

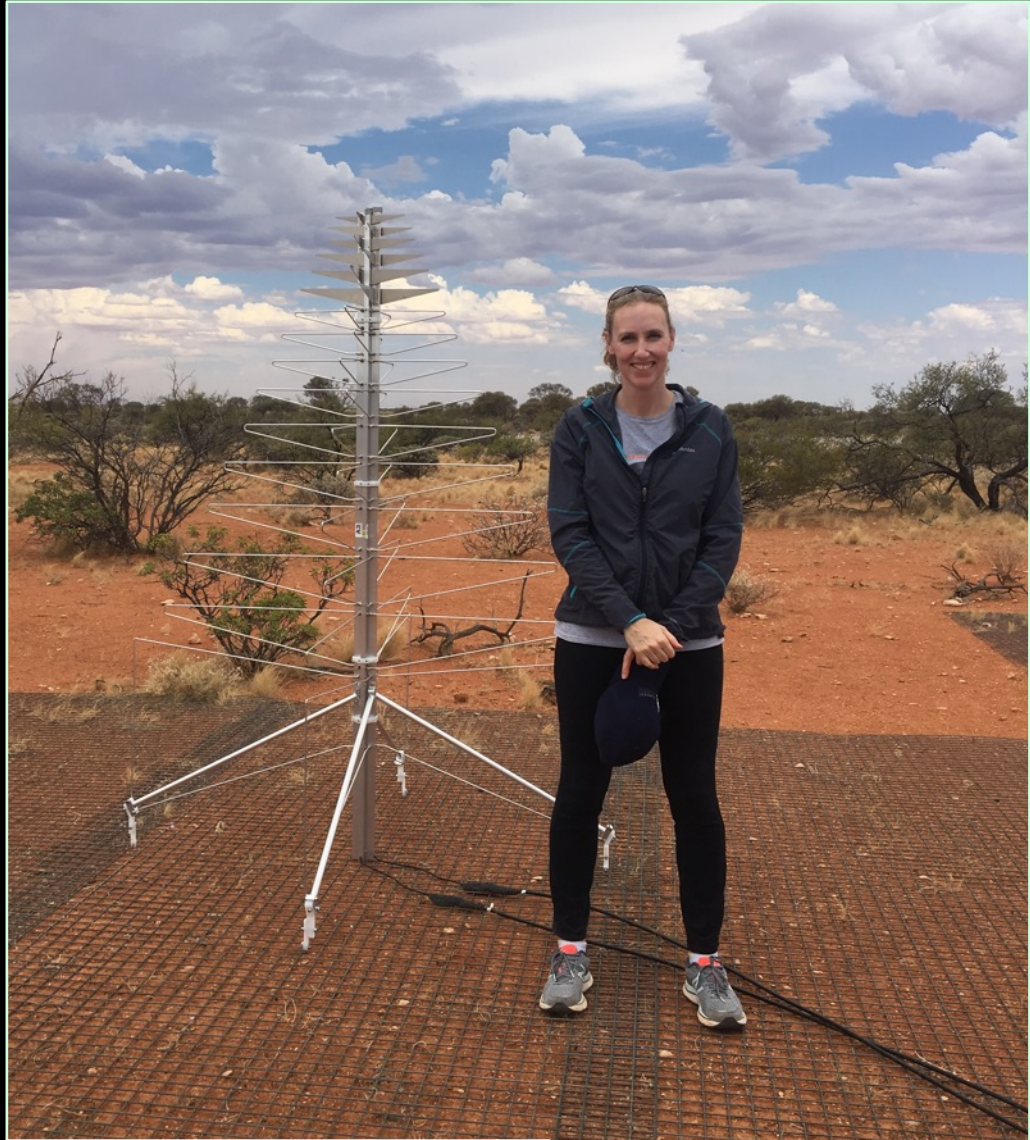


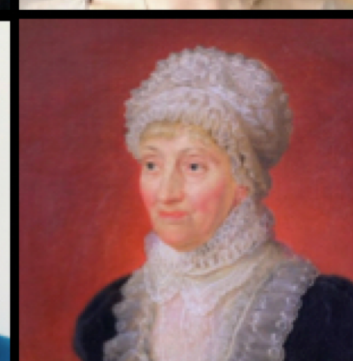
# Women in Astronomy: *past, present and future*

**Kristine Spekkens**  
Royal Military College of Canada

# About me

- From Burlington (near Toronto), Ontario
- BSc in Physics, Queen's University, Ontario
- PhD in Astronomy, Cornell University, New York
- Professor, Royal Military College + Queen's University since 2008
- Canadian Astronomical Society board member/  
Equity+Inclusivity Committee member





# Astronomy is for everyone.

- Innate intellectual ability does not depend on gender or race.
- Under-representation stems from socio-economic factors, and implies that we aren't exploiting society's potential to discover the universe. *This can be changed.*



# Recognizing diversity matters.

- Role models influence career choices among kids.
- Personal connections reduce bias among peers.
- Diverse workplaces are more creative, productive and satisfying.

