

**SISKA DE BAERDEMAEKER**  
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**AREAS OF SPECIALIZATION:** Philosophy of Science, History & Philosophy of Physics (Cosmology)

**AREAS OF COMPETENCE:** Biomedical Ethics, History of Science, Logic & Critical Reasoning

## EDUCATION

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- 2020      **PhD** – University of Pittsburgh, History & Philosophy of Science  
            Dissertation: “Cosmology: The Impossible Integration?” (abstract below)  
            Committee: John Norton (chair), Arthur Kosowsky, Sandra Mitchell, James  
            Woodward
- 2019      **Visiting Graduate Student** – University of Edinburgh, School of Philosophy, Psychology &  
            Language Sciences, under supervision of Michela Massimi (February 10 – March 13)
- 2013      **M.A.** – University of Leuven, Philosophy
- 2014      **B.Sc.** – University of Leuven, Physics
- 2012      **B.A.** – University of Leuven, Philosophy

## PUBLICATIONS

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- 2021      **Siska De Baerdemaeker.** Method-Driven Experiments and the Search for Dark Matter.  
            *Philosophy of Science.* 88 (1)

### Revise & Resubmit

**Siska De Baerdemaeker & Nora Boyd.** Jump Ship, Shift Gears, or Just Keep on Chugging:  
Assessing the Responses to Tensions between Theory and Evidence in Contemporary  
Cosmology. *Studies in History and Philosophy of Modern Physics*

## PRESENTATIONS & CONFERENCE PARTICIPATION

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### Invited presentations

- 2020      TBD. PHEP 2020: Early Career Conference in Philosophy of Particle and High-Energy  
            Physics, Pittsburgh, USA (November 14 – 15)
- 2020      “Experiments in Cosmology”, Conference on the Foundations of Cosmology and Quantum  
            Gravity, Abu Dhabi, UAE (January 19 – 21)
- 2019      “Method-driven Experiments in Astroparticle Physics”  
            • Workshop on Evidence in Astrophysics, Madrid, Spain (June 21)  
            • Symposium Series of the CLPS, University of Leuven, Leuven, Belgium (March 15)

2018 “Evidential Integration in Cosmology”, 2nd Leuven – Buenos Aires Workshop in Philosophy of Physics, Leuven, Belgium (July 22 – 23)

### **Peer-reviewed presentations**

- 2019 “Jump Ship, Shift Gears, or Just Keep on Chugging: Assessing the Responses to Tensions between Theory and Evidence in Contemporary Cosmology”, with Nora Boyd, Dark Matter and Modified Gravity Conference, Aachen, Germany (February 6 – 8)
- 2018 “Integrating in the Face of Contradiction: Lessons from Cosmology”, 26th Biennial Meeting of the Philosophy of Science Association, Seattle, WA (November 1 – 4)
- 2018 “Evidential Integration in Cosmology”, &HPS: International Conference on Integrated History and Philosophy of Science, Hannover, Germany (July 5 – 7)
- 2018 “Integrating evidence in cosmology: the search for dark matter”, 7th Society for the Philosophy of Science in Practice Biennial Conference, Ghent, Belgium (June 29 – July 1)
- 2016 “Georges Lemaître and the Role of Observations in Early Twentieth Century Relativistic Cosmology”
- 32<sup>nd</sup> Boulder Conference on the History and Philosophy of Science: “Gravity: Its History and Philosophy”, University of Boulder, Boulder, CO (October 30)
  - History of Science Society Annual Meeting, Atlanta, GA (November 2)

### **Invited discussant or commentator**

- 2019 Comments on “Models in Cosmology: Knowing What to Believe” (John Peacock), Cross-disciplinary Perspectives on Model-Independent Searches, Edinburgh, UK (February 11 – 12)
- 2018 Chair and discussant for “Norton for Everyone? The Material Theory of Induction and Beyond”, Center for Philosophy of Science, Pittsburgh, PA (October 27 – 28)
- 2018 Invited discussant at 22nd Seven Pines Symposium, “What Counts as Evidence?”, Stillwater, MN (May 16 – 20)
- 2017 Invited discussant at 21st Seven Pines Symposium, “Black Holes in the Spotlight”, Stillwater, MN (May 17 – 21)
- 2017 Reading group leader at Philosophy of Cosmology Workshop, CUNY Graduate Center, New York City, NY (May 5)
- 2017 Discussant at “Methodology and Epistemology in Cosmology”, UC Irvine, Irvine, CA (February 10 – 12)
- 2016 Invited discussant at 20th Seven Pines Symposium, “Big Questions. Some Fundamental Problems in Physics”, Stillwater, MN (May 11 – 15)

