

Concealed Craftswomen of Physics

Emma Goulet, August 5 2022

American Institute of Physics (AIP) Center for
History of Physics (CHP) / Niels Bohr Library &
Archives (NBLA) Intern



Gender Differences in Career Compromises for Family Reasons

In physics, only 21% of bachelor's degrees & 20% of doctorates were received by women in 2018.

Career Compromises	Survey Source	Gender Difference
Relocated for a spouse	Longitudinal Study of Astronomy Graduate Students, 2007–2016	Women were 204% more likely
Declined job for a spouse	PhD Plus 10 Survey, 2011	Women were 346% more likely
Had a career break for family reasons	Global Survey of Physicists, 2010	Women were 400% more likely
Became a stay-at-home parent	Global Survey of Physicists, 2010	Women were 463% more likely
Chose a less demanding or more flexible schedule	Global Survey of Physicists, 2010	Women were 111% more likely
Changed employers or field of employment	Global Survey of Physicists, 2010	Women were 40% more likely
Spent less time at work	Global Survey of Physicists, 2010	Women were 104% more likely

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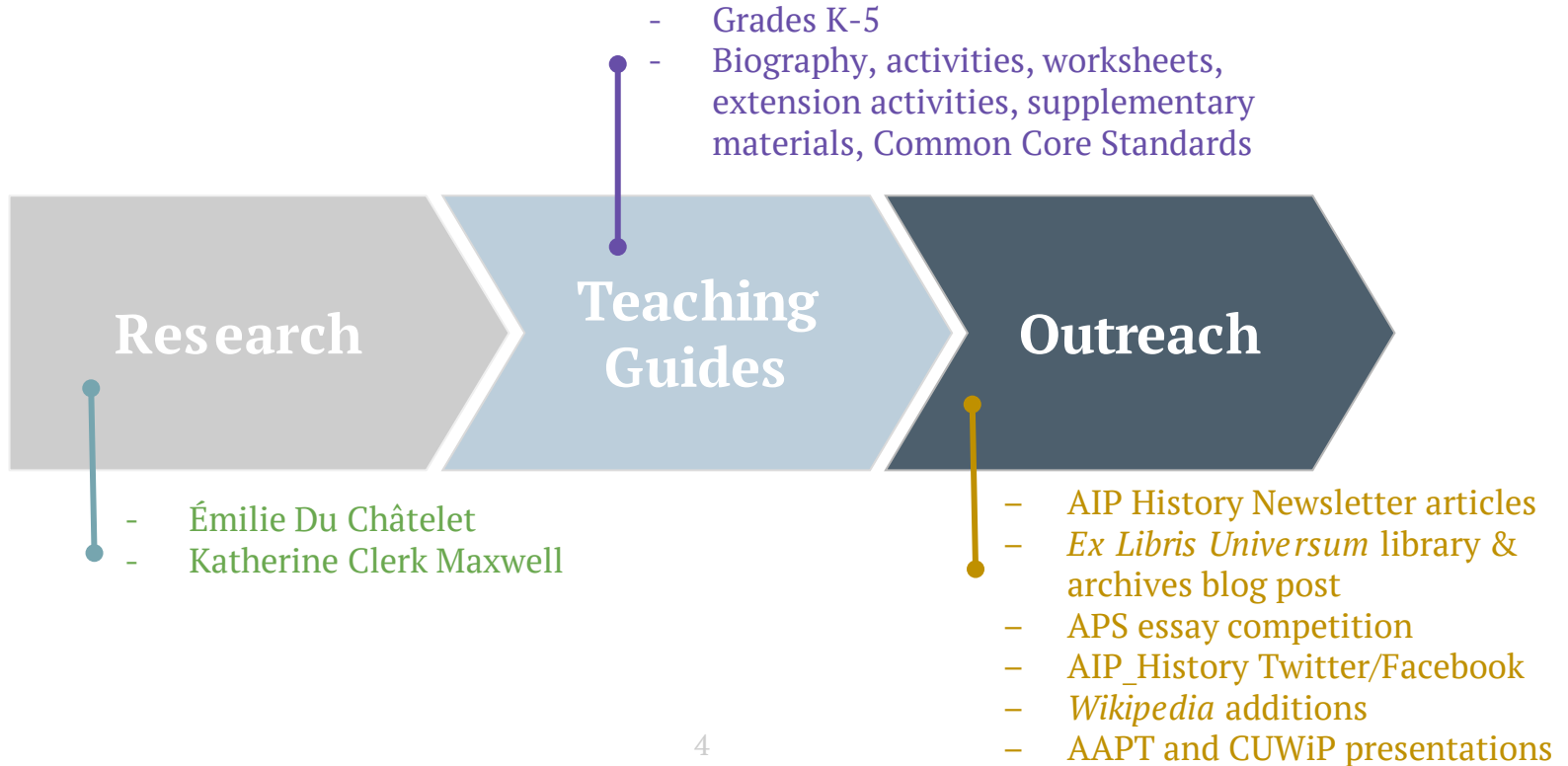
Representation of women scientists in the media also plays an important role in shaping girls' and women's ideas of what they can be.

