Non-standard Models and the Sociology of Cosmology

Martín López Corredoira

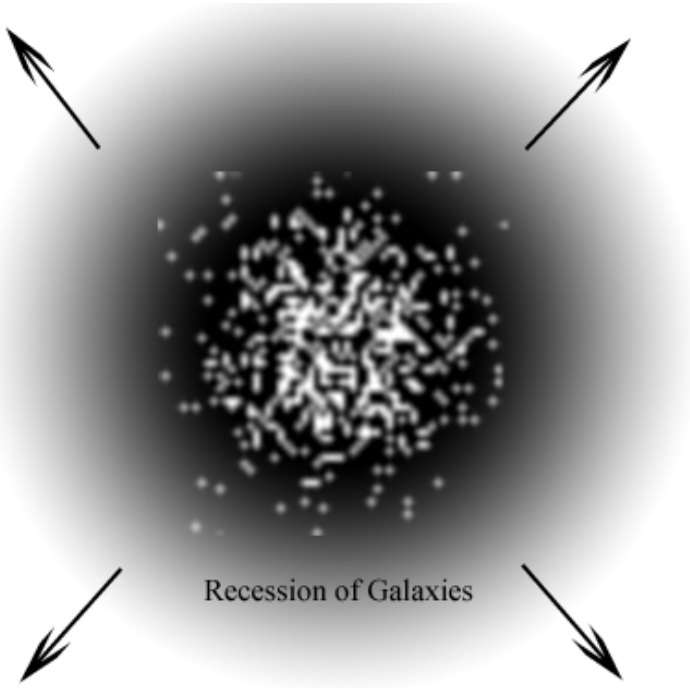
Instituto de Astrofísica de Canarias
(Tenerife, Spain)

Alternative models

1) Quasi steady-state Cosmology

HISTORY:

- Hoyle, Bondi and Gold (1948) proposed a Steady State cosmological (SSC) theory in which there is no beginning (the Universe is eternal) and a homogeneous distribution of matter which is continuously created spontaneously at a steady mean rate (~10^{-24} baryons $cm^{-3}s^{-1}$). The newly created matter forms new galaxies which replace those swept away by the an exponential expansion.



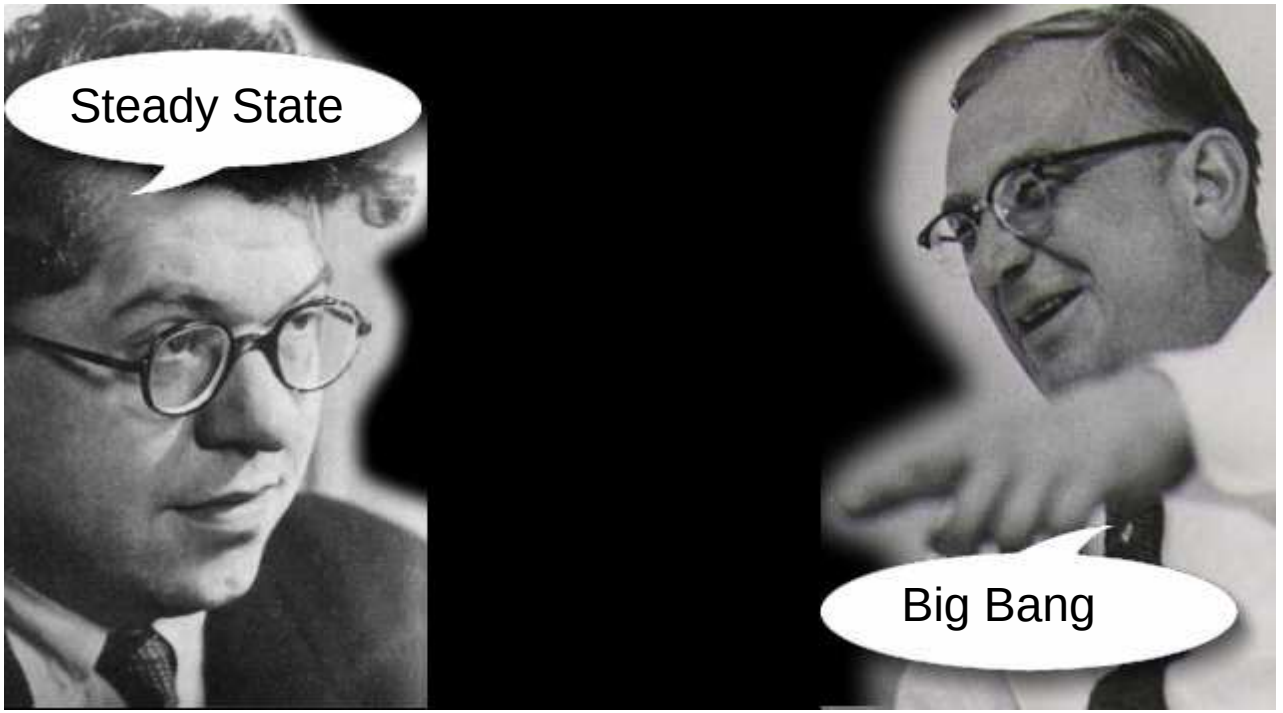
Alternative models

1) Quasi steady-state Cosmology

HISTORY:

- In the 50s, G. R. Burbidge, Hoyle et al. explain the abundance of light elements (helium, deuterium, lithium) made by stars, cosmic rays collision in the past of the Universe.

