

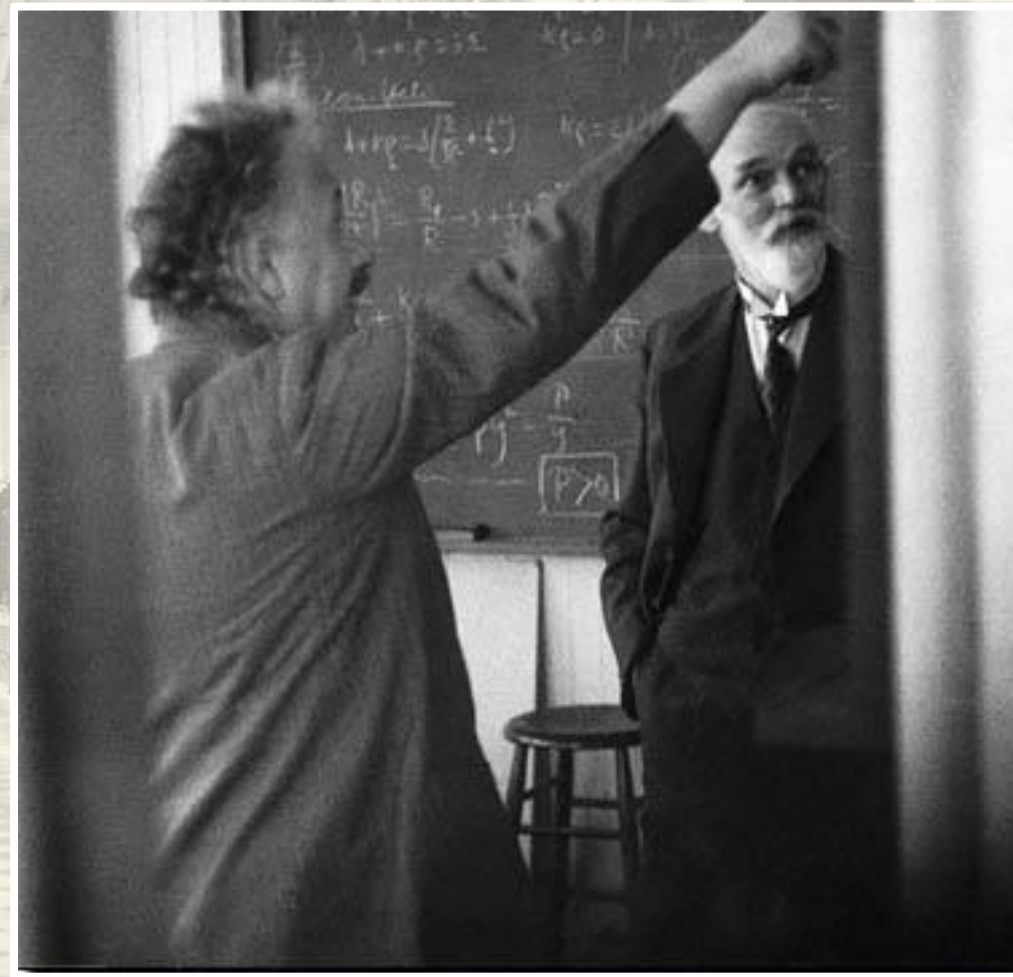
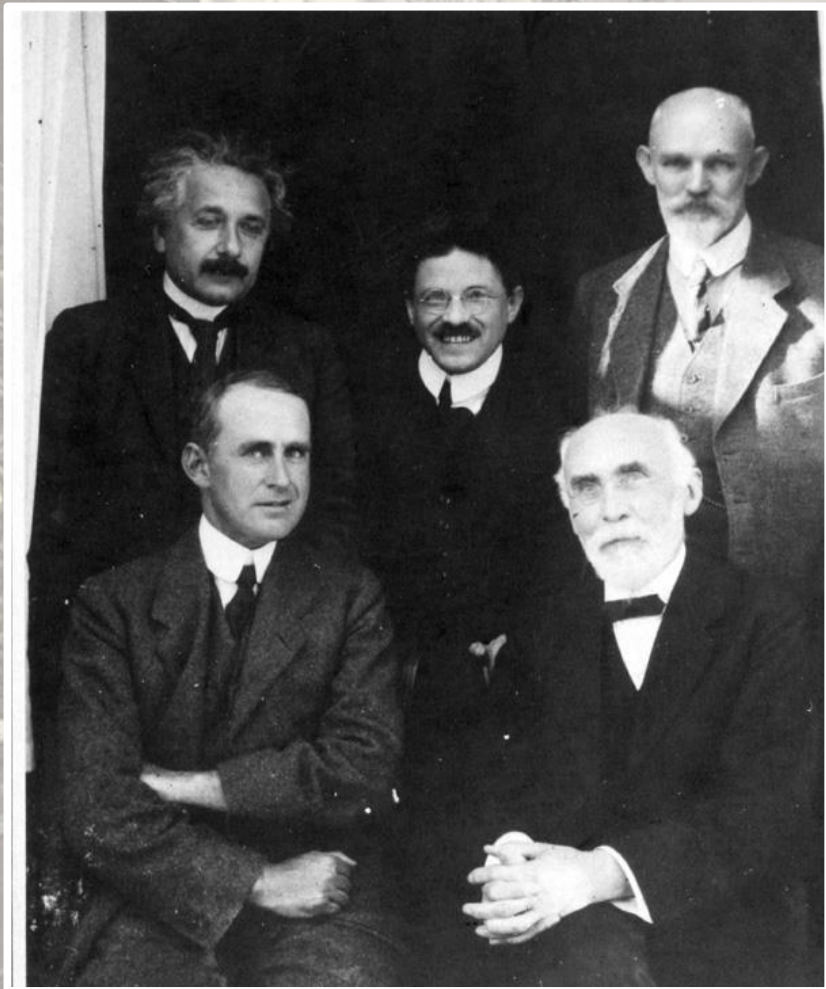


