Misconceptions about modern cosmology

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Questions

- 1) Is space really expanding ?
- 1 a) What is the true size of the visible universe ?
- 2) Does the equation of state an usual perfect fluid one ?
- 3) Why the concept of locally inertial frame is not often used ?
- 3 a) Why the concept of free fall observer is not often used ?
- 4) Why the half plane of the De Sitter models is not often used ?
- 5) Why is it often said that hic et nunc we have $a(t_o) = 1$?
- 6) Does Higgs boson or Mach principle which gives inertial mass ?
- 6 a) Does the use of inflationary models needed ?
- 7) Is it necessary to quantify general relativity ?

In fact all these questions rested upon the same epistemological one, according various point of view : the ontological temptation.

Hints

- a 1) The concept of space-time has no ontological meaning (Zénon, Aristotle, Avicenne, ..., Kant, Poincaré, Tarski, ...).
- a 2) The concept of space-time is a mathematical one ; the coordinates have no physical meaning as Einstein said.
- b 1) The Birkhoff theorem could always be used, but locally.
- b 2) A Painlevé form always exists, globally.
- c) Each model has at any point an osculating De Sitter space.
- d) The redshift is a lapse, a Doppler and gravitational one.
- e) Some models are compatible with the Mach principle.
- f) The equation of state is not in general an usual perfect fluid one.
- g) The Poincaré group imply the Heisenberg inequalities.

Proofs

- I- No stretching of space, a bibliography :

  Fulvio Melia : "Cosmological Redshift in FRW Metrics with Constant Spacetime Curvature", Monthly Notices of the Royal Astronomical Society, 422, 1418 (2012).

"Cosmological Physics" Peacock, pages 87-89, Cambridge University Press, 1999. He said : "An inability to see that the expansion is locally just kinematical also lies at the root of perhaps the worst misconception about the big bang."

Matthew J. Francis, Luke A. Barnes, J. Berian James, Geraint F. Lewis : "Expanding Space : the Root of all Evil ?", Publ.Astron.Soc.Austral.24 :95-102,2007 ; http ://arxiv.org/pdf/0707.0380v1.pdf.
They said : "In this paper, we have shown how a consistent description of cosmological dynamics emerges from the idea that the expansion of space is neither more nor less than the increase over time of the distance between observers at rest with respect to the cosmic fluid."

Martin Rees and Steven Weinberg (1993) said : "...how is it possible for space, which is utterly empty, to expand ? How can nothing expand ? The answer is : space does not expand. Cosmologists sometimes talk about expanding space, but they should know better."
See also :

Baryshev, Yu. "Expanding space : the root of conceptual problems of the cosmological physics", 2008pc2..conf...20B ?

Bunn, Emory F. and Hogg, David W. "The kinematic origin of the cosmological redshift", 2009AmJPh..77..688B ?

Domenico Giulini "Does cosmological expansion affect local physics ?" arXiv :1306.0374v1 [gr-qc] 3 Jun 2013 ;
"I argue that a pseudo Newtonian picture can be quite accurate if "expansion" is taken to be an attribute of the inertial structure rather than of "space" in some substantivalist sense. This contradicts the often-heard suggestion to imagine cosmological expansion as that of "space itself"."

Other papers :
T. M. Davis and C. H. Lineweaver, "Expanding confusion : Common misconceptions of cosmological horizons and superluminal expansion of the universe", Publ. Astron. Soc. Aust. 21, 97-109 (2004).
M. J. Chodorowski, "Is space really expanding ? A counterexample", Concepts of Physics IV, No. 1 (2007).
J. A. Peacock, http ://www.roe.ac.uk/ jap/book/expandspace.pdf , as an addition to J. A. Peacock, Cosmological Physics (Cambridge University Press, Cambridge, 1999). J. A. Peacock, "A diatribe on expanding space", arXiv :0809.4573.
J. A. Morgan, "Are galaxies receding or is space expanding ?", Am. J. Phys. 56, 777-778 (1988).
Barnes L.A., Francis M.J., James, J.B., Lewis G.F., "Joining the Hubble Flow : Implications for Expanding Space", 2006, MNRAS, 373, 382 (astro-ph/0609271)
So no stretching of space and the cosmological redshift is a Doppler one.

– II- A mathematical tool :

  Weinberg, Steven Gravitation and Cosmology : Principles and Applications of the General Theory of Relativity John Wiley, New-York 1972.
  He said in his preface : "I have tried here to put off the introduction of geometric concepts until they are needed, so that Riemannian geometry appears only as a mathematical tool for the exploitation of the Principe of Equivalence, and not as a fundamental basis for the theory of gravitation."