- Jess Wade, columnist, research fellow at Imperial College London, Queen's Birthday Honours for services to gender diversity in science

Studies have consistently shown that a lack of role models dissuades students from underrepresented groups from choosing a STEM major.

- Alexander L. Rudolph, professor of physics and astronomy, director of the Cal-Bridge program, *Physics Today*

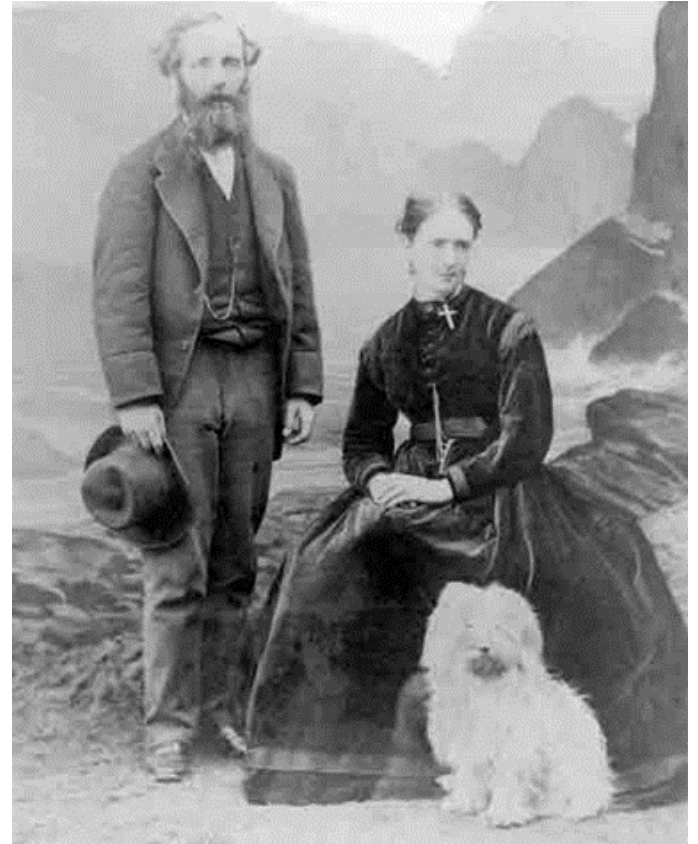
Summer Timeline



Katherine Clerk Maxwell

- ▣ Assisted her husband, James Clerk Maxwell, with many of his experiments
 - Color vision & gas viscosity
- ▣ Records of her role as a technician involved in his work seem to be lost to history; she is completely uncredited
- ▣ Her involvement is only revealed in James' personal correspondence with close friends

*Further reading: AIP History Newsletter & Ex Libris
Universum Articles*



Katherine Clerk Maxwell (right) with her husband James Clerk Maxwell (left) and their dog Tobi.

This equation means that on the 18th of October the observer J. (myself) made an observation in which the breadth of the slit X was 18·5, as measured by the wedge while its centre was at the division (24) of the scale; that the breadths of Y and Z were 27 and 37, and their positions (44) and (68); and that the illumination produced by these slits was exactly equal, in my estimation as an observer, to the constant white W.

