

M. D'Onofrio, C. Burigana (Eds.)

Questions of Modern Cosmology

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Questions of Modern Cosmology

- Are we living in the "golden age" of cosmology?
- Are we close to understanding the nature of the unknown ingredients of the currently most accepted cosmological model and the physics of the early Universe? Or are we rather approaching a paradigm shift?
- What is dark matter and does it exist? How is it distributed around galaxies and clusters?
- Is the scientific community open to alternative ideas that may prompt a new scientific revolution – as the Copernican revolution in Galileo's time?
- Do other types of supernovae exist that can be of interest for cosmology?
- Why have quasars never been effectively used as standard candles?
- Can you tell us about the scientific adventure of COBE?
- How does the extraction of the Cosmic Microwave Background anisotropy depend on the subtraction of the various astrophysical foregrounds?

These, among many others, are the astrophysical, philosophical and sociological questions of modern cosmology and the scientific community that Mauro D'Onofrio and Carlo Burigana ask some of the most prominent cosmologists of our time. Triggered by these questions and in the spirit of Galileo's book "Dialogue Concerning the Two Chief World Systems" the roughly 40 interview partners reply in form of essays, with a critical frankness not normally found in reviews, monographs or textbooks.

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Editors

Questions of Modern Cosmology

Galileo's Legacy

 Springer

Editors: Mauro D'Onofrio & Carlo Burigana

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Motivation

- **2009 is the year of Astronomy**
- **because of the Galileo's discoveries**
- **Galileo first proposed the modern scientific method, opening a new era for human knowledge**

- **In these & in the next years astrophysical / cosmological community has / will have data of high accuracy @ various frequency domains (radio-to-gamma)**
- **Next decades will see the development of even larger projects (in both physics (e.g. LHC) & astrophysics)**
- **we live in the epoch of the so-called *high precision cosmology***

- **Current cosmology (Λ CDM scenario) exhibits a sort of paradox:**
 - **relatively small errors on the cosmological parameters**
 - **but in a Universe with a content *unknown* @ 96% level**
 - → **questions about the faith of our Universe**
 - **we only have ideas about the very early phases of the Universe(s)**
 - **also, many aspects of the evolution of the Universe & of its structures are unknown**

- **We believe this is an appropriate time for looking @**
 - **cosmology fundamentals, models, perspectives, in a puzzle “approach”**
 - **science & society, scientific community self-organization**

Book aims & peculiarities - I

- **Highlight**
 - the *origin / motivation* of current Λ CDM scenario
 - but also the *paradox* of the current Λ CDM scenario, i.e.
 - small errors of the cosmological parameters
 - in a Universe with a content unknown at 96% level
- **Answer the question: are we close to a new scientific revolution?**
 - Confirmation / physical understanding of current model?
 - Change of current view?
- **Focus the attention**
 - on the alternative theories of gravity
 - on the role of non-gravitational forces
 - and on the next observational challenges

Book aims & peculiarities - II

- **Provide an unbiased discussion on the present limits of our scientific knowledge in cosmology**
- **Stress the significant role of our societies in shaping the development of science**
- **It is a dialogue, rather than a collection of proceedings**
- **It gives space even to ideas radically different from the standard paradigm**
- **Scientists express their opinions on the relation between science&society & science self-organization**
- **It can be understood by people not necessarily expert in cosmology**

Fig. 25 Constraints on the cosmological parameters Ω_m and Ω_Λ from three different cosmological tests: SN type Ia explosions (green), analysis of fluctuations in the cosmic microwave background (blue) and abundance as well as spatial clustering analysis of clusters of galaxies detected in X-rays with ROSAT. From [132].

Concordance model

Some next challenges



Fig. 10 The 10.4 m Gran Telescopio Canarias at Observatorio del Roque de los Muchacos.