  Donald H. Kobe and Ankit Srivastava "From Newton's Universal Gravitation to Einstein's Geometric Theory of Gravity" arXiv :1309.4789v1 [gr-qc] 17 Sep 2013
  A simple proof that Einstein's theory is obtained as the covariant and relativistic form of Newton's theory (via the Poisson equation).

– III- The theoretical pluralism in science. H. Poincaré : "The Foundations of Science : Science and Hypothesis, The Value of Science, Science and Method", The Science Press (1913). M. Mizony "Sur le pluralisme théorique : de Kant à Poincaré", in Ateliers sur la contradiction, Presses des Mines, Paris (2010), pp. 93-100.

– IV- "What is the origin of the mass of the Higgs boson ?" M. Novello, E. Bittencourt, http ://arxiv.org/abs/1209.4871 ; the authors "present a unified description of mass generation mechanisms that have been investigated so far and that are called the Mach and Higgs proposals." But "Besides, the Higgs mechanism has a very crucial drawback : it is obliged to assume that the mass of the Higgs boson has a different origin than all other particles."

– V- The general equation of state : "Limitations of the Standard Gravitational Perfect Fluid Paradigm", Philip D. Mannheim, James G. O'Brien and David Eric Cox, arXiv :0903.4381v2 [gr-qc] 16 Sep 2010.

– VI- "Adversus singularitates : The ontology of space-time singularities", Gustavo E. Romero, arXiv :1210.2427v1 [physics.gen-ph] 8 Oct 2012 : it is about the incompleteness theorems in the general relativity theory such that the so called "singularity theorems".

– VII- The half-plane of the De Sitter models of universe : "Alternatives to Dark Matter and Dark Energy", Philip D. Mannheim, arXiv :astro-ph/0505266v2 Aug 2005 ; Prog. Part. Nucl. Phys. 56, 340-445, (2006). Mizony and Lachièze-Rey : Cosmological effects in the local static frame, A.& A. Vol. 434, n^o1, April 2005 ; (gr-qc/0412084). In this paper the Painlevé form (of these metrics) is used. These models are machian models.

– VIII About Quantum Mechanic and general relativity : "Relativity Is Not About Spacetime" Edward J. Gillis, October 15, 2012 ; arXiv :1210.3575v1 [physics.hist-ph]. He said : "But, in order to make current theory logically coherent, we need to realize that relativity is rooted as much in the indeterminism that characterizes quantum theory as in the structure of space and time." For a derivation of the Heisenberg inequalities from the Poincaré group see : F. Balibar, A. Laverne,

J-M. Lévy-Leblond et D. Mouhanna, "Quantique : Eléments" http ://cel.archives-ouvertes.fr/docs/00/13/61/89/PDF/elem_5fev07.pdf. "A possibility to solve the problems with quantizing gravity" Sabine Hossenfelder, arXiv :1208.5874v2 [gr-qc], september 2013.

– IX About Quantum Mechanic and relativity ; on an epistemological point of view : read the thesis (on line) : "Le possible, l'actuel et l'évènement en mécanique quantique, une approche pragmatiste", Manuel Bächtold, université Paris 1-Sorbonne, 2005.

Note : the labeling is different because each hint or proof often involves several issues.

Why such misconceptions ?

– *A) The global theory of differential geometry appears just before the beginning of the second world war (with Cartan and others) and was known after 1945. Before, only local theory resting upon tensor calculus could be used.

– *B) The theoretical pluralism is forgotten since the death of Poincaré (1912)

– *C) Mathematicians and theoretical physicists are too often "Platonician" and not "Aristotelician".

– *D) It is very difficult to searchers to be understood in the laboratories all around the world, when they give a counterexample to a "well known theorem" ; in general a local theorem, not globally valid.

– *E) The competition between teams of scientifics pushes to the leak in the abstraction.

– *F) A lack of general culture epistemological and historical since 100 years in our universities is dramatic.

Conclusion ?

The human animal is limited, like any animal. It certainly has an extraordinary development in terms of evolution. But its main limitation is often "to take bladders for lanterns". Indeed he takes, thanks to its faculties, abstract concepts which he conceives, as expressing reality. This is the ontological temptation (especially in the West). Is it the common epistemological answer to all these questions ?

If yes, so a long life for De Sitter models which are a starting point to solve all these issues.