All under-represented groups deserve recognition. Women are the only such group in academia for which statistical analysis is feasible.



# Outline

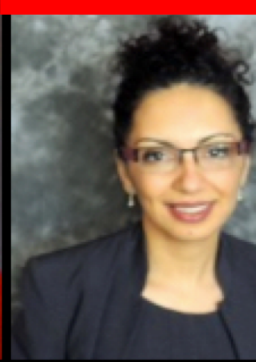
- Women in Astronomy: examples from the past
- Factors to consider: conscious and unconscious bias
- Women in Astronomy (in Canada): now and in the future



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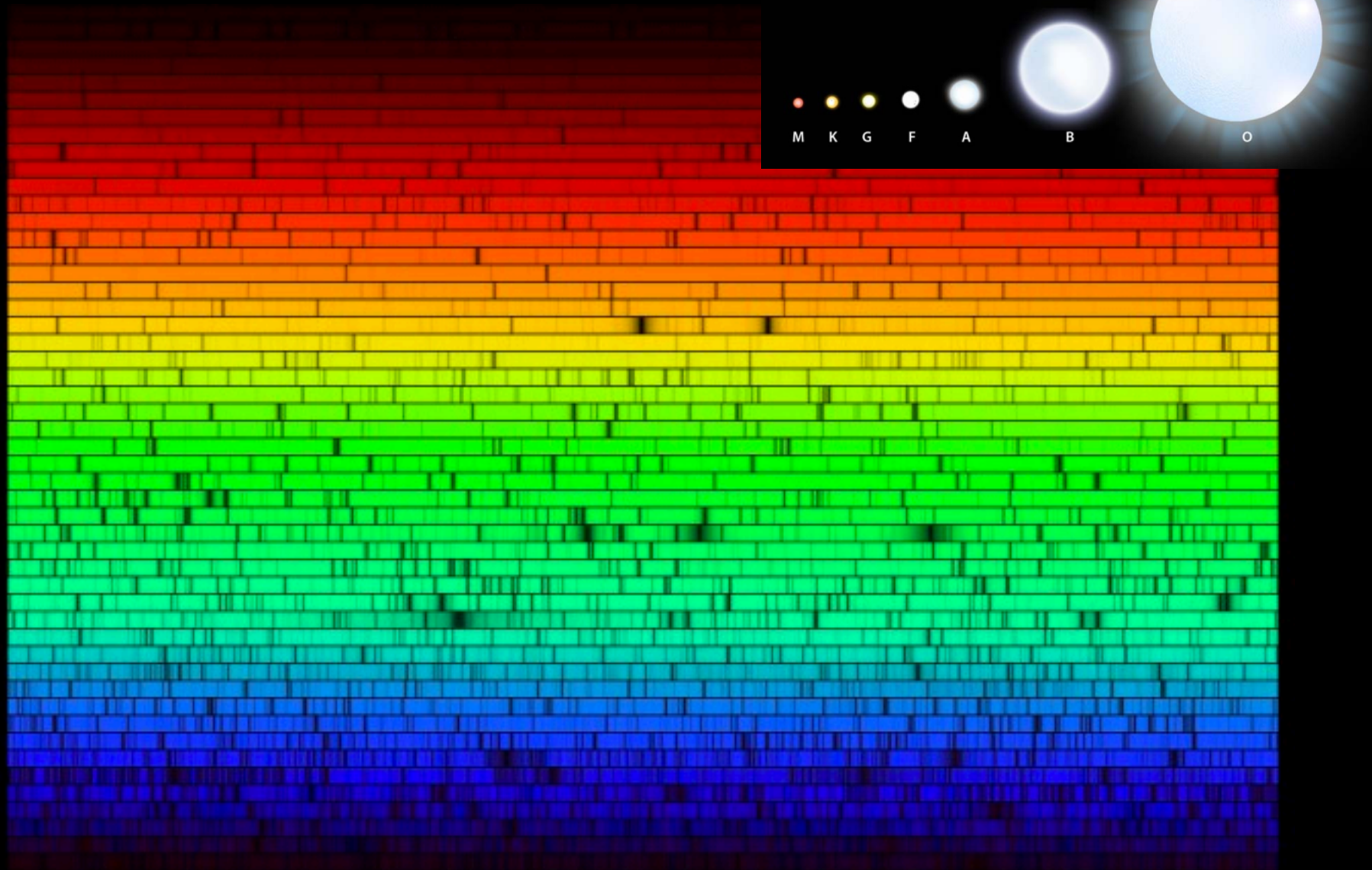