### **Summer school**

- 2018 Rotman Summer Institute in Philosophy of Cosmology, Ontario, Canada (June 11 – 20)
- 2015 3rd International Summer School in Philosophy of Physics, “The Ontology of Physics”, Saig, Germany (July 20 – 25)

## **TEACHING EXPERIENCE**

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### **Primary instructor (University of Pittsburgh)**

- 2020 Morality & Medicine: Biomedical Ethics (Spring)
- 2019 Morality & Medicine: Biomedical Ethics (Fall)

- 2018           Space, Time, and Matter: History of Cosmology and Astronomy (Spring)  
 2017           Principles of Scientific Reasoning (Fall)

**Teaching assistant (University of Pittsburgh)**

- 2016           Mind & Medicine (Spring)  
 2015           Introduction to Philosophy of Science (Fall)

**Teaching training**

- 2016 – 2018   Achievement in Pedagogy Badge, offered by the Graduate Student Teaching Initiative at the Center for Teaching and Learning, University of Pittsburgh  
 2016           AAPT Workshop on Teaching and Learning in Philosophy with a Special Emphasis on Inclusive Pedagogy, University of Pittsburgh (February 4)

**SERVICE**

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**Conference organization**

- 2021           Co-organizer of a workshop on integrative strategies, Center for Philosophy of Science, Pittsburgh, USA  
 2017           Co-organizer of “Super-PAC: Early Career Workshop in Philosophy of Astrophysics and Cosmology”, Center for Philosophy of Science, Pittsburgh, USA (October 27 – 29)  
 2015, 2017    Reviewer for the Pitt-CMU Graduate Student Conference

**Service to the department**

- 2018 – 2019   Co-organizer of a philosophy of cosmology discussion group with participants from the HPS department and the Physics department at the University of Pittsburgh  
 2018 – 2019   Graduate student representative on the ALS Speaker Nomination Committee  
 2018           HPS Graduate Student Representative  
 2016 – 2017   HPS Representative to the Pitt Arts and Sciences Graduate Student Organization  
 2015           HPS Work In Progress Talks Organizer

**Public outreach**

- 2019           Public Lecture at the Amateur Astronomers Association of Pittsburgh: “The Rise and Fall of Anomalies in Science”, Pittsburgh, PA (September 13)  
 2019           Guest on “Let’s Go to the Archives, Episode 2: Harmonia Macrocosmica”, available here: <https://www.youtube.com/watch?v=8bfb7z0ME2A>  
 2018           Astro on Tap talk: “You say you want a revolution (in your cosmological theories)?”, Pittsburgh, PA (April 26)  
 2018           Public Lecture at the Allegheny Observatory: “Space Oddities”, Pittsburgh, PA (April 20). With Nora Boyd.  
 2017           Co-creator of an Instant HPS video on the discovery of Brownian motion, “The Botanist and the Sphynx”, available here : [https://www.youtube.com/watch?v=qukJ\\_gpN\\_VSY](https://www.youtube.com/watch?v=qukJ_gpN_VSY). With William Penn and John Norton.

**Reviewer**

Philosophy of Science (2017, 2019), Studies in History and Philosophy of Science (2019), Synthese (2018)

## AWARDS, PRIZES & RECOGNITION

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| 2020, 2019                | Nominee for the A&S GSO Elizabeth Baranger Teaching Award |
| 2019, 2018,<br>2016, 2015 | Wesley C. Salmon Fund, Research grant                     |
| 2018, 2017                | Outstanding Presenter Award at Pitt Graduate Student Expo |
| 2014 – 2015               | Honorary Fellow of the Belgian American Education Fund    |

## SELECTED GRADUATE COURSEWORK

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### History and philosophy of science

