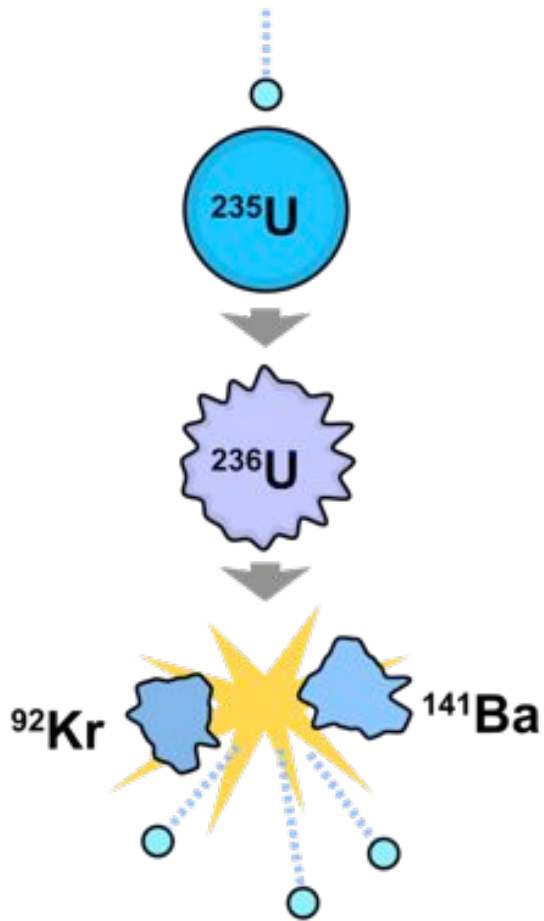
-Lise Mietner, 1964

Berlin, 1921





# Discovery of fission



"The likelihood of transforming matter into energy is something akin to shooting birds in the dark in a country where there are only a few birds."

-Albert Einstein to reporters at AAAS meeting in Pittsburg, 1935

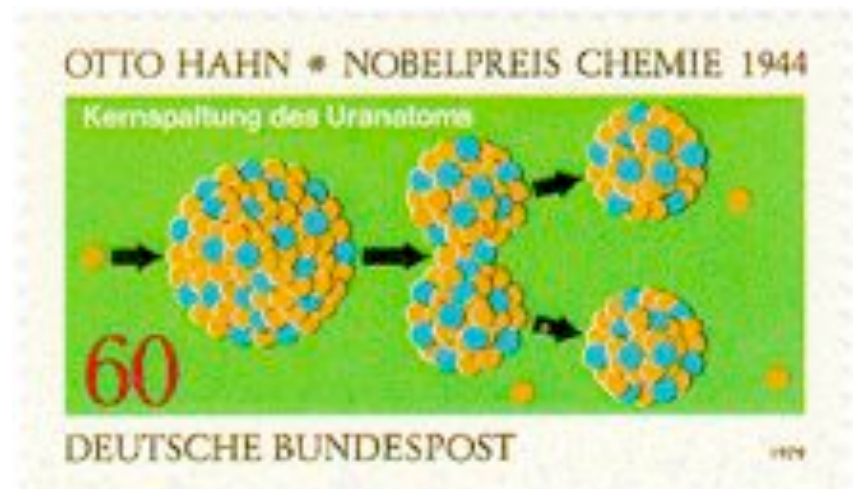
- 1932: Chadwick discovers the neutron
- January 1934: alpha-induced radioactivity (Joliot-Curie, Paris)
- March 1934: neutron-induced radioactivity, slow neutrons (Fermi, Rome)
- 1934: Lise initiated Uranium experiments with Hahn

# “The Jewess endangers the institute.”

-Kurt Hess referring to Meitner

- 1938: Austria annexed by Nazis
  - Exile to Sweden
  - Collaborations with Hahn continue
- 1938: Hahn and Strassmann perform experiments that provided evidence of fission.
- 1939: Meitner and Otto Robert Frisch correctly interpreted results as fission
- Hahn distances himself from Lise and the fission discovery from Physics

Nobel Prize in Chemistry went to Hahn alone.



# Deutsches Museum, Munich



<http://link.springer.com/article/10.1007/s00016-009-0013-x/fulltext.html>



<https://www.flickr.com/photos/brewbooks/176055796/>



# Refusal to work on bomb

“...What still gives me ground for anxiety of course is what mankind will make of this newly won knowledge, which might come to be used for destruction on a tremendous scale.”

-L. Meitner (Meitner, 1964)



“Physics has brought light and fullness into my life.”



- Overcame gender bias, racism, and political prejudice to flourish as a physicist.
- Discovered fission, though not properly credited.
- Maintained her moral integrity throughout her life.

# References

- Meitner, “Lise Mietner looks back,” *Adv. Sci.*, 20 (1964), pp. 39–46.
- Video: Overlooked Achievement: The Life of Lise Meitner by Ruth Lewin Sime (<https://www.youtube.com/watch?v=RRDQhBFhuiE>)
- Ruth Lewin Sime, “An Inconvenient History: the Nuclear-Fission Display in the Deutsches Museum”, *Physics in Perspective*, June 2010, Volume 12, Issue 2, pp 190-218.
- Otto Frisch, “Lise Meitner, nuclear pioneer,” *New Scientist* 9, November 1978.

# Timeline

- November 7, 1879: Born in Vienna
- 1905: PhD from U. of Vienna
- 1912: Keiser Wilhelm Institute (Now Max Planck Institute) (Lise and Hahn moved in 1913)
- 1917: Discovery of proactinium
- 1922: Auger effect
- 1926: Full Professor in Physics at U. of Berlin
- 1934: Lise initiates collaboration with Hahn (motivated by Fermi's finding, asked Hahn to help with the radio-chemistry, later Strassmann)
- 1938: Fled to Sweeden
- 1939: Discovery of fission
- 1968: Died in England