# Annie Jump Cannon

(1863-1941)

- Degree in Physics from Wellesley College, in 1884 and 1907.
- Contracted scarlet fever in 1885, rendering her nearly deaf.
- Worked at Harvard College Observatory under Edward C. Pickering, classifying stars on photographic plates, along with others named “Pickering’s women”. She classified more stars in a lifetime than anyone else.
- First woman to receive honorary doctorate from Oxford (1925), and she created the Annie J. Cannon prize of the American Astronomical Society (1935).





Annie Jump Cannon devised the classification scheme for stars that is still used today.

# Dr. Allie Vibert Douglas

(1894 – 1988)

- First PhD in astrophysics in 1926 from McGill University, Quebec, and one of the first women in North America to obtain the degree
- She carried out research at McGill for 14 years before moving to Queen's University in 1939 to become Dean of Women (until 1958) and Professor of Astronomy (until 1964).
- National president of the Royal Astronomical Society of Canada (1943-44), founder of the Kingston RASC chapter (1961), officer of the Order of Canada (1967).





Mike Lynch

Allie Vibert Douglas researched stars, and was instrumental in having women accepted into engineering and medicine programs.

# Dr. Helen Sawyer Hogg (1905-1993)

- BSc (1928) and PhD (1931) from Radcliffe College, Massachusetts, because Harvard wouldn't award graduate degrees to women in science
- Moved to the University of Toronto in 1935, cataloguing variable stars in clusters
- One of the first female astronomers to travel and work around the world (1930s)
- Founding president of the Canadian Astronomical Society, Officer of the Order of Canada (1968), Stanford Fleming Award (1985)





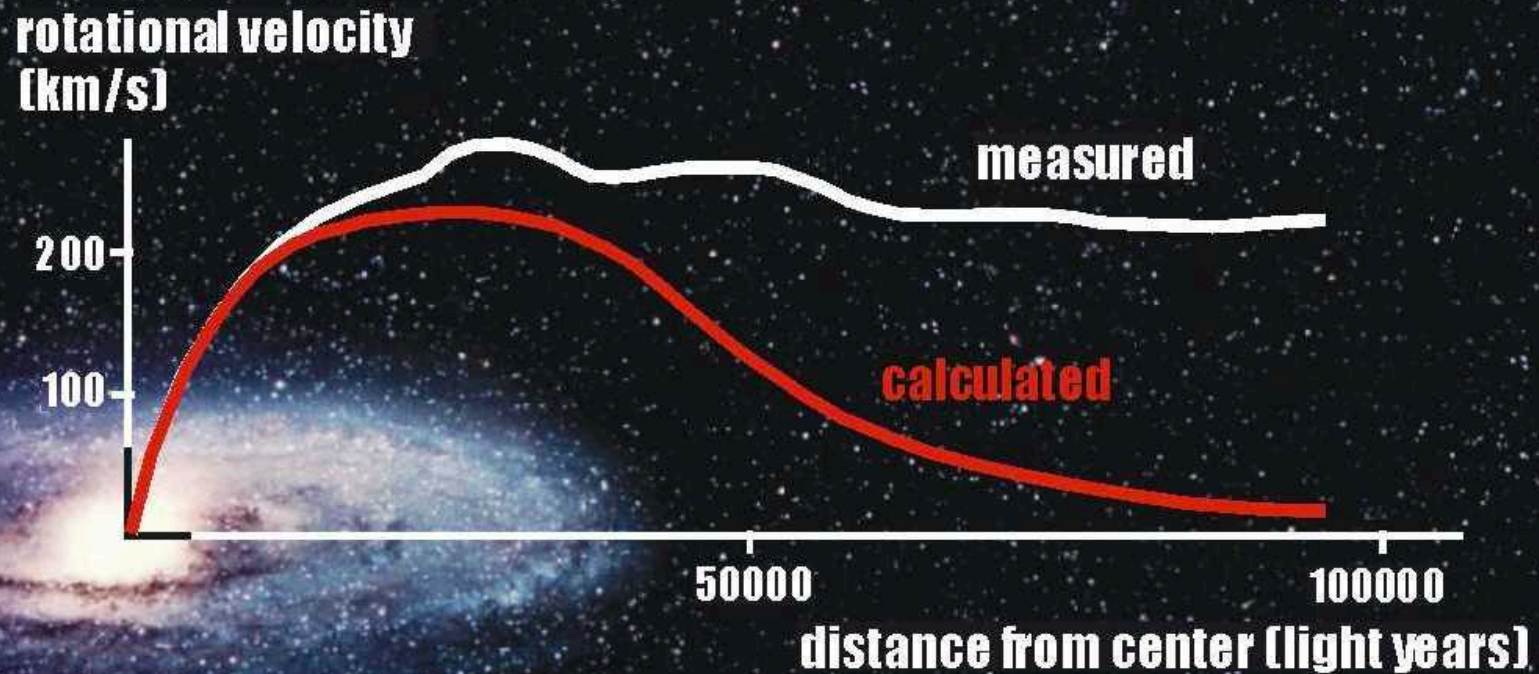
Helen Sawyer Hogg was a world expert on globular clusters. She popularized astronomy in Canada.