Fred Hoyle (1915-2001) George Gamow (1904-1968)

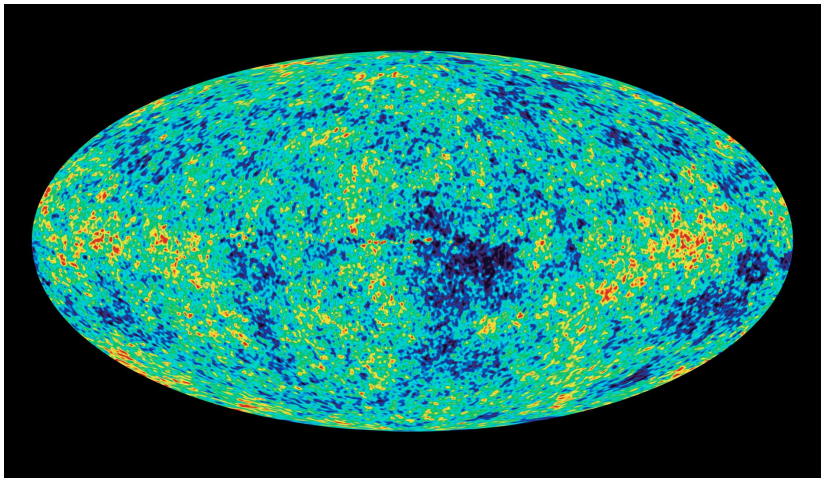


Alternative models

1) Quasi steady-state Cosmology

HISTORY:

- SSC cannot explain why youngest galaxies are those with highest redshift. It also fails to explain why there are many radio sources at large distances while there are so few at short distances (Ryle & Clarke 1964) nor the quasar distributions, nor CMBR radiation. In 1965, most astrophysicists take Big Bang as correct and forget SSC.



Alternative models

1) Quasi steady-state Cosmology

ACTUAL MODEL:

In 1993-1994, Hoyle, Burbidge & Narlikar publish the Quasi-Steady-State model:

- Oscillatory Universe:

$a(t) \alpha e^{t/P}[1+\eta\cos(2\pi\theta(t)/Q)].$

P~10^{12} yr, θ~t The creation is not continuous but confined to the epochs t of minimum $a(t)$.

With the Hubble constant, the age of the glogular clusters and the maximum redshift of galaxies determine Q~$4x10^{10}$ yr, η=~0.75.

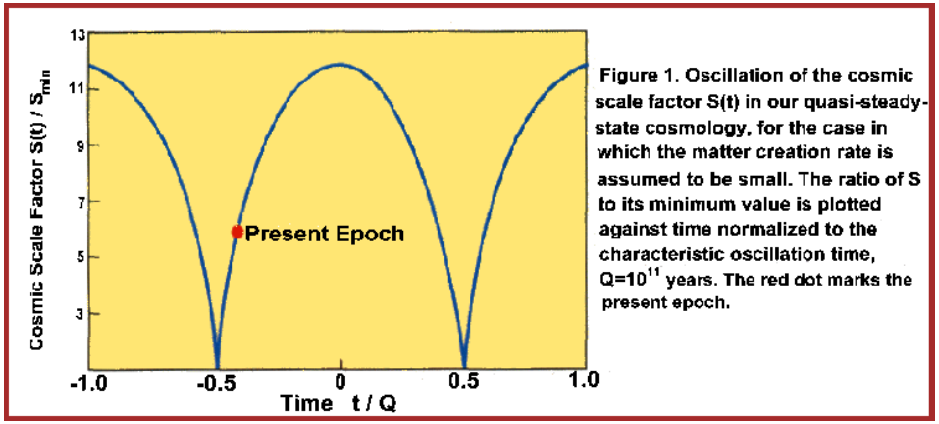


Figure 1. Oscillation of the cosmic scale factor S(t) in our quasi-steady-state cosmology, for the case in which the matter creation rate is assumed to be small. The ratio of S to its minimum value is plotted against time normalized to the characteristic oscillation time, $Q=10^{11}$ years. The red dot marks the present epoch.

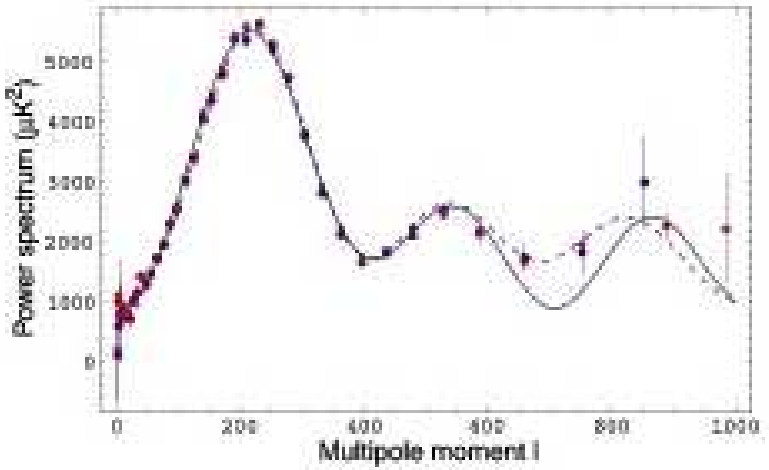
Alternative models

1) Quasi steady-state Cosmology

ACTUAL MODEL:

- They explain why there are younger galaxies with higher redshifts and the radio sources problem, quasar distributions (lower dens. for z>~2.5), large-scale structure.

- CMBR radiation. Thermalization (black body spectrum) is explained by the absorption/emission by whiskers of the stellar light in the last P/3 cycle. Anisotropies explained by Narlikar et al. (2003, 2007) in terms of clusters of galaxies and other elements with 6 free parameters.



