

Advanced Topics in Theoretical Physics (\equiv Modern Cosmology) – Introduction

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**UNIVERSITÀ
DI TRENTO**

**Dipartimento di
Fisica**

Practical information

Timetable: Tue 9:30-11:30 (A211), Thu 11:30-13:30 (A213)

E-mail: sunny.vagnozzi@unitn.it

Office and office hours: temporarily at Via alla Cascata 56C, room 03-12.b (the door says “Rinaldi/Vagnozzi/Vanzo”), Wed 16:30-17:30 (please email me first, ideally at least \gtrsim 48 hours before)

Weight: 6 CFU (48 hrs)

Books

- Scott Dodelson, “Modern Cosmology” (1st Edition, 2003)
- (Daniel Baumann, Part III Mathematical Tripos Cosmology notes)
- (Dragan Huterer, “A Course in Cosmology”)

Notes: handwritten notes gradually posted on DidatticaOnline and my website www.sunnyvagnozzi.com/en/teaching. **Not** a substitute of textbook and discussions in class. **Attendance highly recommended**

Practical information

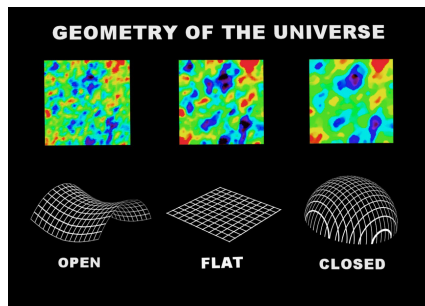
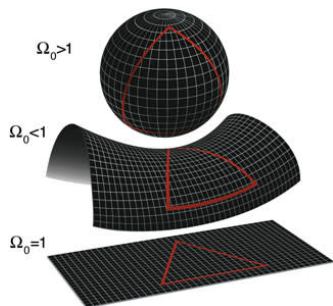
Exam: exclusively oral, general questions and broad discussions (check with students who attended this course last year)

Useful info: some of the mathematically more complex derivations will be deliberately left open (only quoting the final results), completing them left as (optional but highly recommended) homework for the student

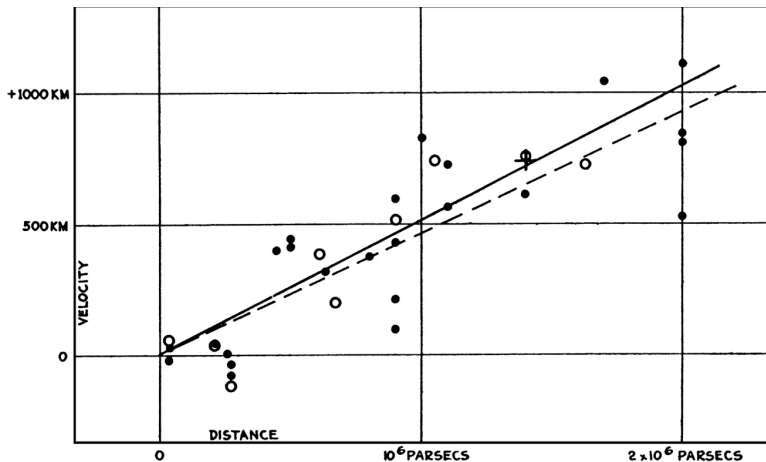
7 tools/technical aspects you need to be comfortable with:

- Integration by parts
- Integrals in spherical polar coordinates
- 4-vectors
- Expanding in small perturbations, recognizing same-order terms
- Chain rule for derivatives
- Switching integration variables repeatedly (Jacobians)
- Taylor expansion, especially binomial expansion
 $(1 \pm x)^\alpha \simeq 1 \pm \alpha x + \mathcal{O}(x^2)$ for $x \rightarrow 0$, valid for $\alpha \gtrsim 0$