Arthur S. Eddington & Georges Lemaître

Naissance d'une idée *abominable*

1923-1933

1915-1916 : Leyde



1918

THE
PHYSICAL SOCIETY
OF
LONDON.

REPORT
ON THE
RELATIVITY THEORY OF
GRAVITATION.

BY
A. S. EDDINGTON, M.A., M.Sc., F.R.S.
Plumian Professor of Astronomy and Experimental Philosophy, Cambridge.

1919-1920

29 mai

12 sept.

6 nov.

20 janv.

14 mars

27 avril

19 juin

1919

1920

Éclipse totale de Soleil

Rencontre
B.A.A.S.

Annonce
officielle

Cours
introductif

Cours
approfondi

Deux manuels

THE MATHEMATICAL THEORY OF RELATIVITY

BY

A. S. EDDINGTON, M.A., M.Sc., F.R.S.

PLUMIAN PROFESSOR OF ASTRONOMY AND EXPERIMENTAL
PHILOSOPHY IN THE UNIVERSITY OF CAMBRIDGE

1923

SPACE TIME AND GRAVITATION

AN OUTLINE OF THE GENERAL
RELATIVITY THEORY

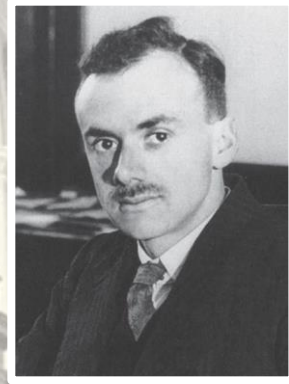
1920

Quelques élèves

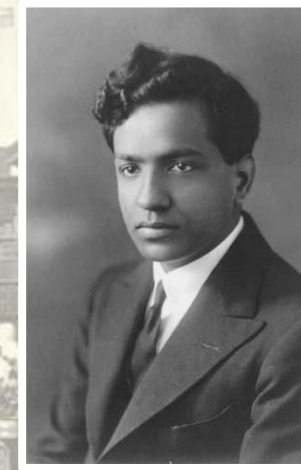
Cecilia PAYNE
(1900-1979)