The position of the slit X was then shifted from (24) to (28), and when the proper adjustments were made, I found a second colour-equation of this form—

Oct. 18, J. $16(28)+21(44)+37(68)=W. \dots\dots\dots (14.)$

Subtracting one equation from the other and remembering that the figures in brackets are merely symbols of position, not of magnitude, we find

$$16(28)=18\cdot5(24)+6(44), \dots\dots\dots (15.)$$

showing that (28) can be made up of (24) and (44), in the proportion of 18·5 to 6.

In this way, by combining each colour with two standard colours, we may produce a white equal to the constant white. The red and yellow colours from (20) to (32) must be combined with green and blue, the greens from (36) to (52) with red and blue, and the blues from (56) to (80) with red and green.

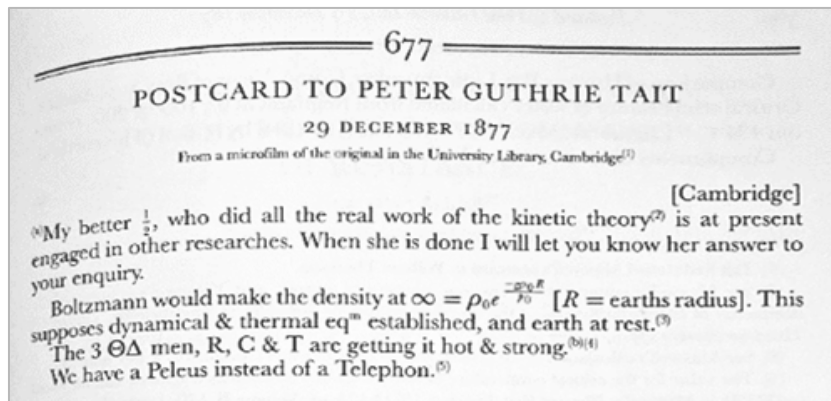
The following is a specimen of an actual series of observations made in this way by another observer (K.):—

TABLE III.

Oct. 13, 1859.	(X).	(Y).	(Z).	Observer (K).
	$18\frac{1}{2}(24)$	$+32\frac{1}{2}(44)$	$+32(68)$	$=W^*$
	$17\frac{1}{2}(24)$	$+32\frac{1}{2}(44)$	$+63(80)$	$=W.$
	18 (24)	$+32\frac{2}{3}(44)$	$+35(72)$	$=W.$
	19 (24)	$+32(44)$	$+31\frac{1}{2}(68)$	$=W^*.$

“observer J. (myself)”
= James, named
specifically as himself

“observer (K.)” = Katherine, unnamed



James Clerk Maxwell's letter to Peter Guthrie Tait:

“My better 1/2, who did all the real work of the kinetic theory is at present engaged in other researches. When she is done I will let you know her answer to your enquiry.”

Page taken from “The Scientific letters and Papers of James Clerk Maxwell,” edited by P. M. Harman

Written in James Maxwell's biography, by two of his close friends, Lewis Campbell and William Garnett:

“Mrs. Maxwell acted as stoker, which was very exhausting work when maintained for several consecutive

hours.” him, had to spend so many hours in staring into a coffin. This was also the scene of his well-known experiments on the viscosity of gases at different pressures and temperatures. For some days a large fire was kept up in the room, though it was in the midst of very hot weather. Kettles were kept on the fire, and large quantities of steam allowed to flow into the room. Mrs. Maxwell acted as stoker, which was very exhausting work when maintained for several consecutive hours. After this the room was kept cool, for subsequent experiments, by the employment of a considerable amount of ice.