# Dr. Vera Rubin

(1928 – 2016)

- BSc from Vassar College 1948, New York, PhD from Georgetown in 1954, Washington DC, despite considerable barriers for women and mothers at the time
- Early work on galaxy clusters proved controversial, and she turned to measuring the internal dynamics of galaxies in the 1970s
- Researcher at the Carnegie Institution until her death
- Elected to the National Academy of Sciences (1981), National Medal of Science (1993), Gruber International Cosmology prize (2002), among others





Vera Rubin measured the rotation speeds of gas clouds in galaxies that provided convincing evidence for dark matter.

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# Conscious Bias = Discrimination

*Discrimination: the unjust or prejudicial treatment of different categories of people or things, especially on the grounds of race, age, or sex.*

Institutionalized discrimination against women (and others) in academia was common until at least the 1970s.



Conscious bias is much less acceptable or common now. But it still happens.

Let me tell you about my trouble with girls ...  
three things happen when they are in the lab ...  
You fall in love with them, they fall in love with  
you and when you criticise them, they cry.

Dr. Tim Hunt, 2001 Nobel Prize in physiology or medicine, 2015

**“Physics was invented and built by  
men. It’s not by invitation.”**

Dr. Alessandro Strumia, professor of Physics at the  
University of Pisa, 2018

A visualization of particle tracks, likely from a particle detector, showing numerous intersecting lines in yellow, orange, and blue against a dark background. The tracks radiate from various points, creating a complex web of lines.

# HIGH ENERGY PHYSICS COMMUNITY STATEMENT

## Statement on a Recent Talk at CERN

*The statement here is based upon widely reported events, publicly available slides, and eyewitness accounts. All authors and signatories represent themselves and not their institutions.*

On Friday, September 28th, 2018, a talk was given at CERN by Alessandro Strumia, a well-known particle theorist who is a Professor of Physics at the University of Pisa and a current associate of the theory department at CERN. In this talk he argued that the primary explanation for the discrepancies between men and women in theoretical physics is that women are inherently less capable. As particle physicists, we are appalled by Strumia's actions and his stated views on women in high energy physics.

We write here first to state, in the strongest possible terms

[www.particlesforjustice.org](http://www.particlesforjustice.org)

# Unconscious Bias = Implicit Cognition

*Implicit cognition: unconscious influences such as knowledge, perception, or memory, that influence a person's behavior, even though they themselves have no conscious awareness whatsoever of those influences.*

Studies show that many professionals are unconsciously biased against women. For example, identical resumes are ranked differently depending on the applicant's name.

## John Garcia

406 East 7<sup>th</sup> Street Morris MN, 56267 (School)|2706 North 63<sup>rd</sup> Avenue Brooklyn Center MN, 55430 (Home)|Pride015@morris.umn.edu

### OBJECTIVE

### PERSONAL QUALIFICATIONS

Excellent writing and research skills, strong analytic skills, logical thinking, good self-starting and self-motivation skills, willing to relocate, extensive teaching and presentation experience, grant writing, proposal writing, multitasking, interdisciplinary thinking, work ethic, strong interpersonal skills, able to communicate respectfully with diverse groups of people. Languages: English (native speaker), Spanish (over six years, conversational), Anishinaabemowin (Ojibwe Language) (elementary, one year).

### EDUCATION

May 2015 Bachelor of Arts in Philosophy and Gender, Women and Sexuality Studies (Double Major), University of Minnesota Morris, GPA: 3.5 out of 4.0.

June 2011 Diploma, Saint Louis Park High School, Saint Louis Park MN.

### COMPLETED COURSES

Spanish, Ethics, Logic (both intro and advanced), Theory of Knowledge, Political Philosophy, Anishinaabemowin (Ojibwe Language).