Paul DIRAC
(1902-1984)



**Subrahmanyan
CHANDRASEKHAR**
(1910-1995)



Georges LEMAÎTRE
(1894-1966)



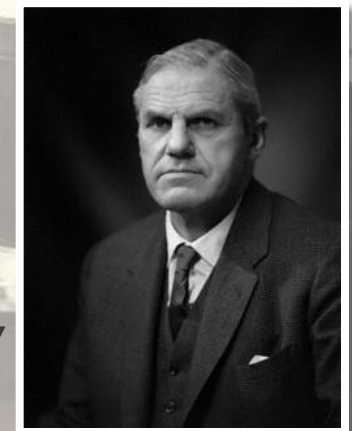
Llewellyn THOMAS
(1903-1992)



Fred HOYLE
(1915-2001)



Richard WOOLLEY
(1906-1986)



THE MATHEMATICAL THEORY OF RELATIVITY

BY

A. S. EDDINGTON, M.A., M.Sc., F.R.S.

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PHILOSOPHY IN THE UNIVERSITY OF CAMBRIDGE

1923

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PROPERTIES OF DE SITTER'S SPHERICAL WORLD

CH. V

The most extensive measurements of radial velocities of spiral nebulae have been made by Prof. V. M. Slipher at the Lowell Observatory. He has kindly prepared for me the following table, containing many unpublished results. It is believed to be complete up to date (Feb. 1922). For the nebulae

Vesto M. SLIPHER
(1875-1969)



A RELATION BETWEEN DISTANCE AND RADIAL VELOCITY AMONG EXTRA-GALACTIC NEBULAE

BY EDWIN HUBBLE

MOUNT WILSON OBSERVATORY, CARNEGIE INSTITUTION OF WASHINGTON

Communicated January 17, 1929

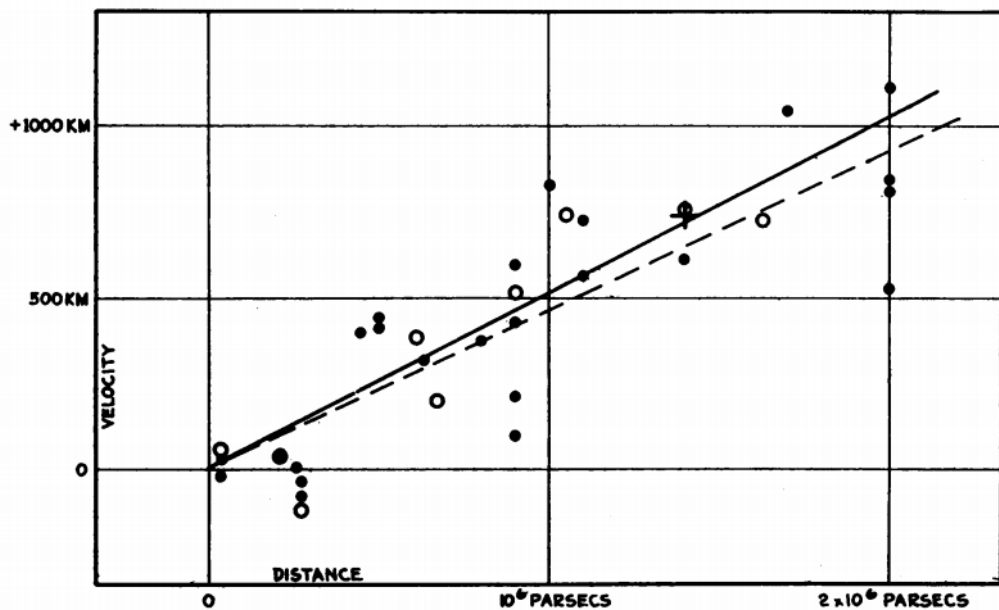


FIGURE 1

Velocity-Distance Relation among Extra-Galactic Nebulae.



