

# Fermi and Astrophysics

## Report on the progress of the edition of the book

Dino Boccaletti<sup>1</sup> Remo Ruffini<sup>2</sup>

The drafting of the book, that will be published by WORLD SCIENTIFIC, is practically finished. It remains to perfect the reproduction of the original papers by Fermi, Gamow, etc. which have been scanned and will be inserted in the book.

The *raison d'être* of this book is to report Fermi's work on relativity, astrophysics, cosmology and related subjects to a large international audience.

Most part of Fermi's work on these topics was published in Italian and on this account largely unknown. Thirteen papers are presented in the book in an English translation. The translations are due to E. Alesci, D. Bini, D. Boccaletti, A. Geralico, S. Mercuri and revised by R. Jantzen.

Seven Fermi's papers in English, four by Gamow et al. and an excerpt of a famous paper by Alpher and Herman are added to complete the picture.

As addenda to Chap. 2 we have inserted a reproduction of a paper (1949) by Kwal and two contributions by Geralico & Ruffini and by Boccaletti on the so called 4/3 problem.

Below we give the contents of the book.

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### Preface

#### 1. Talking about Fermi, General Relativity, Astrophysics and beyond (R. Ruffini)

#### 2. From Fermi's papers of the Italian period (The papers are labeled as in Enrico Fermi: Note e Memorie – Collected papers – Vol. 1, 1961)

##### a) Foreword

##### b) The papers reprinted (in translation)

- 1) E. Fermi: On the Dynamics of a Rigid System of Electric Charges on Translational Motion

*Sulla dinamica di un sistema rigido di cariche elettriche in moto traslatorio* (Nuovo Cimento XXII, 199-207, 1921)

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<sup>1</sup> Retired from Dipartimento di Matematica, La Sapienza, Università di Roma - ICRA

<sup>2</sup> ICRA - Dipartimento di Fisica, La Sapienza, Università di Roma

- 2) E. Fermi: On the Electrostatics of a Homogeneous Gravitational Field and on the Weight of Electromagnetic Masses

*Sull'elettrostatica di un campo gravitazionale uniforme e sul peso delle masse elettromagnetiche* (Nuovo Cimento XXII, 176-188, 1921)

- 3) E. Fermi: On Phenomena occurring close to a World Line

*Sopra i fenomeni che avvengono in vicinanza di una linea oraria* (Rendiconti Accademia Naz. Lincei XXXI, 21-23, 51-52, 101-103, 1922)

- 4c) E. Fermi: Correction of a Contradiction between Electrodynamical and Relativistic Electromagnetic Mass Theories

*Correzione di una contraddizione tra la teoria elettrodinamica e quella relativistica delle masse elettromagnetiche* (Nuovo Cimento XXV, 159-170, 1923)

- 5) E. Fermi: Masses in the Theory of Relativity

*Le masse nella teoria della relatività* - from "I Fondamenti della Relatività Einsteiniana" (Hoepli – Milano, pp. 342-344, 1923)

- 10) E. Fermi, A. Pontremoli: On the mass of the radiation in an empty space

*Sulla radiazione in uno spazio vuoto* (Rend. Lincei, 32-1, 162-164, 1923)

- 12) E. Fermi: The Principle of Adiabatics and the Systems which do not admit Angle Coordinates

*Il principio delle adiabatiche ed i sistemi che non ammettono coordinate angolari* (Nuovo Cimento XXV, 171-175, 1923)

- 13) E. Fermi: Some Theorems of Analytical Mechanics of Great Importance for Quantum Theory

*Alcuni teoremi di meccanica analitica importanti per la teoria dei quanti* (Nuovo Cimento XXV, 271-285, 1923)

- 38b) E. Fermi: A Theorem of Calculation of Probability and some of its Applications

*Un teorema di calcolo delle probabilità ed alcune sue applicazioni* (Thesis, 1922)