### COMPUTER SKILLS

Familiar with Macintosh and PCs, proficient in Microsoft Office (Word, Excel, and PowerPoint), Email, Social Media, Lexis-Nexis, Academic Databases and research (JSTOR, EBSCO, Project Muse).

### EXPERIENCE

2015 Teaching Assistant for Sociology of Childhoods, University of Minnesota Morris.  
• Gave feedback on papers, assisted students, and facilitated discussion.

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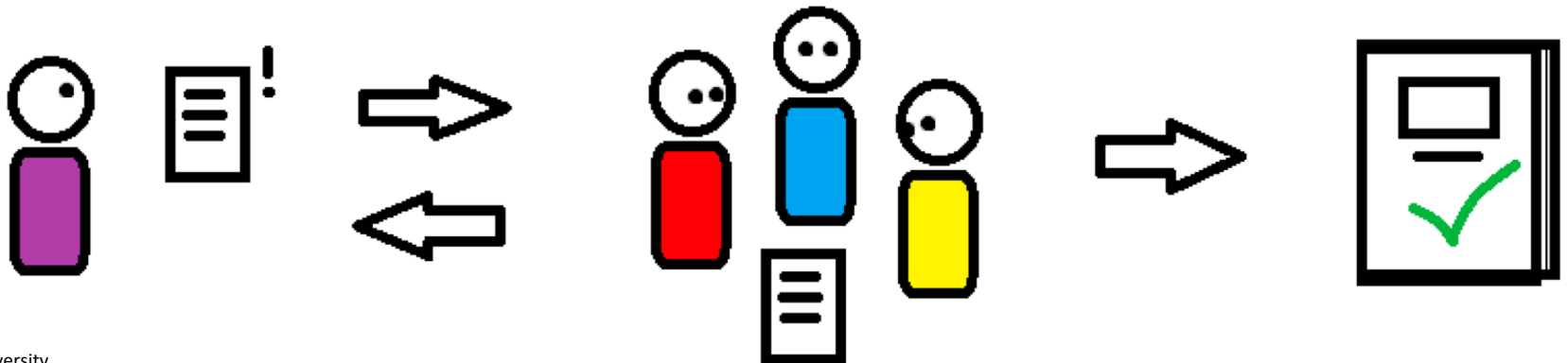
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<https://implicit.harvard.edu>

# Science runs on peer review.

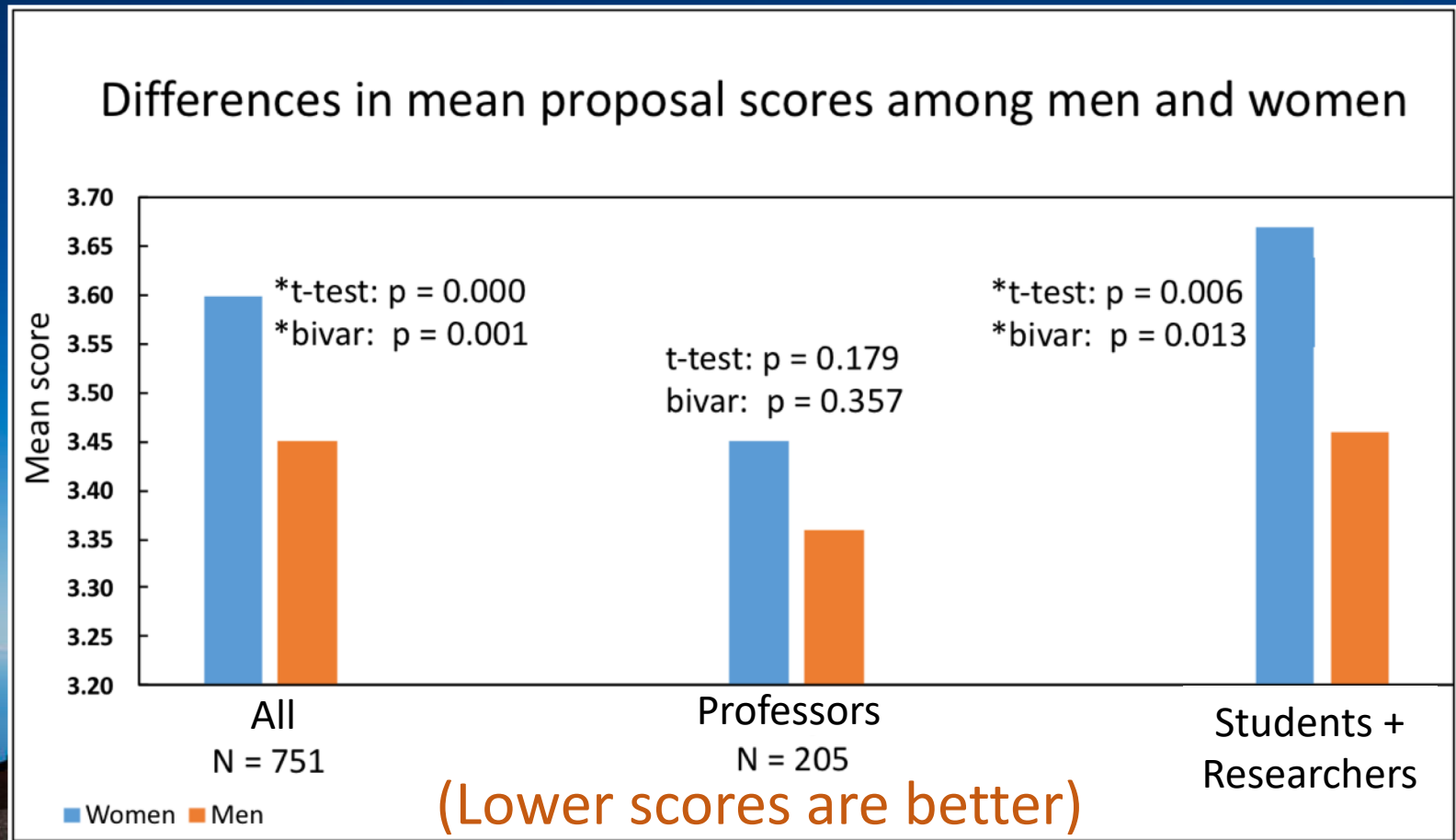
- *Peer review: evaluation of work by one or more people with similar skills to the producers of the work.*
- In **astronomy**, the scientific merit of journal articles, grant applications, facility access requests and award applications is assessed through peer review.
- Biased peer review can negatively impact many aspects of astronomy research.



