THE FAR-FUTURE UNIVERSE

Eschatology from a Cosmic Perspective

EDITED BY GEORGE F. R. ELLIS

THE FAR-FUTURE UNIVERSE

Eschatology from a Cosmic Perspective

EDITED BY GEORGE F. R. ELLIS

Published in association with the
Pontifical Academy of Sciences
and the Vatican Observatory

Vatican City

Templeton Foundation Press
PHILADELPHIA AND LONDON

CONTENTS

PREFACE

The present book about events all the way at the end of time grew out of a symposium sponsored by the John Templeton Foundation under the aegis of its Humble Approach Initiative. The initiative is inherently interdisciplinary, sensitive to nuance, biased in favor of building linkages and connections, and promotes risk-taking discussion that leads to the generation of new ideas for writing, teaching, and research. It assumes a willingness to experiment on the part of all participants. Sir John Templeton has said that "humility is a gateway to greater understanding and open[s] the doors to progress" in all endeavors.[1] He believes that in their quest to comprehend ultimate reality, scientists, philosophers, and theologians have much to learn about and from one another. That those who gathered in Rome on 7–9 November 2000 did so in very considerable measure is indicated by the essays in this volume.

Their spirited conversation, chaired by Martin J. Rees, England's astronomer royal, took place in the Casina Pio IV, once a summer residence of Pope Pius IV. In 1922 the villa became the seat of the Pontifical Academy of the Nuovi Lincei, whose origins date to the founding of the Academy of the Lincei, the world's first scientific academy, by Prince Federico Cesi in 1603.[2]

1. John Marks Templeton, *Worldwide Laws of Life* (Radnor, Pa.: Templeton Foundation Press, 1997), 465.

2. As a result of Italy's political travails, there are now two scientific academies whose origins date to Prince Cesi: the Accademia dei Lincei of the Republic of Italy and the Pontifical Academy of the Nuovi Lincei.

Lincei is derived from the Latin word for lynx—the animal believed to have the sharpest vision of all, and the name was chosen because, according to Cesi, science should rely "on the acute observation of nature and its phenomena and on experimental work."[3] Galileo, who conducted his famous experiments with the pendulum on natural accelerated motion in 1602 and eight years later described his observations of the night sky in *Sidereus Nuncius (The Starry Message)*, was one of the academy's earliest members. The influence of his friend, Cesi, just eighteen years old at the founding of the academy and forty-five at his death in 1630, was so great and his lynx-like sight so good with respect to all manner of things that had he not died prematurely, the 1633 trial of the great astronomer and physicist would almost certainly never have occurred in the opinion of many scholars.

The audacious questions suggested by Galileo's astronomical discoveries continue to be debated as today's astronomers and physicists consider whether the universe will still be expanding 100 billion years from now and examine evidence that it may even be speeding up. The scientists, philosophers, and theologians who enjoyed the gracious hospitality of Bishop Marcelo Sanchez, director of the Pontifical Academy of Sciences, while participating in the Templeton symposium, discussed eschatology from a cosmic perspective. As they considered various scenarios for the long-range future, they benefited from the observations of James E. Peebles, Albert Einstein Professor of Science at Princeton University, Vera C. Rubin, senior researcher in the Department of Terrestrial Magnetism at the Carnegie Institution of Washington, and Allan R. Sandage, staff astronomer emeritus at The Observatories of the Carnegie Institution of Washington. Drs. Peebles and Sandage were presented with the inaugural Cosmology Prizes of the Peter Gruber Foundation at a ceremony held in the Vatican at the conclusion of the Far-Future Universe Symposium. It was a festive finale to a probing and provocative exchange of research findings, ideas, and opinions.

The Far-Future Universe: Eschatology from a Cosmic Perspective contains papers written by those at the symposium plus a few others either specially commissioned after the meeting or reprinted with permission from extant works. While some of them place the discussion in a present day scientific

3. Federico Cesi, et. al., *Lynceographi* (Roma, circa 1605), pars VI, particula 17, pp. 241–42. The manuscript is in the Archives Lincei, Pontifical Academy of Sciences, Vatican City.

setting, all of them consider issues that are themselves eternal, whatever the answers to our questions about the far future may turn out to be. My colleagues and I at the Templeton Foundation thank Martin Rees and John Barrow for their help in shaping a dynamic symposium and George Ellis for his thoughtful and patient editing of this volume. All of us connected with the venture are delighted that the Templeton Foundation Press has agreed to make these deliberations available to a wider audience.

Mary Ann Meyers
JANUARY 2002