Edwin HUBBLE
(1889-1953)

MNRAS, mai

On the Instability of Einstein's Spherical World.
By A. S. Eddington, F.R.S.

1. Working in conjunction with Mr. G. C. McVittie, I began some months ago to examine whether Einstein's spherical universe is stable. Before our investigation was complete we learnt of a paper by Abbé G. Lemaître * which gives a remarkably complete solution of the various questions connected with the Einstein and de Sitter cosmogonies.

Nature, juin

Three years ago a very substantial advance in this subject was made by Abbé G. Lemaître (*Annales de la Société Scientifique de Bruxelles*, April 25, 1927). Until recently, this paper seems to have been almost unknown, and we can scarcely blame Dr. Silberstein for being unaware of it ; but it is unfortunate that the new point of view does not appear in his book. In particular it renders obsolete the contest between Einstein's and de Sitter's cosmogonies. We can now prove that Einstein's universe is unstable. The equilibrium having been disturbed, the universe will progress through a continuous series of intermediate states towards the limit represented by de Sitter's universe. By Lemaître's analysis the history of this progress can be studied ; and the intermediate stages (one of which must represent the present state of the world) can be treated in detail.

A. S. EDDINGTON.

**ON THE DISTANCES AND RADIAL VELOCITIES OF EXTRA-
GALACTIC NEBULAE, AND THE EXPLANATION
OF THE LATTER BY THE RELATIVITY
THEORY OF INERTIA**

BY W. DE SITTER

OBSERVATORY AT LEIDEN

Communicated May 19, 1930

Proc. N.A.S., juillet

**BULLETIN OF THE ASTRONOMICAL INSTITUTES
OF THE NETHERLANDS.**

1930 May 26

Volume V.

No. 185.

COMMUNICATION FROM THE OBSERVATORY AT LEIDEN.

B.A.N., mai

On the magnitudes, diameters and distances of the extragalactic nebulae, and their apparent radial velocities, by *W. de Sitter*.

UN UNIVERS HOMOGÈNE DE MASSE CONSTANTE ET DE RAYON CROISSANT,
RENDANT COMPTE
DE LA VITESSE RADIALE DES NÉBULEUSES EXTRA-GALACTIQUES

Note de M. l'Abbé G. LEMAITRE

Utilisant les 42 nébuleuses figurant dans les listes de Hubble et de Strömberg ⁽¹⁾, et tenant compte de la vitesse propre du soleil (300 Km. dans la direction $\alpha = 315^\circ$, $\delta = 62^\circ$), on trouve une distance moyenne de 0,95 millions de parsecs et une vitesse radiale de 600 Km./sec, soit 625 Km./sec à 10^6 parsecs ⁽²⁾.

Nous adopterons donc

$$\frac{R'}{R} = \frac{v}{rc} = \frac{625 \times 10^5}{10^6 \times 3,08 \times 10^{18} \times 3 \times 10^{10}} = 0,68 \times 10^{-27} \text{ cm}^{-1} \quad (24)$$

tion des nuées de Magellan serait sans influence sur le resultat.

⁽²⁾ En ne donnant pas de poids aux observations, on trouverait 670 Km./sec à $1,16 \times 10^6$ parsecs, 575 Km./sec à 10^6 parsecs. Certains auteurs ont cherché à mettre en évidence la relation entre v et r et n'ont obtenu qu'une très faible corrélation entre ces deux grandeurs. L'erreur dans la détermination des distances individuelles est du même ordre de grandeur que l'intervalle que couvrent les observations et la vitesse propre des nébuleuses (en toute direction) est grande (300 Km./sec. d'après Strömberg), il semble donc que ces résultats négatifs ne sont ni pour ni contre l'interprétation relativistique de l'effet Doppler. Tout ce que l'imprécision des observations permet de faire est de supposer v proportionnel à r et d'essayer d'éviter une erreur systématique dans la détermination du rapport v/r . Cf. LUNDMARK. The determination of the curvature of space time in de Sitter's world M. N., vol. 84, p. 747, 1924, et STRÖMBERG, l. c.