Access to the Canadian share of research-class optical telescope observing time is allocated through peer review.

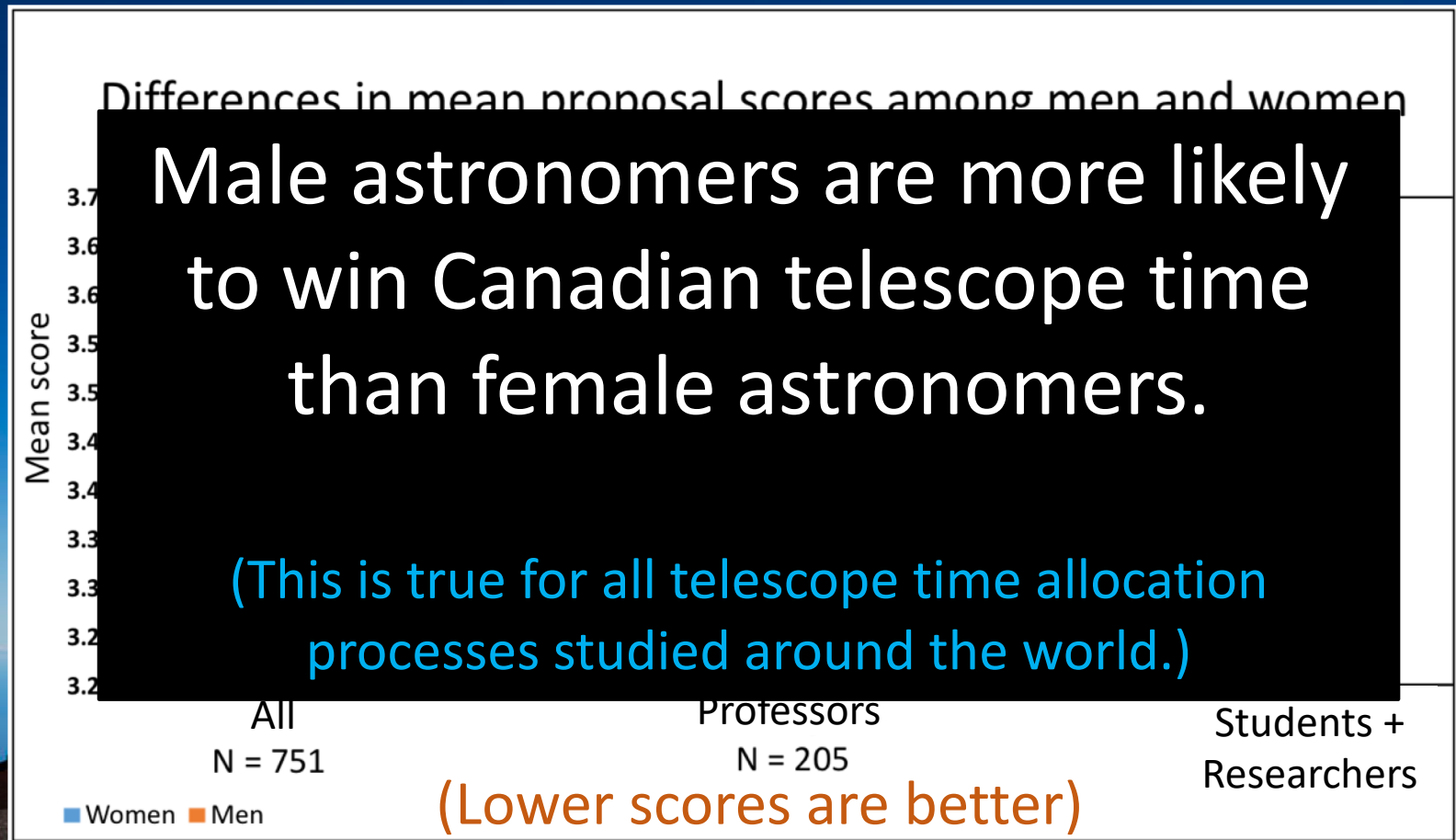


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Spekken+ 2018

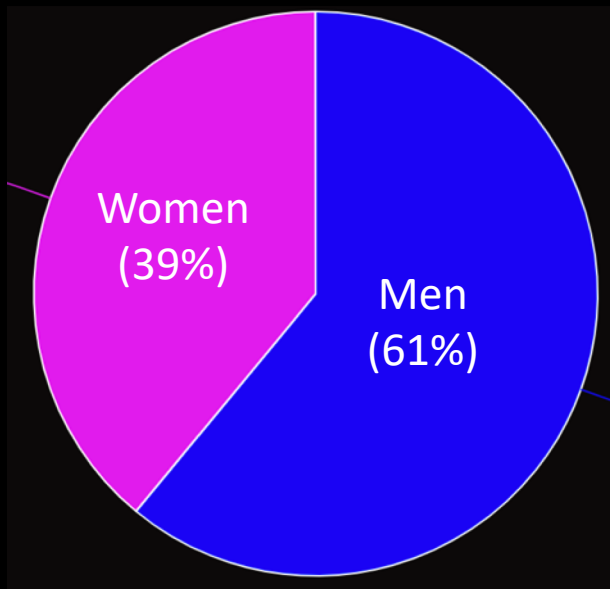
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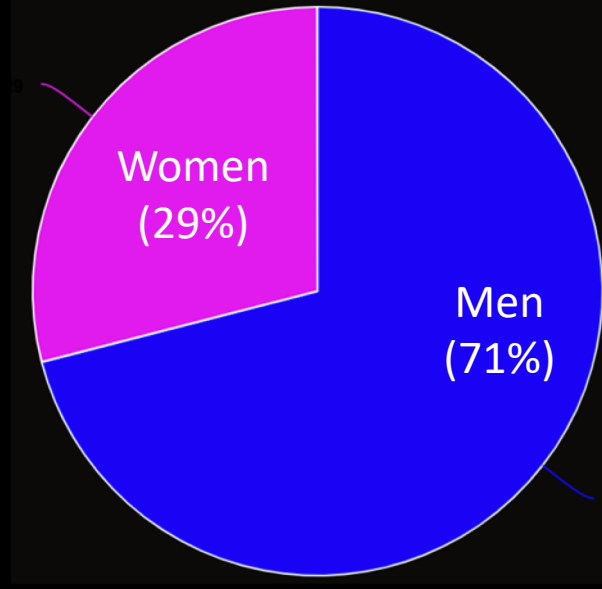
