

# LPS 241: His Dark Materials

## Final Syllabus, April 21, 2018

Instructor: Jim Weatherall  
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Office: SST 781  
Seminar: Tu 9:30-12:20 in SST 442  
Office Hours: by appointment

**Description:** We will discuss a collection of issues in cosmology and in philosophy of science related to the role of simulation in cosmology, with a special focus on models of dark matter and galactic evolution. The goal is to establish a foundation for further work related to the project “New Directions in Philosophy of Cosmology”.

**Requirements:** The requirements for an S is attendance and leading a discussion (i.e., an informal presentation, assuming there is time in the course). If you would like a grade, you will need to do a presentation and (a) write a full-length term paper (15-20 pages) or (b) write three short papers ( $\sim 1000$  words). Another option, aside from a traditional term paper, would be to make a significant contribution to one or more (perhaps collaborative) research articles based on material discussed in the course.

**Readings:** In addition to a number of articles and book chapters, we will read the following books:

- *The Dark Matter Problem: A Historical Perspective*, by Robert H. Sanders (2010, Cambridge).
- *Science in the Age of Computer Simulation*, by Eric Winsberg (2010, Chicago).
- *Reconstructing Reality: Models, Mathematics, and Simulations*, by Margaret Morrison (2015, Oxford).

**Course Schedule:** Below is the course schedule. Readings will be made available electronically.

Meeting 1: Dark Matter: Ancient History 3 April 2018

**Readings:**

Sanders (2010), Chs. 1-6.

Meeting 2: Dark Matter: The Middle Ages 10 April 2018

**Readings:**

Sanders (2010), Chs. 7-12.

Meeting 3: CANCELED FOR SURGERY 17 April 2018

Meeting 4: Dark Matter: Some Recent Developments 24 April 2018

**Readings:**

Hui et al. (2017), “Ultralight scalars as cosmological dark matter”.

Tulin and Yu (2017), “Dark Matter Self-interactions and Small Scale Structure”  
(Esp. I.C-D; II; III.A-B,E; IV.A; VI.A; VIII).

Meeting 5: Dark Matter on Fire (and AREPO)

1 May 2018

**Readings:**

Silk (2017), “Galaxy Formation”.

Hopkins et al. (2017), “FIRE-2 Simulations: Physics versus Numerics in Galaxy Formation”

Robles et al. (2017), “SIDM on FIRE”.

**Supplemental Reading:**

Vogelsberger et al. (2013), “A model for cosmological simulations of galaxy formation physics”

Vogelsberger et al. (2014), “Dwarf galaxies in CDM and SIDM with baryons”

Meeting 6: Winsberg 1

8 May 2018

**Readings:**

Winsberg (2010), Chs. 1-4.

Frigg and Reiss (2009), “The philosophy of simulation: hot new issues or same old stew?”.

Meeting 7: Winsberg 2

15 May 2018

**Readings:**

Winsberg (2010), Chs. 5-8

Humphreys (2009), “The philosophical novelty of computer simulation methods”.

Meeting 8: Morrison 1

23 May 2018

**Readings:**

Morrison (2015), Introduction and Part 1.

Nersessian and MacLeod (2017), “Models and Simulations”.

Meeting 9: Morrison 2

30 May 2018

**Readings:**

Morrison (2015), Part 2.

Wilson (2017), “The Case of the Missing Satellites”.

Meeting 10: Morrison 3

6 June 2018

**Readings:**

Morrison (2015), Part 3.

Parker (2017), “Computer Simulation, Measurement, and Data Assimilation”.