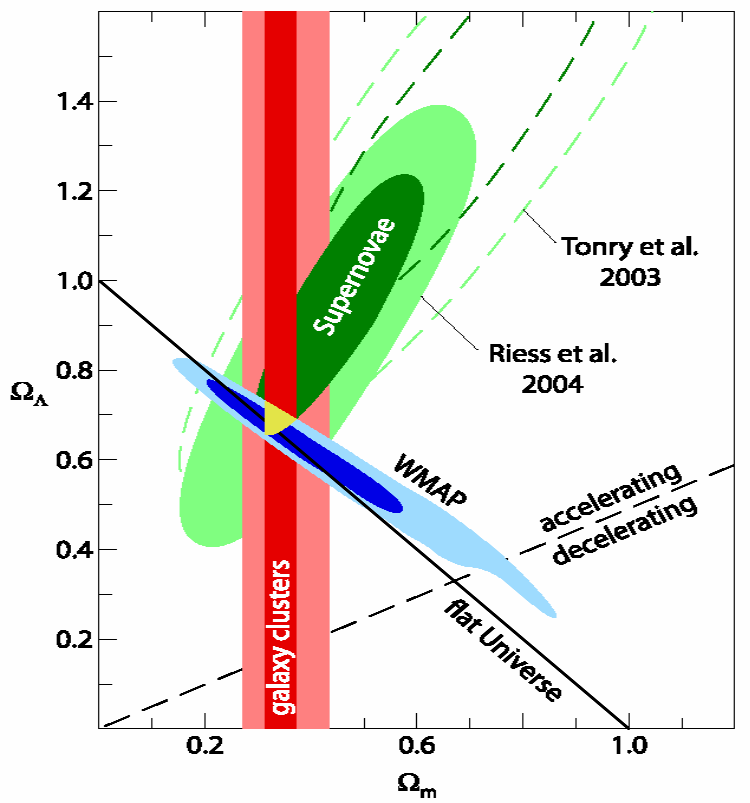


Fig. 4 Two views of a computer model of the *Planck* spacecraft. The spacecraft spins at 1 rounds per minute (rpm) on an axis normal to the solar panel on the circular end. The spin axis is always within a few degrees of the Sun, maintaining full illumination of the solar panels, at the same time keeping everything else in the dark. This is the first key to the thermal design of *Planck*.

Maybe, in ~ 10 yrs some Editor(s) will publish “Answers of Modern Cosmology New Age Legacy !!!” ☺ ☺ ☺