Gabrielle-Émilie Le Tonnelier de Breteuil, Marquise du Châtelet

- ▣ Scientist and intellectual: outstanding contributions to 1700s physics, math, philosophy
- ▣ Worked with revolutionaries of her time: Voltaire, Pierre Louis de Maupertuis, Alexis-Claude Clairaut, Samuel Koenig, the Bernoulli family, etc
- ▣ Advocated for her education despite resistance
- ▣ Translated and explained many complicated cornerstone works; Newton's *Philosophiæ Naturalis Principia Mathematica*
- ▣ Reduced to 'Voltaire's mistress' by history

Further reading: *AIP Essay & Ex Libris Universum Articles*



Portrait of Émilie du Châtelet

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It is unusual for a woman to know simple geometry, let alone the sophisticated mathematics needed to understand the ideas in Newton's immortal work. Clearly, Mme la Marquise du Châtelet has mastered the teaching of that great man. We have seen two miracles: one, that Newton wrote this work in the first place; the other, that a lady has translated and explained it... Mme du Châtelet has rendered a double service to future generations of scholars...

- Voltaire's preface to du Châtelet's translation of Newton's *Philosophiæ Naturalis Principia Mathematica*

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I feel the full weight of the prejudice which so universally excludes [women] from the sciences.

Women have a right to speak out for their education... I confess that if I were king... I would correct this abuse that has cut short a full half of the human race. I would get women to participate in all the privileges of humanity, especially those of the mind.

- Émilie du Châtelet, 1735 preface of her translation of Mandeville's *Fable of the Bees*, a philosophy and ethics piece

Special Thanks!

Joanna Behrman
Center for History of Physics

Audrey Lengel
Niels Bohr Library & Archives

CORINNE MONA
Niels Bohr Library & Archives

The entire Center for History of
Physics and Niels Bohr Library &
Archives staff:
*everyone has been absolutely
wonderful and generous throughout
this process!*



Brad Conrad
Kayla Stephens

Mikayla Cleaver
Andrew Zeidell

*& all of the Society of Physics Students
National Office!*

The American Institute of Physics staff
and Foundation

All of the interns
(who better keep in touch)

Any questions?

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Find my work & more information on:

Ex Libris Universum | AIP History Newsletter | AIP Teaching Guides
APS Essay | [aip_history](#) Twitter/Facebook | *Wikipedia* | AAPT | CUWiP



Niels Bohr Library & Archives
@AIP_Library



Why did we snoop through James Clerk Maxwell's personal correspondence and postcards to learn about his wife? Find out here! buff.ly/3zxDwX9



Ex Libris Universum

August 4, 2022

Research of Underrepresented Voices: Primary Crumbs vs. Secondary Loaves

Researching Katherine Clerk Maxwell and Émilie du Châtelet

Emma Goulet, SPS Intern

[PHYSICS HISTORY](#) | [ARCHIVES](#) |

About the Author



Emma Goulet

Emma Goulet is a student earning her Physics, Psychology, and Astronomy bachelor's degrees from Saint Anselm College in 2023. She was an intern with the Center for History of Physics and the Niels Bohr Library & Archives in the summer of 2022, researching the underrepresented voices of Katherine Clerk Maxwell and Émilie du Châtelet. Emma loves spending time with her pets (or friends) doing anything outside and is a passionate foodie in her free time.

Caption: A mother 'photoshopped' out of a nineteenth century photograph. Photo inspiration from the hilarious Atlantic article "Victorian Mothers Hid Themselves in Their Babies' Photos" by Alicia Yin Cheng and Erin Barnett. Image credit: Museum of Fine Arts, Boston, Gift of Lee Marks and John C. DePrez, Jr. (2019.18.40).

[See all articles by Emma Goulet](#)

AIP Center for History of Physics
@aip_history

We're so pleased to present a new teaching guide written by [@SPSNational](#) intern [@emma4321](#) on the life and science of Katherine Maxwell. This lesson plan is geared towards grades K-3 but can also be adapted for older students. [#WomenInSTEM](#) [#Physics](#)



aip.org

Katherine Clerk Maxwell and Color Mixing of Light

This lesson plan introduces students to Katherine Clerk Maxwell along with the primary colors of light and color ...



The Gravity of Émilie du Châtelet

This lesson focuses on the life and work of Émilie du Châtelet. Students will repeat a simpler version of du Châtelet's own experiment to learn about gravity, understanding that gravity pulls objects down, and that it pulls heavier objects down with more force than lighter objects.

Guide subjects: [History](#) | [Physics](#)

Grade level(s): 1-3 | 4-5

Prep time: 7-10 minutes

In-class time: 40-45 minutes