



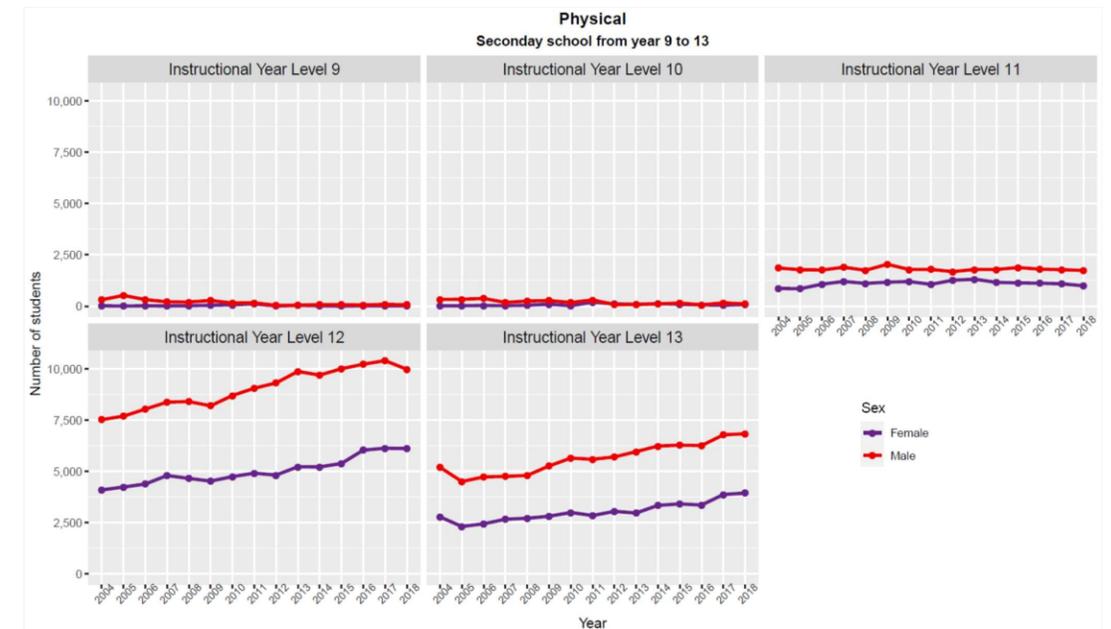
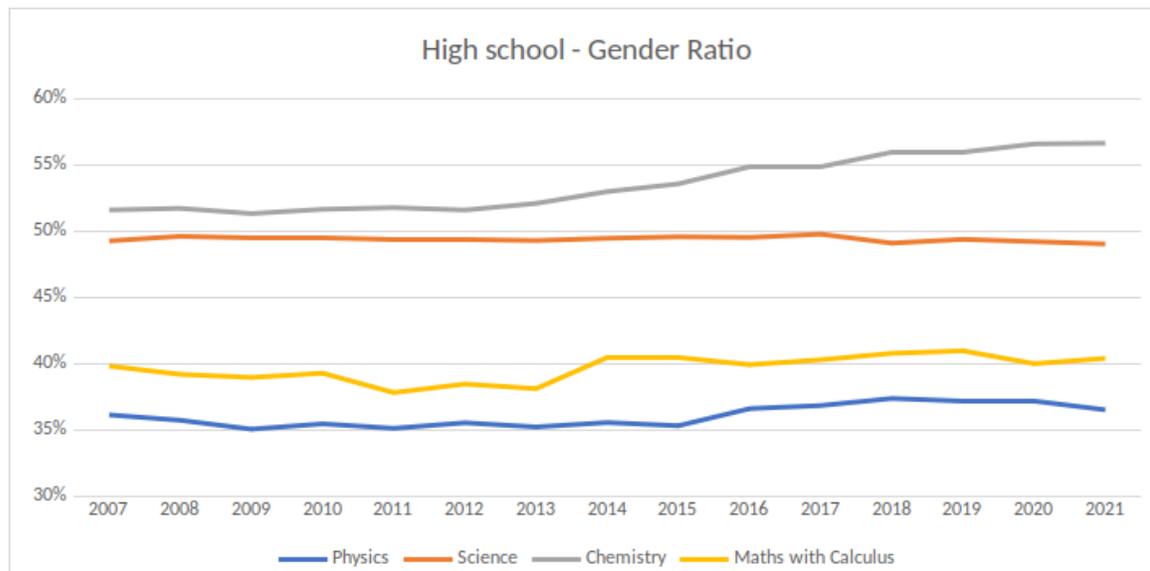
Women in Physics in Aotearoa New Zealand in 2023

Jami Shepherd, Elke Pahl, Helen Housden, David Housden, Frederique Vanholsbeeck, Annika Seppälä, Michael Jack, Ben Ruck, Jenni Adams, Ludmila Adam, Dion O'Neale



Physics in High School

- **36%** of physics students in high school are female, steady for over a decade [1]
- The gender gap begins in Year 11, and widens in Years 12 and 13 [2]
- **30%** of high school physics teachers are female
 - 40% of which have a physics major compared to 48% of male physics teachers



[1] School subject enrolment. <https://www.educationcounts.gov.nz/statistics/subject-enrolment>, 2022

[2] Women in Science in New Zealand. <https://www.awis.org.nz/assets/Stats-ppt.pdf>, 2021. Accessed: 2022-06-22.

Obstacles for female students in physics

Self concept: ones internal beliefs about their competency in science.