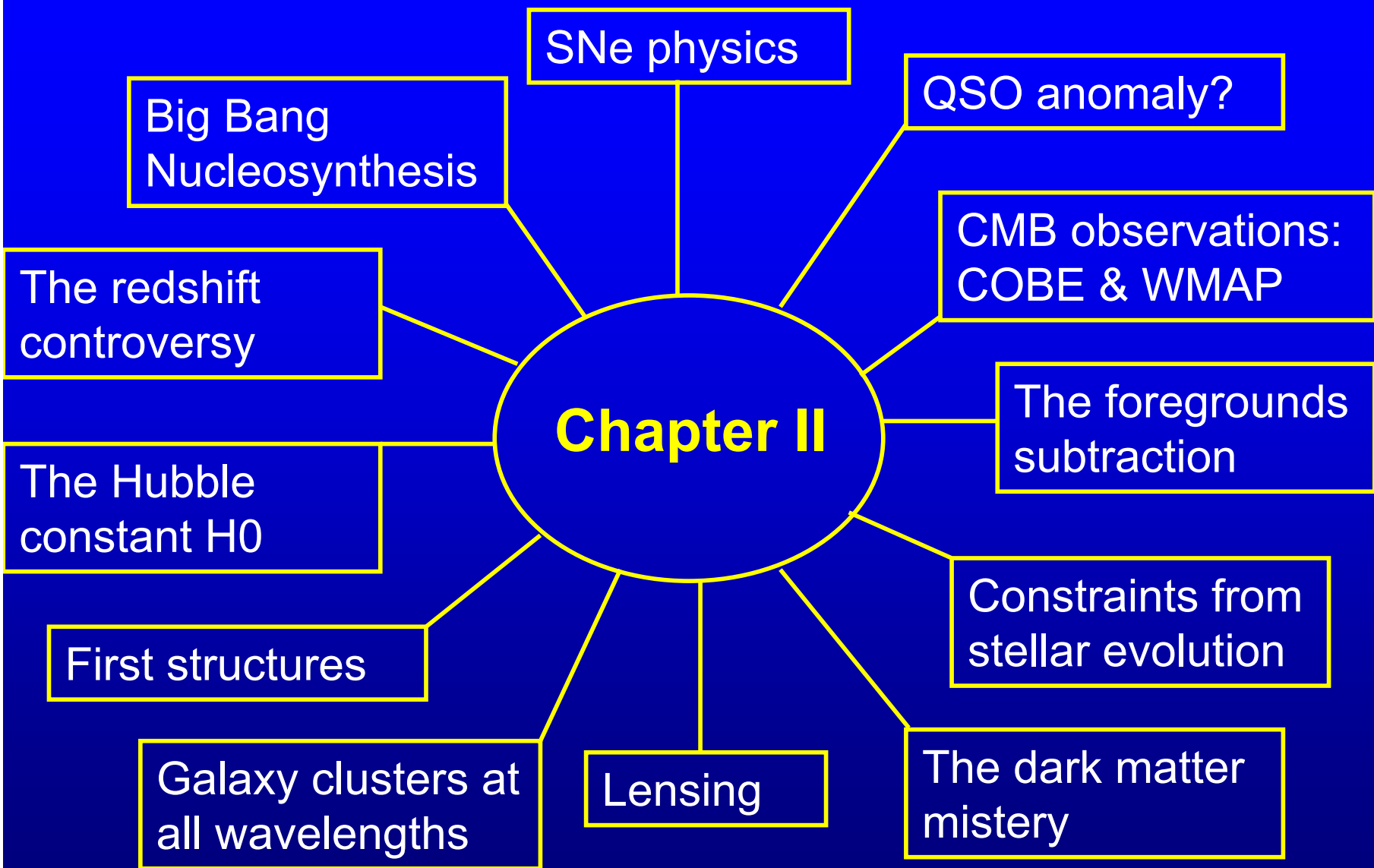
Book structure & numbers

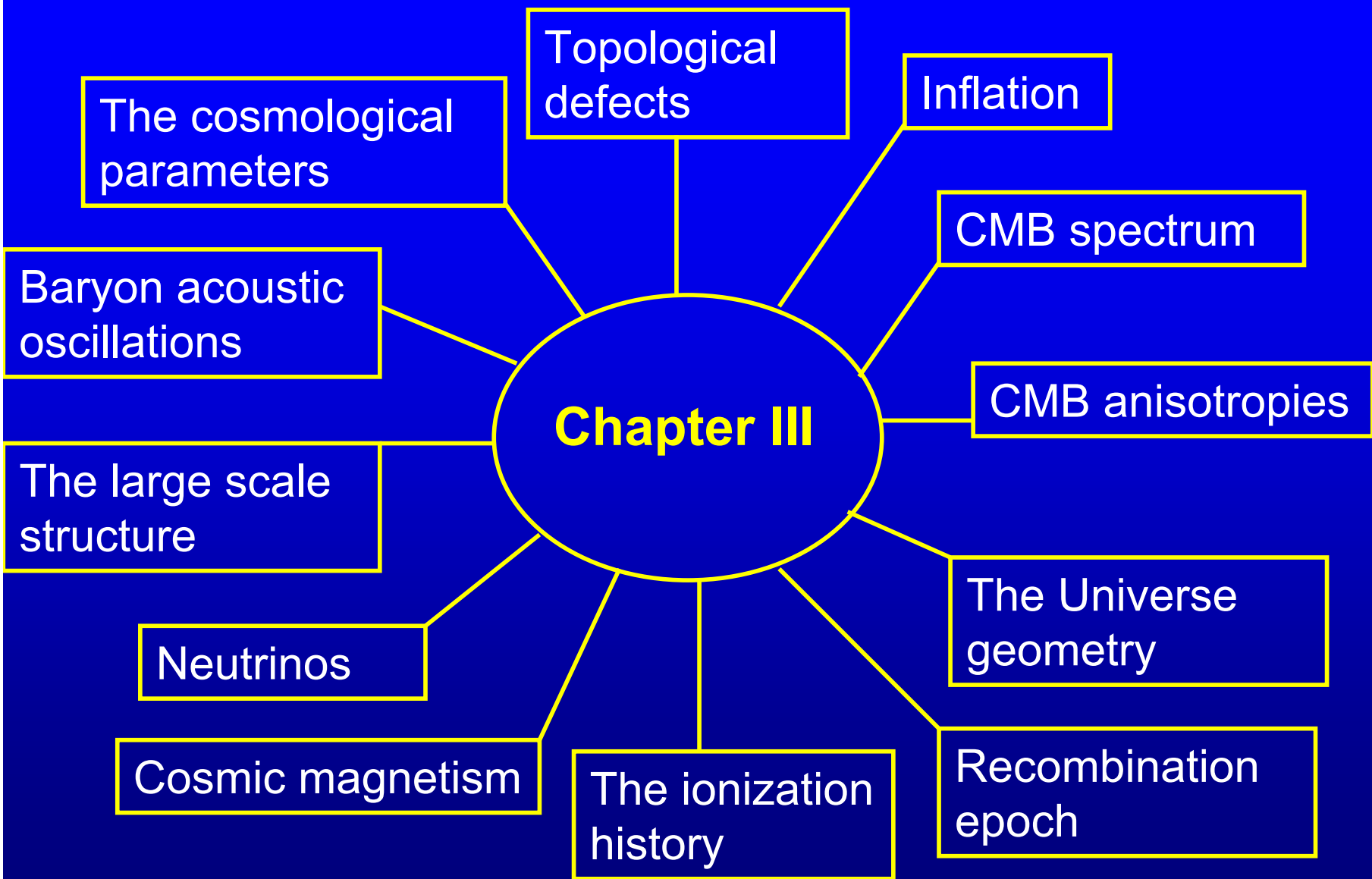
- **Chapter I: Introduction (M.D. & C.B.)**
- **Chapter II: Fundamental cosmological observations and data interpretation (23 authors)**
- **Chapter III: Astrophysical cosmology (14 authors)**
- **Chapter IV: From Galileo to modern cosmology: alternative paradigms and science boundary conditions (18 authors)**
- **Chapter V: Next challenges (21 authors)**
- **Chapter VI: Concluding remarks (M.D. & C.B.)**