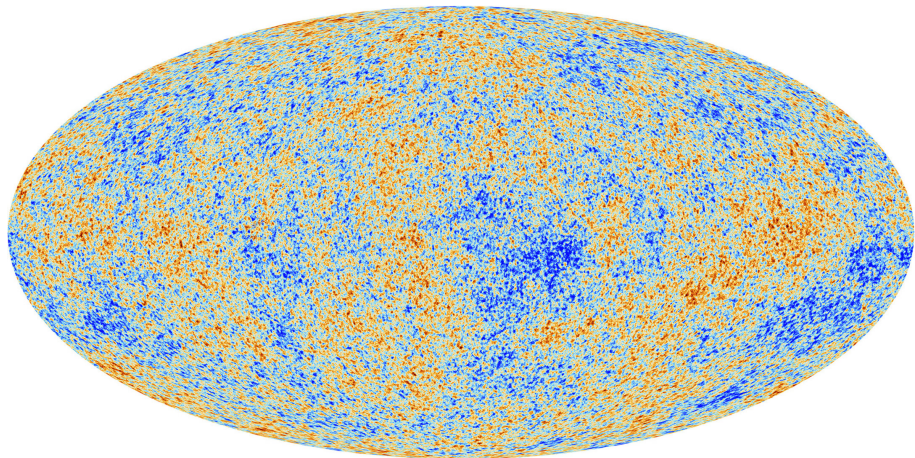
Geometry of the Universe



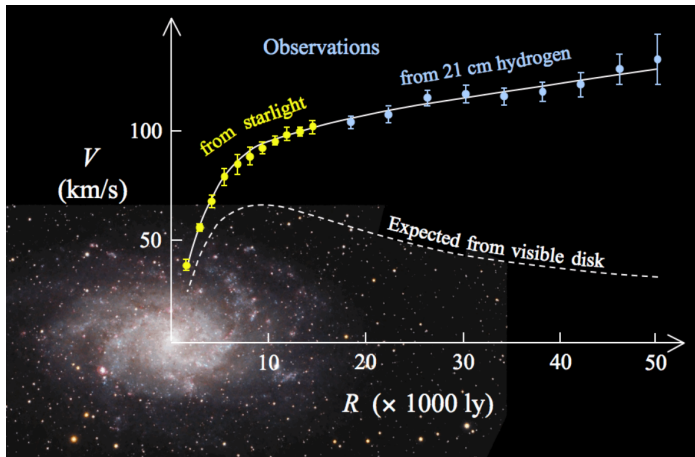
The first Hubble diagram (published in 1929)



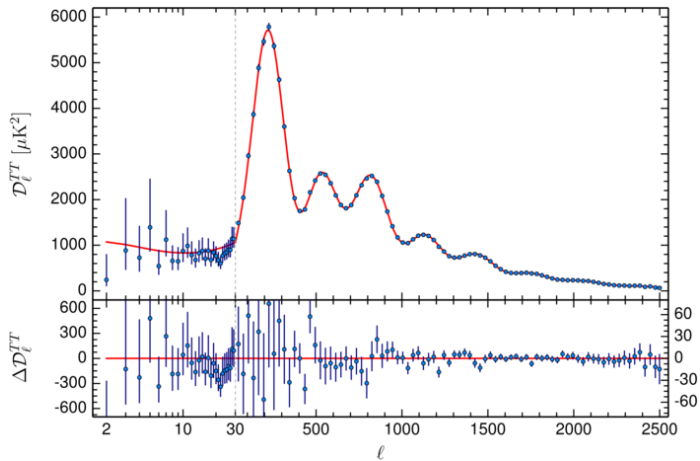
CMB



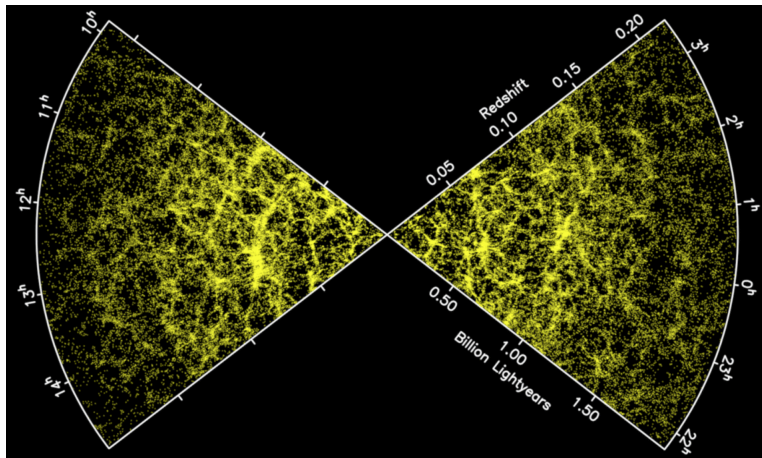
Galaxy rotation curves (M33)



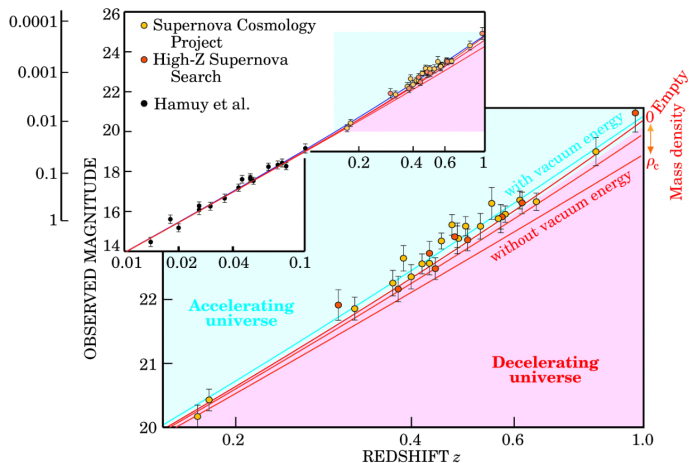
CMB power spectrum



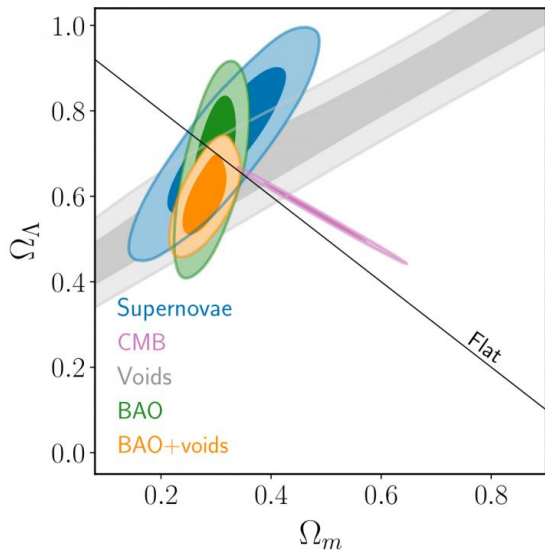
Galaxy surveys



Type Ia Supernovae



Combined measurements point towards cosmic acceleration



The Λ CDM model