Spekken+ 2018

# Canadian Astronomy Demographics: 2018

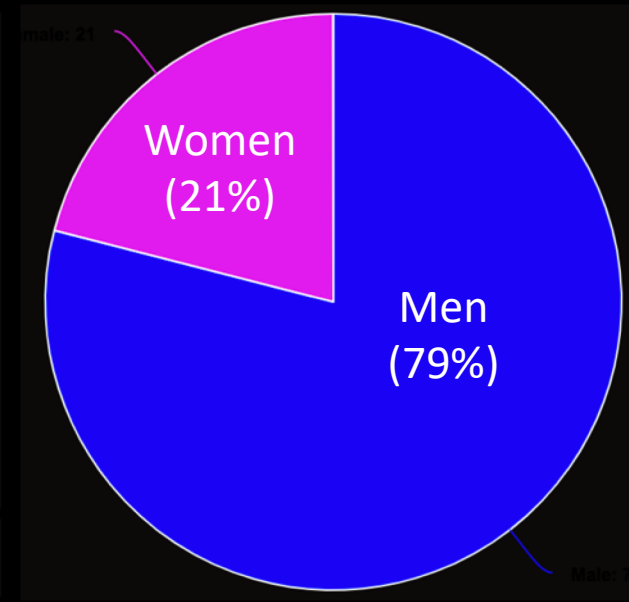
Members of the Canadian Astronomical Society:



Graduate  
students



Early-career  
researchers  
(postdocs)



Professors

Fewer women rise through the professional astronomy ranks than men.

