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Asteroids: New Observations, New Models

Edited by

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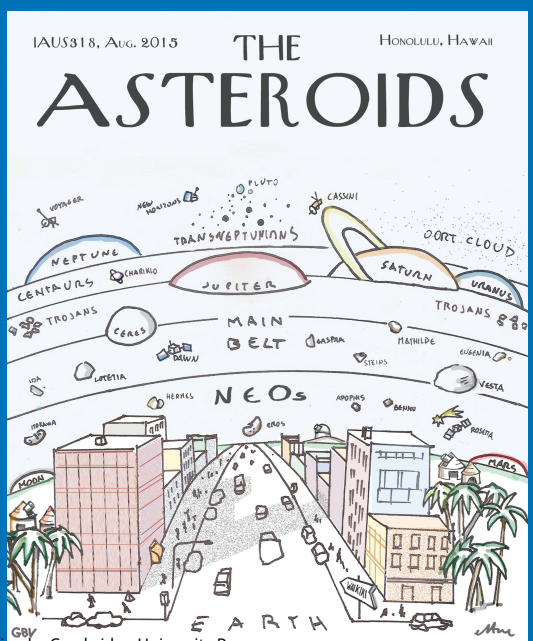

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ASTEROIDS: NEW OBSERVATIONS, NEW MODELS

IAU SYMPOSIUM 318

COVER ILLUSTRATION:
A VIEW OF THE SOLAR SYSTEM FROM HONOLULU

Composed by Ettore Perozzi and conceived by Giovanni B. Valsecchi, this illustration served as the distinctive logo for IAU Symposium 318, held in Honolulu 3-7 August, 2015. The drawing is inspired by the famous "View of the World from 9th Avenue," illustration by Saul Steinberg that served as the cover of the March 29, 1976, edition of *The New Yorker*. As with the original, the cover illustration projects a parochial view, in this case one that emphasizes the tremendous importance of the diminutive asteroids in the realm of the solar system. As this volume amply demonstrates, the asteroids hold a wealth of information—wildly out of proportion to their tiny size—that is vital for decoding the origin of the solar system and understanding the geological and biological history of Earth. Ground-based telescopes are depicted near the horizon and several major exploratory space missions and their target bodies are highlighted, collectively emphasizing the importance of ground-based and space-based astronomical instruments to our understanding of the solar system as a whole, and the asteroids in particular.

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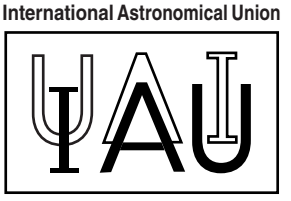

ASTEROIDS: NEW OBSERVATIONS, NEW MODELS

PROCEEDINGS OF THE 318th SYMPOSIUM OF THE INTERNATIONAL ASTRONOMICAL UNION HELD IN HONOLULU, UNITED STATES AUGUST 3–7, 2015

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Preface

Asteroids are the small, usually rocky, bodies that reside primarily in a belt between Mars and Jupiter. Although some of these objects might have formed elsewhere and evolved into the main belt, others have certainly escaped and been scattered throughout the solar system to varying degrees. They carry the signature of the processes that gave birth to the solar system in the way that they are organized, both individually and as a population. Moreover, they are the leftovers of the planetesimals from which the planets formed, and so, in a real sense, the asteroids form the fabric of our solar system. Their observed compositional, structural and dynamical properties permit testing of current theories and facilitate development of new theories regarding the evolutionary processes that brought the solar system to its present state and that continue to act to reshape our planetary neighborhood. Asteroids also inform our understanding of the evolutionary processes taking place in other solar systems at various stages of development across the Milky Way and thus have relevance to diverse cosmogonical fields from circumstellar debris disks to exoplanets.

The main asteroid belt is a lively place where the physical, rotational and orbital properties of asteroids are governed by a complicated interplay of collisions, planetary resonances, radiation forces, and the formation and fission of secondary bodies. At the same time, the main asteroid belt is a "crossroads" in the solar system, connected either genetically or dynamically to a host of other populations of small bodies. Our symposium was oriented by the following core themes and unifying connections that serve to organize both the field and the meeting itself.

Origins. The dynamical structure of the asteroid belt and the physical properties of its constituents serve as a strong constraint on models describing the formation and the evolution of the early solar system.

Collisional Evolution. The collisional evolution of the solar system continues today and is most evident in the asteroid belt that is slowly being turned back into the dust from which it came.

Orbital Evolution. The main asteroid belt is a labyrinth of dynamical resonances intersected with subtle nongravitational forces that both feed and interrupt these resonances. The orbital evolution theories are continually tested and refined as surveys fill in the asteroid catalogs to smaller sizes.

Rotational evolution. Asteroids rotate in various ways, for example with simple rotation, precession or tumbling, and their rotation evolves along different pathways due to a variety of torques. The story of asteroid rotation is complex and still unfolding.

Evolutional Coupling. The collisional, orbital and rotational evolution mentioned so far are individually complex and rich in detail, and yet they are each coupled to the others in ways that make the complete evolutionary picture for asteroids truly fascinating.

Our symposium closed with a Q&A panel session designed to bring data producers and representatives of data processing centers together with the asteroid research community to communicate capabilities and plans, and to understand future data demands. Like many scientific fields, the study of asteroids is at the intersection of computer science and astronomy. Our work is fed by an immense and growing stream of data from systematic asteroids surveys, often operated in conjunction with astrophysical surveys. Such a wealth

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of data represents an exciting challenge to ensure that the data are processed, archived and distributed in a way that maximizes the scientific return.

We thank the members of the Scientific Organizing Committee for their support in organizing the Symposium and in chairing the sessions. We are particularly grateful to the many colleagues who provided timely reviews of the papers presented here, thereby ensuring a volume of high-quality, peer-reviewed papers. We are hopeful that these Proceedings from the first-ever IAU Symposium to focus exclusively on asteroids will serve as a valuable milestone in our field.

Steve Chesley, Alessandro Morbidelli, Robert Jedicke and Davide Farnocchia
November 13, 2015

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CONFERENCE PHOTOGRAPH

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