(Narlikar et al. 2007)

Alternative models

1) Quasi steady-state Cosmology

Total redshift: $(1+z)=(1+z_{expansion})(1+z_{intrinsic})$

Variable mass hypothesis:

The intrinsic redshift does not indicate the distance but the age.
Hoyle & Narlikar (1964) developed a new theory of gravitation based on Mach's principle whose simple solution is the Minkowski metric and particle masses depending on time according to $m \propto t^2$.
This brings about

$(1+z_{intrinsic}) = m_{observer}/m_{source} = t_0^2/(t_0-r/c)^2 = exp(sQ/P)$; s integer

It explains the periodicity of QSO redshift distribution
For QSOs, the anomalies are explained because their particle masses increase as $(t-t_{QSO})^2$ and not as t^2
(Narlikar 1977, Narlikar & Arp 1993).

Alternative models

1) Quasi steady-state Cosmology

Predictions different to the standard model:

- Small blueshifts ($\Delta z<0.1$) of faint galaxies ($m>27$).

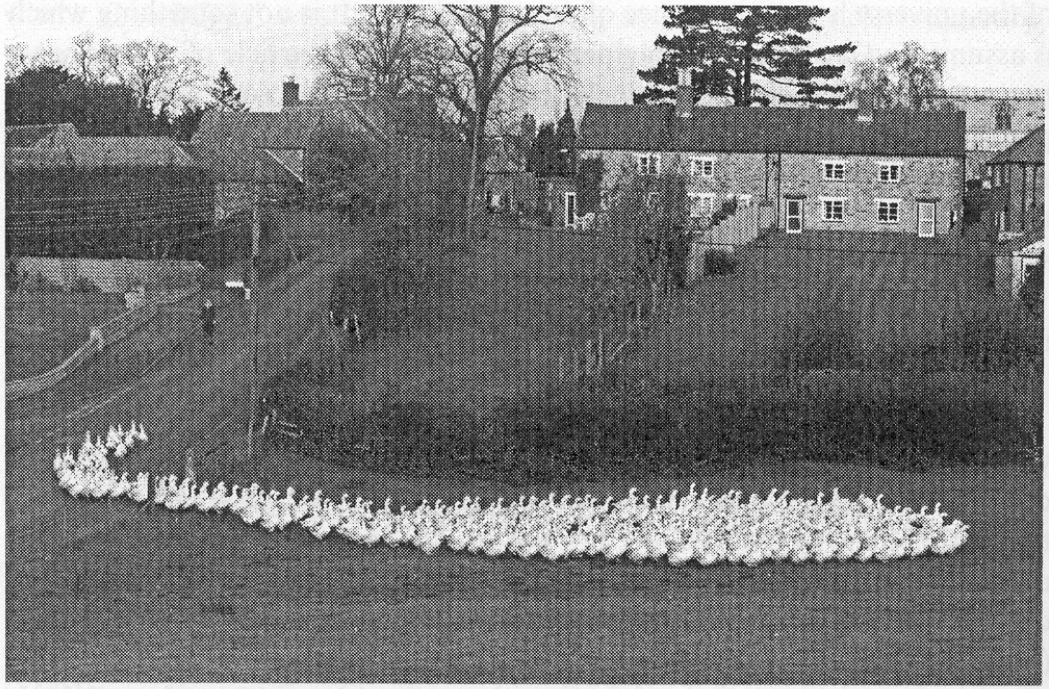
- Stars and galaxies older than 14 Gyr.

- Baryonic matter over the limit of Big Bang.

- Gravitational radiation of mini-bangs.

Alternative models

1) Quasi steady-state Cosmology



This is our view of the conformist approach to the standard (hot big bang) cosmology. We have resisted the temptation to name some of the leading geese.

From a book by Hoyle, Burbidge & Narlikar (2000)

Alternative models

2) Plasma Cosmology

- Plasma cosmology (Alfvén, Klein, Peratt, Lerner, 60s-90s) assumes that most part of the mass is plasma and is controlled by electricity and magnetism, not just gravitation. The universe has always existed and is always evolving and will exist and evolve for an infinite time to come.

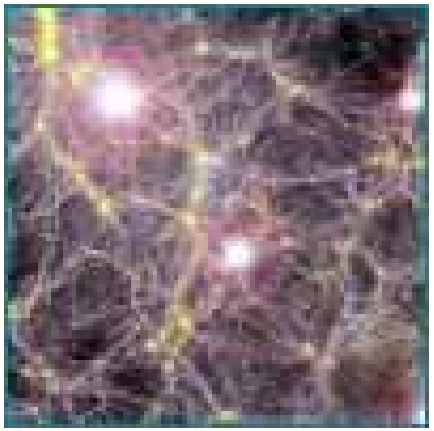
Hannes Alfvén (1908-1995), Nobel prize of Physics

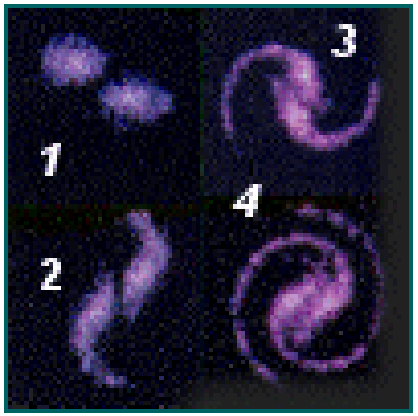
Alternative models

2) Plasma Cosmology

- Plasmas in the middle of magnetic fields and electric currents create filaments and this explains the filamentary Universe. The plasma model predicts the observed hierarchy of the Universe: the distances between stars, galaxies, clusters of galaxies,... The large-scale structure would contain filaments of huge sizes. The streaming velocities in regions near large superclusters are practically coincident with those observed (around 1000 Km/s), without need of dark matter.

