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

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

Research
- Émilie Du Châtelet
- Katherine Clerk Maxwell

Teaching Guides
- Grades K-5
- Biography, activities, worksheets, extension activities, supplementary materials, Common Core Standards

Outreach
- AIP History Newsletter articles
- *Ex Libris Universum* library & archives blog post
- APS essay competition
- AIP_History Twitter/Facebook
- *Wikipedia* additions
- AAPT and CUWiP presentations
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 un credited
- Her involvement is only revealed in James’ personal correspondence with close friends

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

\[ 16(28) + 21(44) + 37(68) = W. \]  

(14.)

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

\[ 16(28) = 18.5(24) + 6(44). \]  

(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>
<thead>
<tr>
<th>Table III.</th>
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<tbody>
<tr>
<td>Oct. 13, 1859.</td>
</tr>
<tr>
<td>Observer (K).</td>
</tr>
<tr>
<td>(X)</td>
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<tr>
<td>18(\frac{1}{2}(24) + 32\frac{1}{2}(44) + 32\ (68) = W. )</td>
</tr>
<tr>
<td>17(\frac{1}{2}(24) + 52\frac{1}{2}(44) + 63 \ (80) = W. )</td>
</tr>
<tr>
<td>18 ( (24) + 32\frac{1}{2}(44) + 37 \ (72) = W. )</td>
</tr>
<tr>
<td>19 ( (24) + 32\frac{1}{2}(44) + 31\frac{1}{2}\ (68) = W. )</td>
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</table>
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.”

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.”

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*
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*
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!

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*Niels Bohr Library & Archives*

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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?  
Find me at:  
*egoulet@aip.org    |    emmagoulet1@gmail.com*

Find my work & more information on:  
*Ex Libris Universum    |    AIP History Newsletter    |    AIP Teaching Guides*
*APS Essay    |    aip_history Twitter/Facebook    |    Wikipedia    |    AAPT    |    CUWiP*
Research of Underrepresented Voices: Primary Crumbs vs. Secondary Loaves

Emma Guilet, SPS Intern

We’re so pleased to present a new teaching guide written by SPS National 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

The Gravity of Emilie du Châtelet

This lesson focuses on the life and work of Emilie du Châtelet. Students will read 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.

Grade levels: 1-3
Prep time: 7-15 minutes
Investigation time: 45-60 minutes

About the Author

Emma Guilet

Emma Guilet is a student earning her Physics, Psychology, and Astronomy bachelor’s degree 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 Emilie du Châtelet. Emma loves spending time with her pets (or friends) doing anything outside and is a passionate foodie in her free time.


See all articles by Emma Guilet.