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Editor

New Horizons

Reconnaissance of the Pluto-Charon System and the Kuiper Belt

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Cover illustration: NASA's New Horizons spacecraft was launched on 2006 January 19, received a gravity assist during a close approach to Jupiter on 2007 February 28, and is now headed for a flyby closest approach 12,500 km from the center of Pluto on 2015 July 14. This artist's depiction shows the spacecraft shortly after passing above Pluto's highly variegated surface, which may have black-streaked surface deposits produced from cryogenic geyser activity, and just before passing into Pluto's shadow when solar and earth occultation experiments will probe Pluto's tenuous, and possibly hazy, atmosphere.
Sunlit crescents of Pluto's moons Charon, Nix, and Hydra are visible in the background. After flying through the Pluto system, the New Horizons spacecraft could be re-targeted towards other Kuiper Belt Objects in an extended mission phase.
This image is based on an original painting by Dan Durda.

Back cover illustration: The New Horizons spacecraft was launched aboard an Atlas 551 rocket from the NASA Kennedy Space Center on 2008 January 19 at 19:00 UT.

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Foreword

New Horizons: Reconnaissance of the Pluto–Charon System and the Kuiper Belt

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Exploration is mankind's imperative. Since the beginnings of civilization, men and women have not been content to build a wall around their settlements and stay within its confines. They explored the land around them, climbed the mountains, and scanned the horizons. The boldest among them pushed exploration to the most distant frontiers of the planet. As a result, much of the Earth was inhabited well before the days of the renowned European explorers of the 15th and 16th centuries. Exploration did not cease, after the circumnavigation of the globe; it continued to the present. Today explorers are going in new directions, not just east and west, north and south. They explore backward in time and upward in space. Archeology explores the shorter time scales, and geochemistry the longer time scales of geophysical events: asteroidal and cometary collisions, magnetic reversals, continental formation and more. However, on Earth we cannot go back indefinitely, for much of the evidence of the very earliest days has been lost.

To go further back in time we must first go up, climb out of the Earth's gravitational potential well, and use our spacecraft to scan new horizons on the surfaces of our planetary neighbors. Like the Earth, these planets are dynamic, evolving spheres, large enough that their interiors have undergone significant thermal evolution. The terrestrial planets, Mercury, Venus, Earth, and Mars have aged the most. The outer gas giants have also changed, and because of their enormous size, most evidence of past processes is difficult to obtain. Fortunately, the smaller planetary bodies in the asteroid belt and those in the furthest reaches of the solar system, the ones that have evolved the least, are accessible with current technology.

To enable bold initiatives such as a flight to the outermost classical planet, Pluto, NASA established the New Frontiers program. This volume describes the first successful response to New Frontiers opportunity. The very appropriately named New Horizons mission, by the year 2020, extends planetary exploration to the Pluto–Charon system and one or two Kuiper Belt objects. Selected in 2000 and launched in 2006, New Horizons is well on its

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way to arrival at Pluto on July 14, 2015, fifty years to the day after the first successful Mars reconnaissance by Mariner 4 in 1965.

This collection of articles describes the New Horizons mission, its spacecraft, instruments and scientific investigations. It begins with a historical overview of the events leading to the New Horizons mission by the Principal Investigator, Alan Stern. This introduction to the mission is followed by a description of the spacecraft by G.H. Fountain and colleagues. A critical aspect of the mission is the Jupiter gravity assist that was essential in speeding the spacecraft on its way to the Pluto–Charon system. The mission design that enabled the gravity assist and the observations to be obtained at Pluto and Charon is described by Y. Guo and R.W. Farquhar. Next H. Weaver and colleagues describe the science payload and L.A. Young and colleagues describe the anticipated scientific investigations. The volume closes with seven articles describing the instruments and investigations. D.C. Reuter et al. discuss Ralph; the visible and infrared imager. S.A. Stern et al. describe the UV imaging spectrograph. A.F. Cheng et al cover the long-range reconnaissance imager, LORRI. G.L. Tyler et al., present the radio science experiment, REX. D.J. McComas et al. describes the solar wind instrument. R.L. McNutt et al. discusses the energetic particle spectrometer science investigation, PEPSSI. Finally M. Horanyi and colleagues describe the Student Dust Counter.

The success of this volume is due to many people; but first of all, the editor wishes to thank the authors who had the difficult job of distilling the thousands of documents and the millions of facts such missions produce, into highly readable articles. The editor also benefited from an excellent group of referees who acted as a test readership, refining the manuscripts provided by the authors. These referees included M. A'Hearn, J.D. Anderson, S. Auer, K. Baines, M. Belton, D. Byrne, M.C. de Sanctis, A. Driesman, A. Fedorov, J. Goldstein, J. Gosling, L. Iess, B. Klecker, E.A. Miller, S. Mottola, B. Perry, B.R. Sandel, D. Seal, S. Solomon, and J. Woch.

Equally important has been the strong support this project has received at Springer and the extra effort expended by Fiona Routley, Randy Cruz and Harry Blom. At UCLA we were skillfully assisted by Marjorie Sowmendran who acted as the interface between the authors, the referees and the publishers.