- Formation of galaxies governed by forces and interactions of electric and magnetic fields (Peratt)

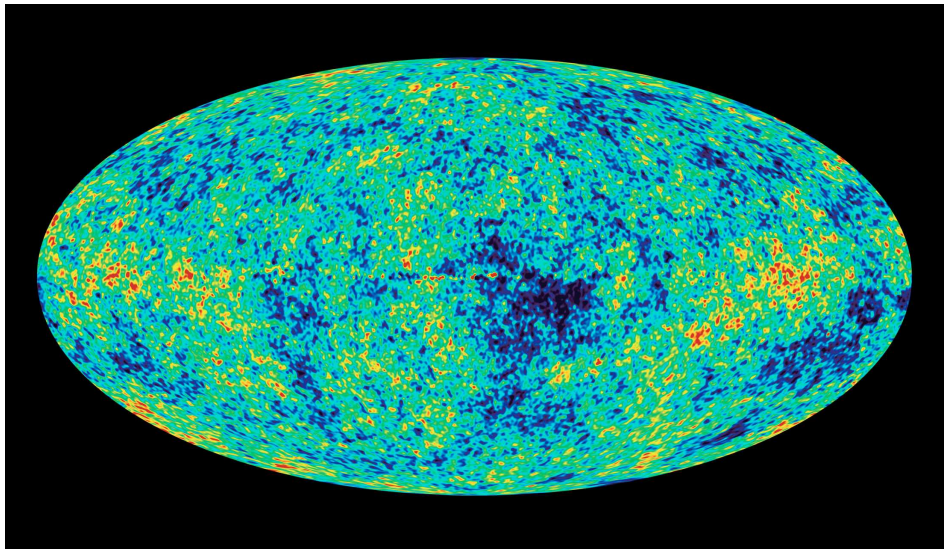




Alternative models

2) Plasma Cosmology

- CMBR produced by absorption and reemission of electrons in the Intergalactic medium (Lerner). The scattering would produce the loss of direction of the radiation. This would produce absorption of radio waves.



Alternative models

2) Plasma Cosmology

OLD VERSION:

- Hubble expansion is explained as the repulsion between matter and antimatter. (Firework model; Alfvén) “firework” model, in which supercluster is expelled from other superclusters; within each supercluster clusters is expelled from other clusters; within each cluster galaxies expelled one each other...

- The energy derived from the anhilation of positrons and electrons would produce an X-rays or γ-rays background radiation.

NEW VERSION:

-There is no expansion, the Universe is static (Lerner, Brynjolfsson).

- Redshift explained by a tired light effect of the interaction of photons with electrons in the plasma.

Alternative models

3) Static, euclidean, infinite space, eternal time models

- Hawkins (60s): negative pressure in the cosmic fluid derived from relativity. Redshift as a gravitational effect.

- Chronometric cosmology (Segal 70s): the global spatial structure is that of the 3-surface of a 4-sphere. The events in the universe are globally ordered according to a temporal order. Redshift proportional to the square of distance.

- Curvature Cosmology (Crawford 80s-): a combination of general relativity and wave mechanics leads to a new gravitational interaction. Curvature pressure results from the non-geodesics motion of charged particles. Applied to photons traveling through uniform material it produces a 'tired light' type of redshift.

- Wave system (Andrews 90s-): The Universe is a pure wave system with mass density and tension parameter proportional to the local intensity of the wave modes. The constructive interference peaks are the elementary particles. Redshift by tired light mechanism.

Alternative models

Variations on the standard model

- Newtonian Cosmology (Milne, 30s) instead of general relativity.

- Fractal Universe (e.g., Baryshev, Sylos-Labini 90s, 00s): the large-scale structure of the Universe is not homogeneous but a fractal.

- Cold Big Bang (Layzer 60s; Aguirre 90s, 00s); beginning of the Universe with T=0 K.

- Variations/oscillations in the constants of the Physics (c, G, h, α) with time or distance.

- Multiple variations on inflation, strings, walls and other textures, number of neutrino families, amount of antimatter, etc.

- Monolithic instead of hierarchical structure formation.

Alternative models

Alternatives to non-baryonic dark-matter, dark energy

ROTATION CURVES:

- Modifiying Newtonian gravity (e.g., MOND, MOG), or with other gravitational theories.

- A massive photon (Bartlett & Cumalat).

- Dark matter are protons and alpha particles (“baryonic”) moving at relativistic speeds (so they are interact very little) (Drexler).

- Magnetic fields (Battaner).

- Mass is in the outer discs instead of halos (Feng & Gallo; Nicholson)

SUPERNOVAE DATA:

- Inhomogeneous Universe.

- Evolution of SNIa luminosity.

- Extinction.

- Variation of c, G,…

- Other cosmologies.

Problems of alternative models

- Expansion: either it is a fact (and needs some speculation to argue there was not a beginning of the Universe: continuous creation of matter, repulsion matter/antimatter, etc) or it needs an alternative explanation for the redshift different to Doppler/expansion, and none of them has firm evidences in favour.

- CMBR: not well understood its thermalization (black body spectrum) and the idea of whiskers/electron absorption/reemission has not evidences in favour. The anisotropies are also poorly understood in comparison with the standard model.

- Light elements: it needs some *ad hoc* assumptions to explain why light elements were produced by very old stars and not heavier elements.

- Large scale structure and galaxies formation/evolution: there are toy models but they are not able at present to give detailed explanations of the facts.

Difficulties to create alternative models

1) Methodology of science

Mathematical deductive method:

- Pythagoras/Plato. Pure relations of numbers in arithmetics and geometry are the changeless reality behind the shifting appearances of the sensible world. Reality can be known not through sensory observation, but only through pure reason, which can investigate the abstract mathematical forms that rule the world.
- Modern science example: Einstein's general relativity.
- Modern Cosmology/physics: Search of beauty, about the beautiful plan by which Creator designed the universe, to read God's mind. It can be understood and judged only by an elite priesthood who are able to think in four or more dimensions.