- History of Science I: History of the Physical Sciences (Paolo Palmieri)
- Philosophy of Science Core Seminar (John Norton)
- History of Science II: History of the Life Sciences (James Lennox)
- Experiment & Scientific Practice (Mazviita Chirimuuta)
- Recent Topics in Philosophy of Science (Adam Caulton)
- Recent Topics in Philosophy of Physics – Climate Science (Giovanni Valente)
- Einstein 1905 (John Norton)
- Models & Modeling (Sandra Mitchell & James Woodward)
- Galileo (Paolo Palmieri)
- Realism (Mazviita Chirimuuta)
- Theories of Confirmation (John Norton)
- Science and Metaphysics (Porter Williams) – *audit*
- Modern Cosmology (John Norton) – *audit*
- Recent Topics in Philosophy of Physics (Harvey Brown) – *audit*

### Philosophy and history of philosophy

- Topics in Logic (Michael Caie)
- Locke & Leibniz (Peter Machamer)
- Scholasticism (Paolo Palmieri)
- Sellars (Robert Brandom) – *audit*

### Physics

- Nuclear and Particle Physics (Ayres Freitas)
- General Relativity I (Eric Swanson)
- Particle Astrophysics (Ayres Freitas)
- General Relativity II (Eric Swanson) – *audit*
- Topics in Quantum Physics – Physics at the LHC (Tae Min Hong) – *audit*

## DISSERTATION ABSTRACT

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Cosmology has been, and continues to be remarkably successful in reconstructing the evolution of the universe over its 13.8 billion years. This success is somewhat surprising, if one examines cosmological practice in detail: the cosmological concordance model draws on theoretical frameworks ranging from particle physics to hydrodynamics, and its supporting empirical evidence is an amalgamate of data coming from table-top experiments to large-scale structure surveys. In my dissertation, I use a careful study of the recent history of cosmology (specifically dark matter and dark energy) to develop a new account of how empirical methods and evidence from a wide range of disciplines can be integrated successfully into a model of a complex target system.

My starting point is an explication of a method-driven ‘logic’ or general schema for justifying the use of one set of empirical methods over another to probe a given target. The two characterizing features of a method-driven logic are, first, that an existing empirical method is repurposed to a new target. Second, the theoretical model of that target is adapted to incorporate the features that the target would need to have in order for the existing empirical method to be effective in probing that target. In other words, the target is adapted to a particular method, rather than, as is more common, a method being chosen based on its fit with a particular target. This method-driven logic is particularly useful (and used!) whenever the existing description of a target is limited. For example, dark energy was introduced to explain the accelerating expansion of the universe on the largest scales. Aside from its effects on the expansion, little is known about its nature. Nonetheless, atomic physicists run table-top experiments that supposedly probe dark energy’s nature. The method-driven logic illuminates how these experiments are justified. Thus, the method-driven logic helps to explain unexpected connections between (sub)disciplines – connections that are ubiquitous in modern cosmology.

Recognizing this method-driven logic brings various new questions to the forefront as to how the results of method-driven experiments can be interpreted. I address these in subsequent chapters. Specifically, a significant positive result from a method-driven experiment turns out to be ambivalent as to what conclusions about the target it warrants, while a negative result warrants secure constraints on the space of possibilities for the target. Luckily, not all is lost to ambivalence when a method-driven experiment leads to a positive results: I show how various strategies (paralleling [Staley’s \(2004\)](#) security of evidence framework) allow for an escape out of the ambivalence. I then broaden up this discussion of evidence: I discuss possible conflicts in evidence in an integrative context, and I argue that, under specific circumstances, ignoring a particular subset of the available empirical evidence is warranted. Here, I draw on the early history of relativistic cosmology – particularly the disagreeing estimates for the age of the universe in the 1930s.

In the final chapter, I draw on the insights from the previous chapters to discuss the use of cosmological evidence and theorizing as a constraint on other physics sub-disciplines. This completes the circle: my analysis starts from cosmology’s adoption of various empirical methods from other sub-disciplines, but these sub-disciplines themselves now look to cosmology for future research. Mine is a cautionary tale, however: in coupling back, both old and new problems endanger the quality of the cosmological constraints.

My work complements previous accounts of integration in philosophy of science (see for example [Bechtel 1986](#); [Darden & Maull 1977](#); [Love 2008](#); [Mitchell 2003](#)) in two ways. I introduce an explicit epistemology for the transferability of methods to new contexts, which informs my analysis of evidential reasoning in cosmology. This approach also allows me to bring philosophers’ attention to observational cosmology, a scientific field that, until recently, remained underexplored by philosophers of science.