Lessons from a study of first-year undergraduate physics students in ANZ [3]:

- Greatest predictor of a positive scientific self-concept is a positive experience with high school science teachers
- Males have higher levels of science self-concept, even controlling for academic achievement

Stereotypes:

- Physics has stronger gender stereotypes than most STEM disciplines [4]
- There is an exaggerated perception that innate genius is required to be successful in physics [4]
- Women are less likely to believe they possess the intrinsic talent required for physics [5]

[3] Steven Martin Turnbull et al. The impact of science capital on self-concept in science: A study of university students in New Zealand. In *Frontiers in Education*, volume 5, page 27. Frontiers Media SA, 2020.

[4] Sarah-Jane Leslie et al. Expectations of brilliance underlie gender distributions across academic disciplines. *Science*, 347(6219):262–265, 2015.

[5] Z Yasemin Kalender et al. Framework for unpacking students' mindsets in physics by gender. *Physical Review Physics Education Research*, 18(1):010116, 2022

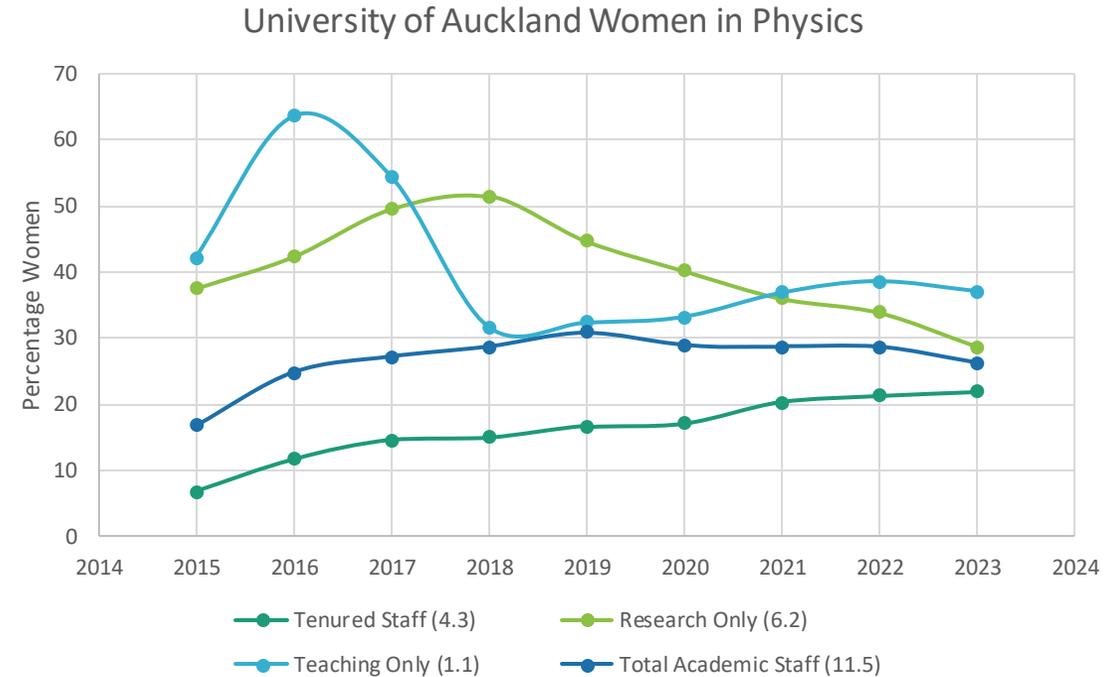
The Leaky Pipeline

- Academic female representation:

- **High School: 36%**
- **Undergraduate: 36%**
- **Postgraduate: 33%**
- **Doctoral: 31%**
- **Teaching-only staff: 33%**
- **Research-only staff: 20%**
- **Tenured academic faculty: 23%**



There is a high correlation between female academics supervising female postgraduate students at the postgraduate level (Auckland)



Obstacles for women in physics/academia

- Under-representation of women in physics
- Stereotypes [6] and culture around who belongs
- Implicit bias in hiring and promotion [7, 5]
- Perception that personal / family sacrifice is required [8,9,10,11,12]

[6] Bettina J Casad et al. Gender inequality in academia: Problems and solutions for women faculty in stem. *Journal of Neuroscience Research*, 99(1):13–23, 2021.

[7] Nicola Gaston. *Why science is sexist*, volume 34. Bridget Williams Books, 2015

[8] Marc Goulden, Mary Ann Mason, and Karie Frasch. *Keeping women in the science pipeline*

[9] Catherine Hill, Christianne Corbett, and Andresse St Rose. *Why so few? Women in science, technology, engineering, and mathematics*. ERIC, 2010.

[10] SS Canetto et al. Challenges to the choice discourse: Women's views of their family and academic-science career options and constraints. *Journal of Feminist Family Therapy*, 29(1-2):4–27, 2017.

[11] Elaine Howard Ecklund and Anne E Lincoln. Scientists want more children. *PLoS One*, 6(8):e22590, 2011.

[12] Elisabeth D Martinez et al. Falling off the academic bandwagon: Women are more likely to quit at the postdoc to principal investigator transition. *EMBO reports*, 8(11):977–981, 2007.

What has worked?

- Government recognition of career gaps on CV
- Governmental support of Centers of Research Excellence
 - Educational outreach is active focus
- Positive role models
- Strong community amongst women in physics
- Increased availability of female postgraduate supervisors
- Improved parental leave timeline, pay, and policies

Where to from here?

- Science/physics teacher support and training, with a focus on increasing female teachers
- Prioritize visible examples of successful female physicists at all levels
- Promote mindset that physics intelligence is malleable [6]
- Create classroom environments where all students belong, are encouraged, and have opportunity
- Promote work-life balance in academia
- Increase female faculty at universities for role models and supervisor

[6] Kathy Carey. Mindset: The new psychology of success. Montessori Life, 24(4):43, 2012.

THANK YOU



Agnes Blackie: the first female physics lecturer in New Zealand

Photo credit: University of Otago