Pythagoras of Samos, VI cent. BC

Difficulties to create alternative models

1) Methodology of science

Empirical inductive method:

- Anaxagoras/Aristotle: Nature is matter, not maths; the method to know nature is based on observations and extrapolations of those observations to parts of the universe distant in space and time.
- Modern science example: empirism of Galilei.
- Modern Cosmology/Physics: Cosmology is to be derived from the observations without a priori prejudices.
- Sherlock Holmes (Conan Doyle's novels) method:

  "It is a capital mistake to theorize before you have all the evidence" ("A Study in Scarlet")

  "Before one has data, one begins to twist facts to suit theories instead of theories to suit data" ("A Scandal in Bohemia").

Anaxagoras, V cent. BC

Difficulties to create alternative models

1) Methodology of science

• Dingle (1937): Attack against Cosmology for using a rationalist-deductive method instead of an empiricist-inductive one:

"Universe mania"

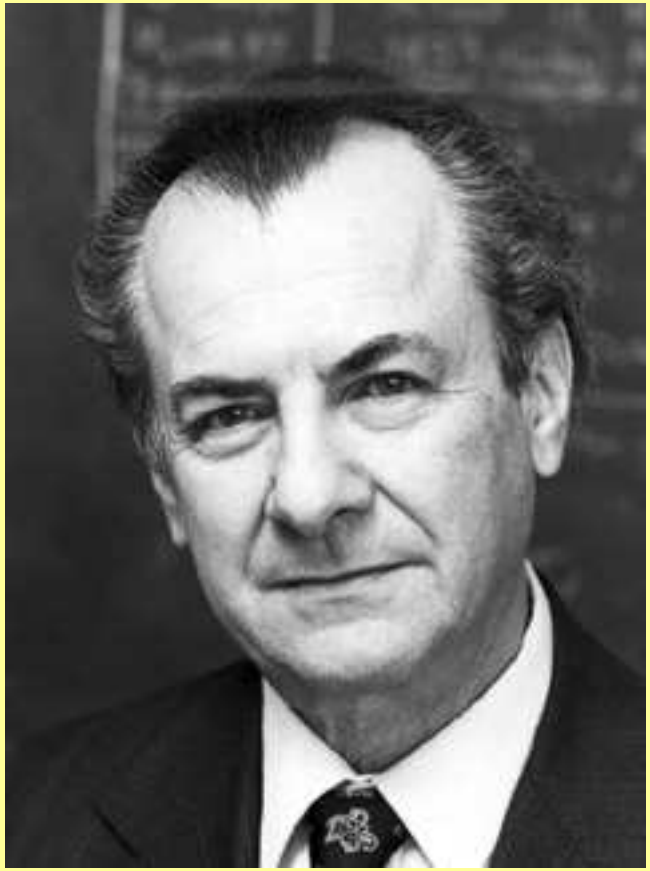
• Other empiricists: Robertson, Eddington, de Sitter

Herbert Dingle (1890-1978)

Difficulties to create alternative models

1) Methodology of science

- *"...parallelisms between modern cosmology and medieval scholasticism. (...) Above all I am concerned by an apparent loss of contact with empirical evidence and observational facts, and, worse, by a deliberate refusal on the part of some theorists to accept such results when they appear to be in conflict with some of the present oversimplified and therefore intellectually appealing theories of the universe."* (G. de Vaucouleurs 1970)



Gérard de Vaucouleurs (1918-1995)

Difficulties to create alternative models

1) Methodology of science

Actual mathematical/empirical method in Cosmology (López-Corredoira 2008):

Case 1: *"Given a theory A self-called orthodox or standard, and a non-orthodox or non-standard theory B. If the observations achieve what was predicted by the theory A and not by the theory B, this implies a large success to the theory A, something which must be divulged immediately to the all-important mass media. This means that there are no doubts that theory A is the right one. Theory B is wrong; one must forget this theory and, therefore, any further research directed to it must be blocked (putting obstacles in the way of publication, and giving no time for telescopes, etc.)."*

Difficulties to create alternative models

1) Methodology of science

Actual mathematical/empirical method in Cosmology (López-Corredoira 2008):

Case 2: *"If the observations achieve what was predicted by theory B rather than by theory A, this means nothing. Science is very complex and before taking a position we must think further about the matter and make further tests.*

It is probable that the observer of such had a failure at some point; further observations are needed (and it will be difficult to make further observations because we are not going to allow the use of telescopes to re-test such a stupid theory as theory B).

Who knows! Perhaps the observed thing is due to effect "So-and-so", of course; perhaps they have not corrected the data from this effect, about which we know nothing.

Everything is so complex. We must be sure before we can say something about which theory is correct.

Furthermore, by adding some new aspects in the theory A surely it can also predict the observations, and, since we have an army of theoreticians ready to put in patches and discover new effects, in less than three months we will have a new theory A (albeit with some changes) which will agree the data.

In any case, while in troubled waters, and as long as we do not clarify the question, theory A remains."

