THE INTELLIGIBLE UNIVERSE

An Overview of
the Last Thirteen
Billion Years

2ND EDITION

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the Last Thirteen
Billion Years

2ND EDITION

JULIO A. GONZALO

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To my brothers Bernardo, José, Manuel and Leopoldo, their wives and children.

To our parents, Leónides and Concepción, who are already in the presence of their Creator.

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“The world must be some shape, and it must be that shape and no other; and it is not self-evident that nobody can possibly hit on the right one.”

Gilbert Keith Chesterton,
“**All is grist**”, pp 7–8
(New York: Dodd, Mead, 1932)

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Prologue to 2nd Enlarged Edition

Except for the Second Section of this book (Chapters 7 to 10) in which the “New Inflationary Cosmology” was considered in some detail by distinguished invited speakers (John C. Matter and George F. Smoot) at the Summer Course at El Escorial August 16 to 19, 1993, the rest of it uses basically the standard Friedmann–Lemaître Big Bang Cosmology (with $k < 0$, $\Lambda = 0$) to describe most of the available observational evidence. The question of the reported cosmic acceleration (S. Perlmutter, 1998) which, according to Martin Rees (Spring, 2000), makes the case for a non-zero cosmological constant strong but not overwhelming, is left aside for the time being.

In the First Section (Chapters 1 to 6) the masses, distances and times in the universe are discussed in the perspective of Relativistic Cosmology, among other things. The material is the same as the one included in the first edition of “The Intelligible Universe” (Shanghai Educational Publishing House, 1993).

In the Second Section the English version of two invited lectures given at El Escorial are reproduced. They were presented by John C. Mather (COBE’s Project Scientist and FIRAS Principal Investigator) and George F. Smoot (COBE’s DMR Principal investigator). The Spanish version of these two lectures was published in book form in “Cosmología Astrofísica” (Alianza Universidad: Madrid, 1994) eds. J. A. Gonzalo, J. L. Sánchez Gómez, M. A. Alario. Other distinguished speakers at El Escorial are given bellow:

Professors Ralph A. Alpher (New York), Antonio Fernandez Rañada (Madrid), Jose L. Sánchez Gómez (Madrid), Manuel Catalan Perez-Urquiola (Cadiz), Hans Elsässer (Heidelberg), Julio A. Gonzalo

(Madrid), Stanley L. Jaki (Princeton) author of “God and the Cosmologists” and J. Lejeune (Paris).

As it is well known Jonh C. Mather and Goerge F. Smoot received the 2006 Nobel Prizes in Physics for “their discovery of the blackbody form and anisotropy of the cosmic microwave background radiation”. To say the least, these Nobel Prizes were not unexpected.

The Third Section (“The last thirteen billion years”) summarizes the contents of a book published in Spanish by the UAM (Universidad Autónoma de Madrid) one year after the results given in a paper by N. Cereceda, G. Lifante and Julio A. Gonzalo in “Acta Cosmologica” (Krakow, 1998) anticipating accurately the time elapsed since the Big Bang as (13.7 ± 0.2) billion years.

The Fourth (very short) Section (from Chapter 6 of “Inflationary Cosmology Revisited” World Scientific, 2005) comments on NASA’s WMAP result reporting the first full year accurate observations resulting in $t_0 = (13.7 \pm 0.2) \times 10^9$ years and $H_0 = R_0/R_0 = 67$ km/Mpcsec.

The Fifth Section presets a historical discusion of the medieval roots of contemporary science (physics and astronomy in particular) following the steps of P. Duhem and S. L. Jaki. Not so long ago, for many physicist chemists, mathematicians “the Wisdom of God is manifested in the works of his Creation.”

And the (very short) last Section summarizes some important cosmic numbers before making some relevant concluding remarks.

In summary, the universe is well made by a Wise, and Allpowerful Creator, and man’s intellect, limited as it is, also is well made by Him in His image and likeness. That is the reason why man can find the intelligible Universe after all.

Julio A. Gonzalo
Madrid, 19 March 2007
Festivity of Saint Joseph

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Credits for the illustrations and photos appearing with minor or major modifications in the various chapters of this book have been given whenever possible and useful. In particular, the web pages of NASA (www.nasa.gov) and ESA (www.esa.int/); Shanghai Educational Publishing House (Shanghai, 1993); Harper and Row (New York, 1969); Warner Books (New York, 1980); W. W. Norton & Co. (New York-London, 1978); Alianza Universidad (Madrid, 1995); Ediciones UAM (Madrid, 2002) and Mister Kerry Magruder for the pictures of Copernicus Galileo, Kepler and Tycho.