# Canadian Astronomy Climate: 2018

Women are more likely to experience negative workplace climates than men.



Word cloud responses from the Canadian Astronomical Society's anonymous workplace climate survey in 2018

# What are Canadians doing about all of this?

Increasing equity, diversity and inclusion (EDI) is a complex issue. There is no easy solution. Some steps forward:

- Blind review of telescope access proposals
- Support for initiatives that stimulate EDI
- Regular, systematic and rigorous demographic and climate surveys



There is still lots to do, but we are moving forward.

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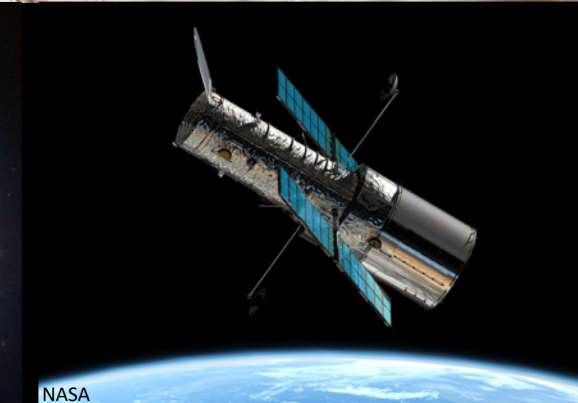




# Dr. Laura Ferrarese

- Scientist at the National Research Council of Canada, professor at the University of Victoria, British Columbia
- Interim director of the Gemini Observatory and vice-president of the International Astronomical Union
- Recipient of QEII Diamond Jubilee Medal (2012), Hogg Lectureship (2014), Martin Award (2015)

**Research Expertise:**  
**Supermassive black holes**



# Dr. Sarah Gallagher

- Professor at Western University, Ontario
- Ministry of Research and Innovation Early Career Award (2010-14), UWO faculty outreach and scholarship awards (2010, 2016-18)
- Named the first ever science advisor to the Canadian Space Agency (2018)

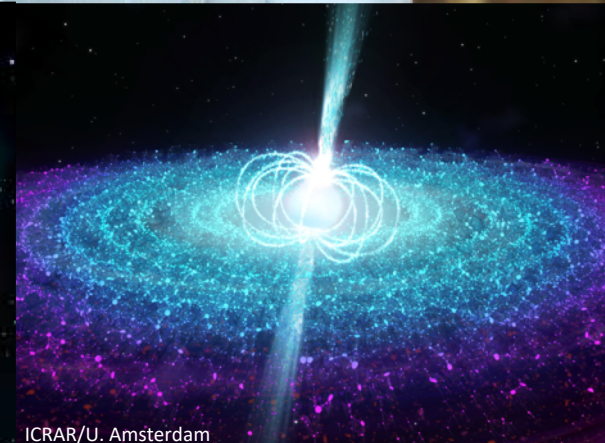
**Research Expertise:**  
**Galaxy evolution**

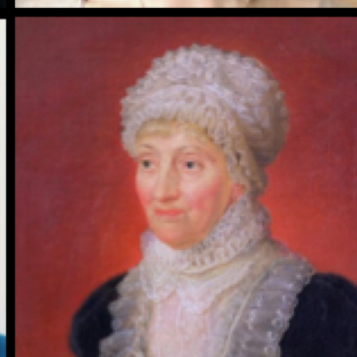


# Dr. Vicky Kaspi

- Professor at McGill University, Quebec
- Among the most prolific and influential astrophysics researchers in Canada today
- Her work has been widely recognized: Herzberg Medal (2004), Rutherford Memorial Medal (2006), Canada Gold Medal (2016), Companion of the Order of Canada (2016)

**Research Expertise:**  
**Neutron stars**







**Historically, women have made important contributions to astronomy research. Often, their accomplishments weren't acknowledged.**

**Both conscious and unconscious bias likely influence equity, diversity and inclusivity in Canadian astronomy. Efforts are underway to address this complex issue.**

**There is a fabulous community of world-renowned female astronomers in Canada today. The future is bright!**