Difficulties to create alternative models

1) Methodology of science

Actual mathematical/empirical method in Cosmology:

Case 2: … *Perhaps, as was said by Halton Arp (2008), the informal saying "to make extraordinary changes one requires extraordinary evidence" really means "to make personally disadvantageous changes no evidence is extraordinary enough"."*

"Of course, if one ignores contradictory observations, one can claim to have an 'elegant' or 'robust' theory. But it isn't science." (Arp 1991)

Halton C. Arp (1927-)

Difficulties to create alternative models

2) Snowball effect

"The snowball effect arising from the social dynamics of research funding drove more researchers into the Standard Cosmology fold and contributed to the drying out of alternative ideas." (Narlikar 2001)

Jayant V. Narlikar (1938-)

Difficulties to create alternative models

2) Snowball effect

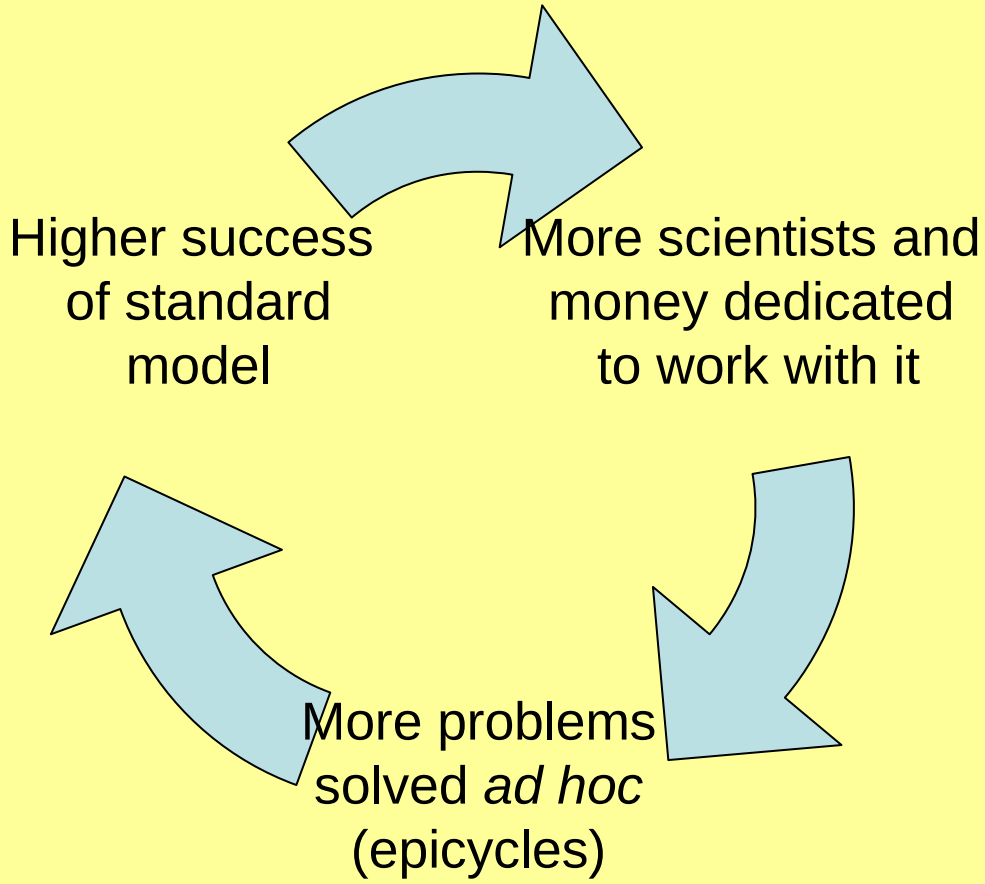
“Let me start on a somewhat pessimistic note. We all know that new ideas and revolutions in science in general come from the younger generation, who look critically at the contemporary schemes, and having absorbed the new evidence, overthrow the old views. This, in general, is the way that science advances. However, in modern astronomy and cosmology, at present, this is emphatically not the case. Over the last decade or more, the vast majority of the younger astronomers have been conformists in the extreme, passionately believing what their leaders have told them, particularly in cosmology. In the modern era the reasons for this are even stronger than they were in the past. To obtain an academic position, to obtain tenure, to be successful in obtaining research funds, and to obtain observing time on major telescopes, it is necessary to conform.”

(G. R. Burbidge 1997)

Geoffrey R. Burbidge (1925-2010)

Difficulties to create alternative models

2) Snowball effect



Difficulties to create alternative models

3) Psychological profile of the orthodox/heterodox researcher

HETERODOX:

- Complex of unappreciated genius. Too much "ego"

- Normally working alone/individually or in very small groups.

- Creative, intelligent.

- Inconformist.

- His/her illusion is creating a new paradigm in science which changes completely our view of the Universe

- Einstein is the one of the heros (because it Is the symbol of genius of Physics), so many of them claim that Einstein was wrong (i.e., they are geniuses over Einstein)

MOST OF THEM ARE CRACKPOTS

Difficulties to create alternative models

3) Psychological profile of the orthodox/heterodox researcher

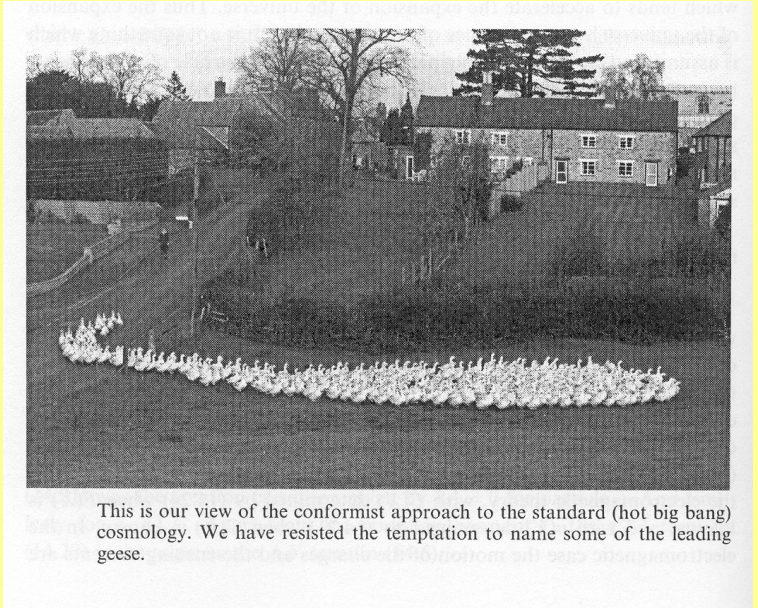
ORTHODOX:

- Groupthink: following leader(s) opinion, like in the “Naked king” tale.