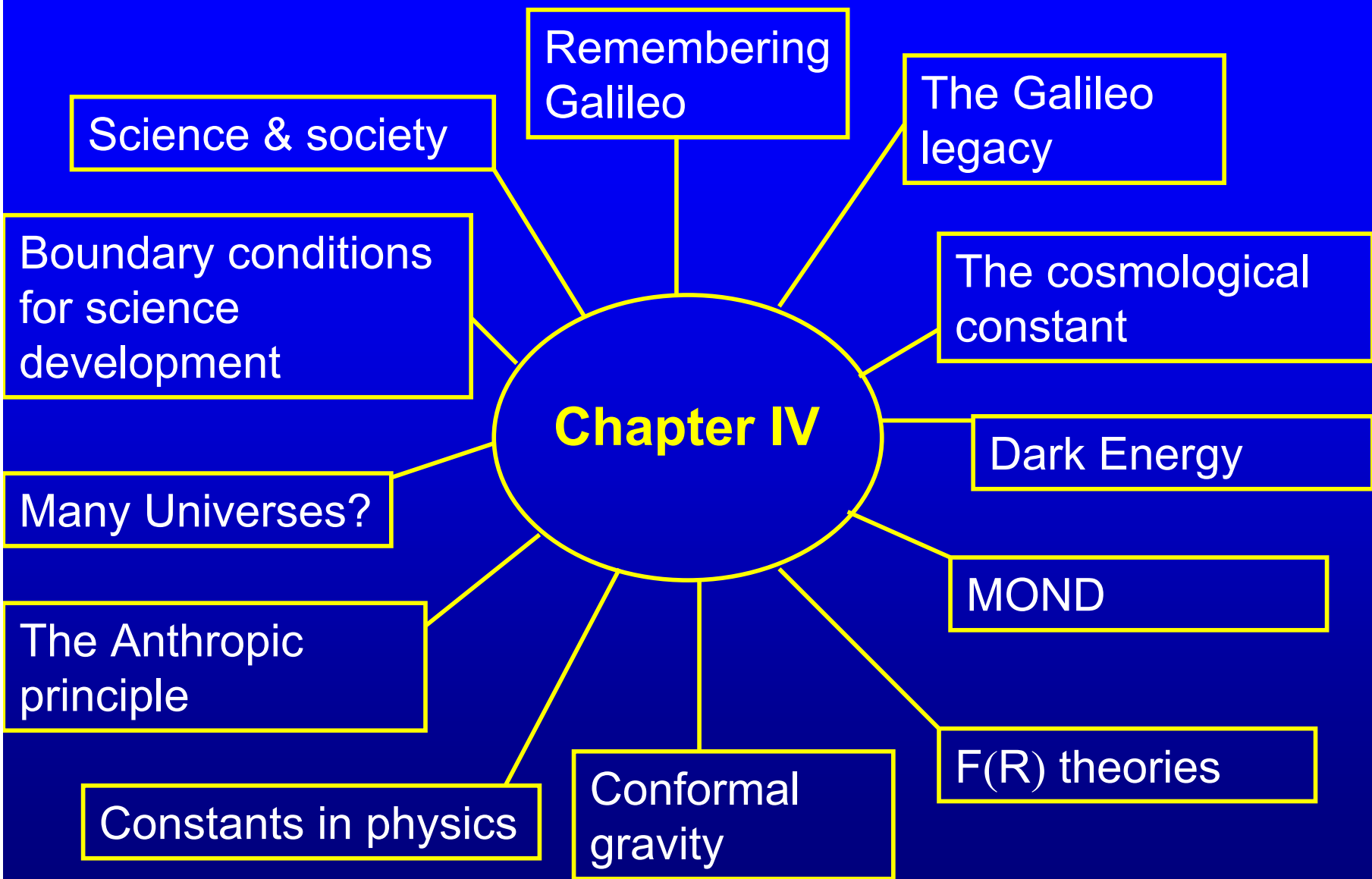
- **Pages: 523 – Figures: 104**
- **References: 1305 – Web pages of “projects”: 101**

Chapter I

- **Motivation / context / aims**
- **Introduction to the themes**
- **Description of chapters**







Chapter V

Radio perspectives

The future of CMB

The Planck mission

Sub mm & IR surveys

VST optical surveys

Observing first structures?

N-body simulations

SNe perspectives

DM & DE constraints

The future of lensing

Cosmic strings

News for Neutrinos

Chapter VI

- **Discussion on aspects common to various contributions**
- Inductive approach vs deductive approach
- Implications for efforts on different directions / approaches
- Resources / self-organization of astrophysical community
- Relevance on non-linear phases – “nature vs nurture”
- Early Universe, CMB relevance, cosmology as a (the?) way for fundamental physics
- Data analysis complexity vs reproducibility & scientific method
- **Different kinds of projects:**
 - multi-purposes vs “single” task
 - detection/analysis of phenomena predicted/observed vs fundamental tests

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