- 7) E. Fermi: Formation of Images with Rontgen Rays

*Formazione di immagini coi raggi Röntgen* (Nuovo Cimento XXV, 63-68, 1923)

- 43) E. Fermi: A Statistical Method for the Determination of some Properties of the Atom

*Un metodo statistico per la determinazione di alcune proprietà dell'atomo* (Rendiconti Accademia Naz. Lincei – serie sesta, VI, 602-607, 1927)

80a) E. Fermi: An Attempt at a Theory of Beta Rays

*Tentativo di una teoria dei raggi  $\beta$*  (Nuovo Cimento, 11, 1-19, 1934)

## **APPENDIX A**

A. Geralico, R. Ruffini: On the solution to the “4/3 problem” by Fermi

D. Boccaletti: When a problem is solved too early – Enrico Fermi and the infamous 4/3 problem

## **APPENDIX B**

B. Kwal: Les expressions de l'énergie et de l'impulsion du champ électromagnétique propre de l'électron en mouvement (Le Journal de Physique et le Radium – serie VIII, Tome X, Mars 1949 pagg. 103-104)

### **3. From Fermi's papers of the American period** (The papers are labeled as in Enrico Fermi: Note e Memorie – Collected papers – Vol. 2, 1965)

a) **Foreword**

b) **The papers reprinted**

237) E. Fermi: On the Origin of the Cosmic Radiation (Phys. Rev. 75, 1169 – 1174, 1949)

238) E. Fermi: An Hypothesis on the Origin of the Cosmic Radiation (Nuovo Cimento, suppl. 317- 323, 1949)

265) E. Fermi: Galactic Magnetic Fields and the Origin of Cosmic Radiation (Ap. J. 119, 1-5, 1954)

241) E. Fermi: High Energy Nuclear Events (Progr. Theor. Theoret. Phys. 5, 570 – 583, 1950)

261) S. Chandrasekhar, E. Fermi: Magnetic Fields in Spiral Arms (Ap. J. 118, 113 – 115, 1953)

262) S. Chandrasekhar, E. Fermi: Problems of Gravitational Stability in the Presence of a Magnetic Field (Ap. J. 118, 116 – 141, 1953)

266) E. Fermi, J. Pasta, S. Ulam: Studies of Non-linear Problems (Document LA – 1940, May 1955)

#### **4. Gamow's theory, Fermi and Turkevich calculations and Zel'dovich's zero temperature model**

##### **a) Foreword**

##### **b) The papers reprinted**

- 1) R. A. Alpher, H. Bethe, G. Gamow: The Origin of Chemical Elements (Phys. Rev. 73, 803-804, 1948)
- 2) G. Gamow: The Origin of Elements and the Separation of Galaxies (Phys. Rev. 74, 505-506, 1948)
- 3) G. Gamow: The Role of Turbulence in the Evolution of the Universe (Phys. Rev. 86, 251, 1952)
- 4) G. Gamow: Expanding Universe and the Origin of Galaxies (Det Kongelige Danske Videnskaberne Selskab, vol. 27, n. 10, 1-15, 1953)
- 5) E. Fermi: Theories on the Origins of the Elements (240.3)  
*Teorie sulle origini degli elementi* – translated from “Conferenze di Fisica Atomica – terza conferenza – (Roma, Accademia Nazionale dei Lincei, 1950, pp. 31-45)
- 6) (Fermi – Turkevich): An excerpt from “Theory of the Origin and Relative Abundance Distribution of the Elements” by Ralph A. Alpher and Robert C. Herman (Reviews of Modern Physics, 22, 193-197, 1950)
- 7) Ya. B. Zel'dovich: Prestellar state of matter (Soviet Physics JETP. 16, 1102-1103, 1963)

#### **5. Contributed papers presented at the IX ICRA Network Workshop “Fermi and Astrophysics” (Rome, Pescara, September 2001)**

##### **a) Foreword**

##### **b) A reprint of Vol. 117B, N. 9-11, 2002 of “Il Nuovo Cimento”**