- Good worker in monotonous tasks without ideas in large groups. Specialist in a small field which knows very well.

- Conformist, domestic.

- His/her illusion is getting a permanent position in an University or Research center, to be leader of a project, to do astropolitics,…



This is our view of the conformist approach to the standard (hot big bang) cosmology. We have resisted the temptation to name some of the leading geese.

MOST OF THEM ARE SHEEP
(OR GEESE)… OR SHEPHERDS

Difficulties to create alternative models

3) Psychological profile of the orthodox/heterodox researcher

SOCIOLOGICAL REASONS FOR THE SUCCESS OF BIG BANG IN PRESENT-DAY ASTROPHYSICS:

- Sheep are preferred to crackpots.

- Finding a truth among 1000s of crazy ideas is very hard.

- Investment in science prefer a safe/domestic/controlled way to do science rather than an unsafe promising change of paradigm.

… ANYWAY, evidences in favour of some aspects of the theory are there.

The impossible science of Cosmology

"And we would pretend to understand everything about cosmology, which concerns the whole Universe? We are not even ready to start to do that. All that we can do is to enter in the field of speculations. So far as I am concerned, I would not comment myself on any cosmological theory, on the so-called `standard theory' less on many others. Actually, I would like to leave the door wide open." (Pecker 1997)

Jean-Claude
Pecker (1923-)

The impossible science of Cosmology

1) The Cosmologist's Credo according to Mike J. Disney (2000)

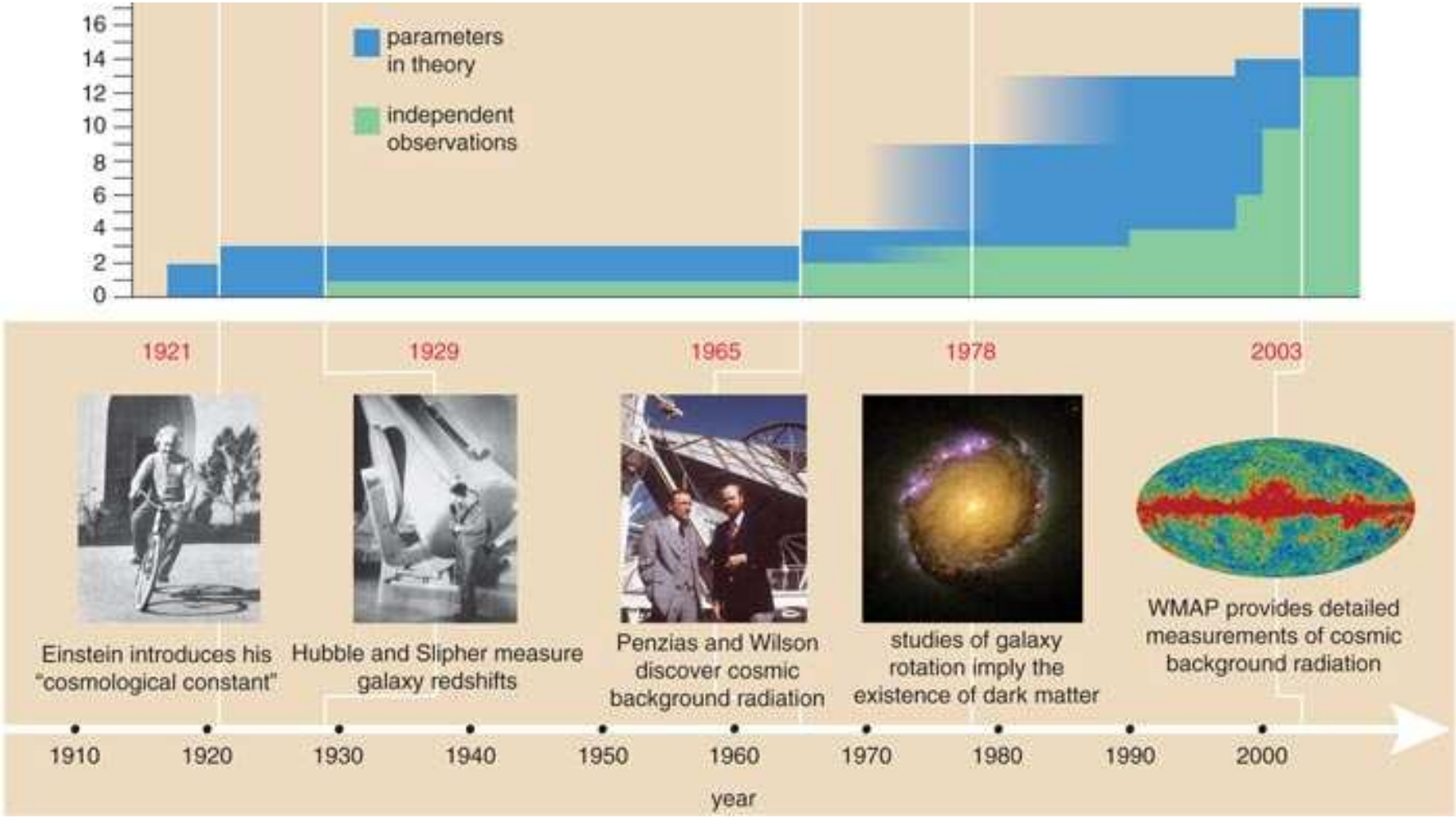
Non-theological assumption: speculations are not made which cannot, at least in principle, be compared with observational or experimental data, for tests.