Mar. 1931. *Homogeneous Universe of Constant Mass.*

483

A Homogeneous Universe of Constant Mass and Increasing Radius accounting for the Radial Velocity of Extra-galactic Nebulae. By Abbé G. Lemaître.

(Translated by permission from "Annales de la Société scientifique de Bruxelles," Tome XLVII, série A, première partie.)

From a discussion of available data, we adopt

$$\frac{R'}{R} = 0,68 \times 10^{-27} \text{ cm}^{-1} \quad . \quad . \quad . \quad (24)$$

THE END OF THE WORLD.

(FROM THE STANDPOINT OF MATHEMATICAL PHYSICS.)

BY PROF. SIR ARTHUR S. EDDINGTON, D.Sc., F.R.S.

If we are not stopped earlier we must come to a time when the matter and energy of the world had the maximum possible organisation. To go back further is impossible. We have come to an abrupt end of space-time—only we generally call it the “beginning”.

I have no philosophical axe to grind in this discussion. Philosophically the notion of a beginning of the present order of Nature is repugnant to me. I am simply stating the dilemma to which our present fundamental conception of physical law leads us. I see no way round it; but whether future develop-

5 janvier
1931

Si cette suggestion est correcte, le commencement du monde est intervenu un peu avant le commencement du temps et de l'espace.

The Beginning of the World from the Point of View of Quantum Theory.

SIR ARTHUR EDDINGTON¹ states that, philosophically, the notion of a beginning of the present order of Nature is repugnant to him. I would rather be inclined to think that the present state of quantum theory suggests a beginning of the world very different from the present order of Nature. Thermodynamical principles from the point of view of quantum theory may be stated as follows: (1) Energy of constant total amount is distributed in discrete quanta. (2) The number of distinct quanta is ever increasing. If we go back in the course of time we must find fewer and fewer quanta, until we find all the energy of the universe packed in a few or even in a unique quantum.

Now, in atomic processes, the notions of space and time are no more than statistical notions; they fade out when applied to individual phenomena involving but a small number of quanta. If the world has begun with a single quantum, the notions of space and time would altogether fail to have any meaning at the beginning; they would only begin to have a sensible meaning when the original quantum had been divided into a sufficient number of quanta. If this suggestion is correct, the beginning of the world happened a little before the beginning of space and time. I think that such a beginning of the world is far enough from the present order of Nature to be not at all repugnant.

9 mai
1931

The Expanding Universe. By Abbé G. Lemaître.

(Communicated by Sir A. S. Eddington.)

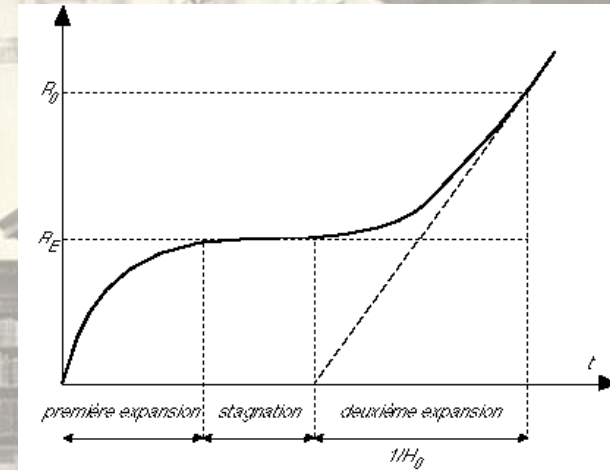
mars 1931

Modèle de Lemaître (1931)

