Advanced Cosmology

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University of Heidelberg

with help from
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Thanks to C.Pfrommer for some of his slides

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Course material and information:
https://www.thphys.uni-heidelberg.de/~amendola/advcosm-ss2022.html

Goals

- Learn about current cosmological research
- **Educate** your classmates
- Develop scientific presentations **skills** and improve public **speaking** (in English!)
- Learn how to **learn** quickly and effectively **read** scientific literature
- Become comfortable **discussing** science given only a ‘shallow’ understanding

Format of the seminars

- We have compiled a list of several cosmology topics
- Work in pairs and jointly present a given topic
- Each person should plan to speak for 25 minutes, and expect about 5 minutes of interruptions

Topics

-1. Supernovae and cosmology
- 2. Cold Dark Matter and numerical cosmology
- 3. From dark matter halos to galaxies
- 4. Alternatives to a cosmological constant
- 5. Cosmic Microwave Background
- 6. Gravitational Lensing
- 7. Gravitational Lensing of the CMB
- 8. CMB polarisation and GW from inflation
- 9. Galaxy clusters as cosmological probes
- 10. The Sunyaev-Zel'dovich effect
- 11. Strong gravitational lensing
- 12. Non-Einsteinian gravity
- 13. Gravitational waves and cosmology
- 14. Galaxy clustering and baryon acoustic oscillations
- 15. The Lyman-alpha Forest & the Intergalactic Medium
- 16. First Light & Cosmic Reionization
- 17. Cosmological tests of gravity
- 18. Growth of linear cosmological fluctuations
- 19. Baryogenesis
- 20. Reheating in inflation

Elements of a Seminar Talk

- Spend your time to convey the most
  - new
  - important
  - likely correct

  insights to be gained from the paper(s)

  [Don’t need to discuss everything in the paper(s)!]
- Briefly set the stage:
  - What is the question, puzzle, observation to be understood
  - You may draw a (few) plot(s) from other articles as well

Elements of a Seminar Talk

- What are the "punchline(s)" or key insight(s)?
- Is that based on a new
  - calculation
  - idea
  - data
  - technology
- What are broader implications of the results?
  - based on the author's view, filtered by your judgement
- Are these insights/conclusions (in your judgement)
  - clearly presented?
  - persuasive?
  - is speculation clearly separated from sound fact?
  - [much of the refereed literature is good, innovative, but not all. Don't believe everything you read!!]

Preparation

- Plan to spend about 2 weeks preparing your presentation with your partner
  - could be longer depending on fluency in English
  - read a few other papers/references to enhance understanding
- The references in the topic list are:
  - popular articles, commentary
  - project/telescope websites
  - online tutorials
  - review articles
  - journal articles

We are available to answer questions and go over slides beforehand. Contact Tutor: Ziyang Zheng zheng@thphys.uni-heidelberg.de

9. The Sunyaev-Zel'dovich Effect

South Pole Telescope: http://pole.uchicago.edu

Atacama Cosmology Telescope: http://www.physics.princeton.edu/act

Planck Satellite: http://sci.esa.int/planck/

Review Article: *Cosmology with the Sunyaev-Zel'dovich Effect*
Carlstrom, J. E., Holder, G. P., & Reese, E. D. 2002, ARAA, 40, 643
http://adsabs.harvard.edu/abs/2002ARA%26A..40..643C

Review Article: *Tracing cosmic evolution with clusters of galaxies*
Voit, G. M. 2005, Reviews of Modern Physics, 77, 207
http://rmp.aps.org/abstract/RMP/v77/i1/p207_1

Article: *The Atacama Cosmology Telescope: Cosmology from Galaxy Clusters Detected via the Sunyaev-Zel'dovich Effect*
Sehgal, N., Trac, H., Acquaviva, V., et al. 2011, ApJ, 732, 44
http://adsabs.harvard.edu/abs/2011ApJ...732...44S

Article: *A Sunyaev-Zel'dovich-selected Sample of the Most Massive Galaxy Clusters in the 2500 deg2 South Pole Telescope Survey*
Williamson, R., Benson, B. A., High, F. W., et al. 2011, ApJ, 738, 139
http://adsabs.harvard.edu/abs/2011ApJ...738..139W

Article: *Discovery and Cosmological Implications of SPT-CL J2106-5844, the Most Massive Known Cluster at z>1*
Foley, R. J., Andersson, K., Bazin, G., et al. 2011, ApJ, 731, 86
http://adsabs.harvard.edu/abs/2011ApJ...731...86F

Article: *Planck 2013 results. XX. Cosmology from Sunyaev-Zeldovich cluster counts*
Planck Collaboration 2013, arXiv:1303.5080
http://adsabs.harvard.edu/abs/2013arXiv1303.5080P

Choose Your Topics

- We will soon set up a doodle poll with the topics. Please indicate 4 possible topics in this list by next Friday. **And leave your email in the doodle comments!**
- Topics will be assigned on a first-come first-serve basis

Your Grade

- Seminar is 4LP
- **Regular attendance is mandatory**! If more than 1 meetings is missed, you will fail unless special arrangements are made.

Schedule

- Apr. 21, today
- May: free
- Then every Friday (calendar TBC)
- Meet 14:15–16:00 here

Scientifically Speaking

L. Amendola

Generalities

- Think about your audience first
  - what do they already know?
  - what will get them excited about your topic?
  - what is minimal & sufficient information to make your point?
- The first and last slides are most important
  - spell out your first 5 and last 5 sentences verbatim
- Two days later your audience will remember either 0 or 1 of your points. So tell a story

Generalities

- Give a clear exposition of the scientific issue
  - what is the question being addressed?
  - why is it interesting?
  - state the obvious, but only briefly
- Practice your talk all the way through before you present it.
- Put your name on every slide!

Practicalities

- Budget 2-3 minutes per slide
  - never, ever run over your time limit
  - make intermediate time marks for yourself
  - recognize which slides you can skip if you are behind
  - never say “I think I’ll stop here” or “I’m running out of time”

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  - legible axes! (modify or annotate original plots)
  - if there are several lines, add labels with colors
  - don’t show dense tables

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  - don’t show dense tables
- Explain everything on slide, or don’t put it on the slide
- Streamline: if a slide has no bearing on your conclusions, omit it

Equations??

- Complicated equations usually add very little to a presentation.
  - if you must show equations, talk through meaning
  - remember this will slow you down
  - substitute heuristics whenever possible

Fonts??

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- Use readable font size. Recommended font > 24 pt. This is 38pt.

Colors??

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- Colorized text is useful for highlighting an issue, but do not over-colorize!

Logic??

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- Use readable font size. Recommended font > 24 pt. This is 38pt.
- Colorized text is useful for highlighting an issue, but do not over-colorize!
- If you make complex arguments, or switch topics, provide a summary of preceding logical progression

Delivery

- Studies of interpersonal communication show that:
  - 55% comes from facial expressions and body language
  - 38% comes from vocal quality or tone of voice
  - 7% comes from content, actual meaning of the words
- Speak in a conversational tone
- Smile!
- Make eye contact with members of the audience
- Never simply read what is on the screen!
- Face the audience, don't talk to the screen
- Animations can be useful, but if overdone they are very distracting

Most Importantly

HAVE FUN!!!

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