"Good-luck'" assumption: the portion of the Universe susceptible to observation is representative of the cosmos as a whole.

"Simplicity'" assumption: the Universe was constructed using a significantly lower number of free parameters than the number of clean and independent observations we can make of it.

"Non-circularity" assumption: the Laws of Physics which have significantly controlled the Universe since the beginning are, or can be, known to us from considerations outside cosmology itself.

"Fortunate epoch'" assumption: we live in the first human epoch which possesses the technical means to tease out the crucial observations.

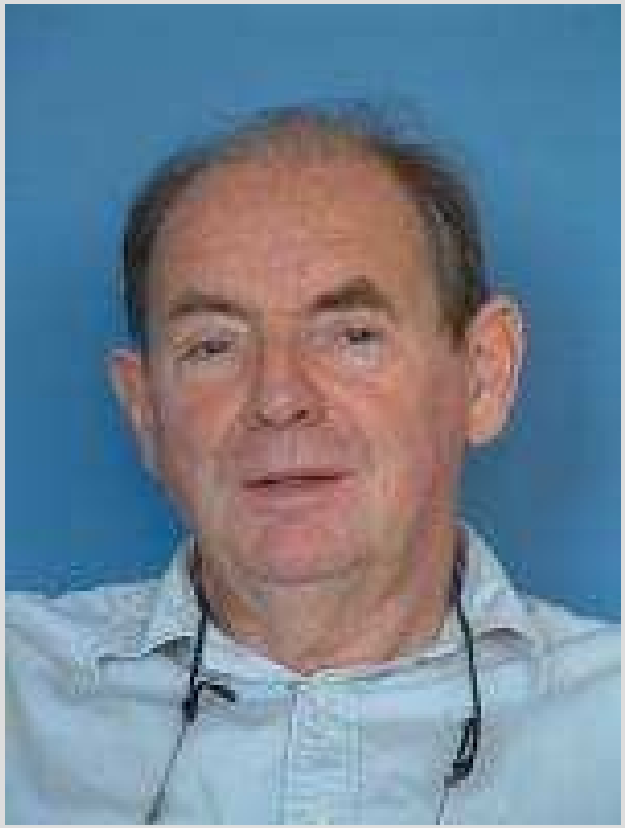

16
14
12
10
8
6
4
2
0
parameters in theory
independent observations
1921
1929
1965
1978
2003
Einstein introduces his "cosmological constant"
Hubble and Slipher measure galaxy redshifts
Penzias and Wilson discover cosmic background radiation
studies of galaxy rotation imply the existence of dark matter
WMAP provides detailed measurements of cosmic background radiation
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
year

(Disney 2007)

The impossible science of Cosmology

1) The Cosmologist's Credo according to Mike J. Disney (2000)

"We believe the most charitable thing that can be said of such statements is that they are naive in the extreme and betray a complete lack of understanding of history, of the huge difference between an observational and an experimental science, and of the peculiar limitations of cosmology as a scientific discipline." (M. J. Disney 2000)



Michael J. Disney (1937-)

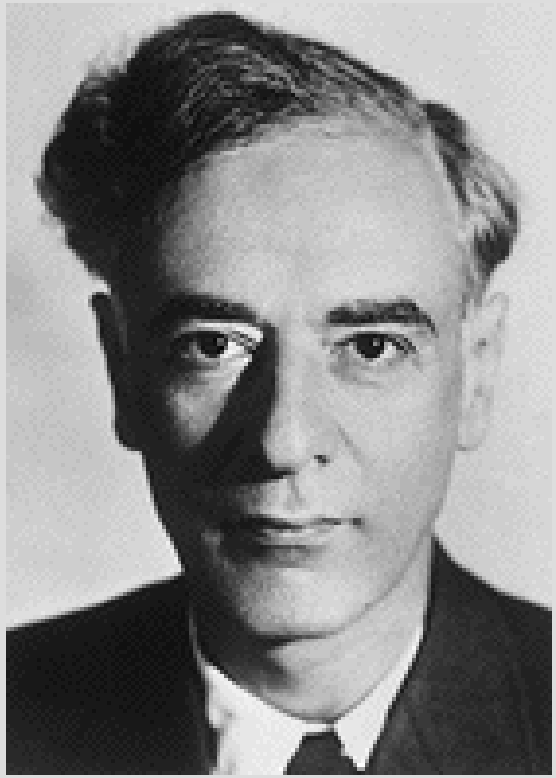
Cirkovic (2002): Disney's claims are rethoric with no new ideas about sociology/philosophy of science, and critiques which are unfair, biased and constrained in an extreme inductivism.

Other disciplines do similar things than Cosmology and they are "Sciences".

The impossible science of Cosmology

2) Limits of Cosmology

“Cosmologists are often in error, but never in doubt” (Landau)



Lev Lavidovich Landau (1908-1968)

The impossible science of Cosmology

2) Limits of Cosmology

"It should not be forgotten that all this talk about the universe involves a tremendous extrapolation, which is a very dangerous operation." (de Sitter 1931)

Willem de Sitter (1872-1934)

The impossible science of Cosmology

2) Limits of Cosmology

A new alternative theory?

Noooo.....!!!!!!

The impossible science of Cosmology

2) Limits of Cosmology

- “Don't let me hear anyone use the word `Universe´ in my department” (Rutherford)

- “The word `cosmologist´ should be expunged from the scientific dictionary and returned to the priesthood where it properly belongs.” (M. J. Disney 2000)

Ernest Rutherford (1871-1937)

Non-standard models and the sociology of cosmology

Recommended bibliography:

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