Courbure +

Constante cosmologique $\lambda > \lambda_E$

Expansion décélérée puis accélérée

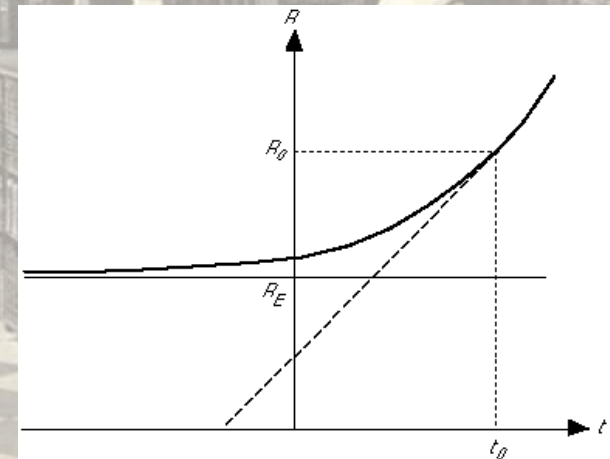


Modèle de Lemaître-Eddington (1927)

Courbure +

Constante cosmologique λ_E

Expansion accélérée



DISCUSSION ON THE EVOLUTION OF THE UNIVERSE.

(SIR JAMES JEANS, F.R.S. ; Prof. E. A. MILNE, M.B.E., F.R.S. ; Prof. W. DE SITTER ; Prof. Sir A. S. EDDINGTON, F.R.S. ; Prof. R. A. MILLIKAN ; Rt. Rev. the LORD BISHOP OF BIRMINGHAM, F.R.S. ; Gen. the Rt. Hon. J. C. SMUTS, P.C., C.H., F.R.S. ; M. L'ABBÉ LEMAITRE ; SIR OLIVER LODGE, F.R.S.)

Held in Section A (*Mathematical and Physical Sciences*)
on Tuesday, September 29, 1931.

Je représenterai l'évolution comme suit : à l'origine, toute la masse de l'univers existait sous la forme d'un unique atome ; le rayon de l'univers relativement petit sans pour autant être nul. L'univers entier fut produit par la désintégration de cet atome primitif.

I would picture the evolution as follows : At the origin, all the mass of the universe would exist in the form of a unique atom ; the radius of the universe, although not strictly zero, being relatively very small. The whole universe would be produced by the disintegration of this primeval atom.

Septembre 1932, Cambridge (USA)



Septembre 1932, Cambridge (USA)

ASTRONOMERS PLAN HARVARD MEETING

First Convention of International
Union Ever Held in United
States to Begin Sept. 2.

EDDINGTON WILL LECTURE

"The Expanding Universe" Will Be
His Topic—Scientists From All
Parts of World to Attend.

CAMBRIDGE, Mass., March 21.—
The first meeting ever to be held
in the United States by the Inter-
national Astronomical Union is an-
nounced by the Harvard College Ob-
servatory for the week beginning
Sept. 2 and ending Sept. 9. The only
public lecture of the session will be
given by Sir Arthur Stanley Edding-
ton, distinguished European astron-
omer, on the subject, "The Expanding
Universe."

SIR ARTHUR EDDINGTON

THE EXPANDING UNIVERSE

"I deal with the view
now tentatively held that
the whole material universe of stars
and galaxies of stars is dispersing;
the galaxies scattering apart
so as to occupy an
ever-increasing
volume."

3/6 NET

CAMBRIDGE UNIVERSITY PRESS

EDDINGTON PICTURES EXPANDING UNIVERSE

British Scientist, in Lecture at
M. I. T., Uses a Balloon to
Illustrate Einstein's Terms.

ABBE LE MAITRE PRESENT

Belgian Priest Hears Theory
Upheld Which He Advanced to
Astronomers Years Ago.

METEOR SPEED MEASURED

Dr. Opik of Estonia Uses "Wabbling
Mirrors" and New Device to Trace
Course of Falling Stars.

By JAMES STOKLEY,
Associate Director of Franklin Insti-
tute Museum of Philadelphia.

Special to THE NEW YORK TIMES.
CAMBRIDGE, Mass., Sept. 7.—The
expanding universe now has a se-
cure place in science, declared Sir
Arthur Eddington, Plumian Profes-