

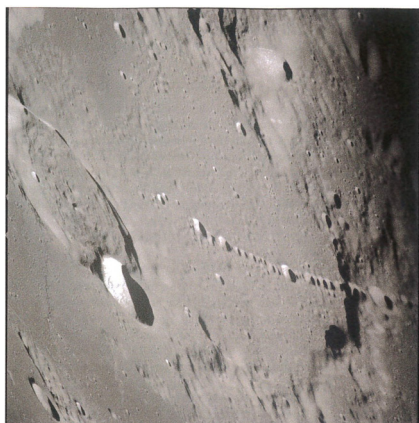
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**Annual Review of Astronomy and Astrophysics, 2018.** S. M. Faber and Ewine van Dishoeck (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 56. xiv + 724 pages. Price: US\$ 112.

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Every year the community of astrophysicists looks forward to this volume of reviews that informs them of the current state of research in a few select fields. These reviews not only try to find the important threads of research in the past years or decades, but often also set the tone for future research in these fields. This makes them valuable not only for the beginners, who may want to familiarize themselves with the past works, but also for the active practitioners, for new insights and ideas for further research. In addition, every volume comes with a memoir of a well-known astrophysicist, whose story of research serves as a resource material for historians, and inspiration for young astronomers.

The review volume for 2018 begins with a memoir by Jaan Einasto, a cosmologist who did most of his research in Estonia. His account gives a rare glimpse into the astrophysical community in the erstwhile USSR, during the height of the cold war. It is interesting to read how scientists there had often thought and worked on ideas that became fashionable in the West later on, but whose names are not remembered in the annals of science because their papers were published in Russian journals. The figure of Yakov Zel'dovich naturally occupies a central place in the narrative, and Einasto describes a number of radical shifts in the cosmological ideas during this era, from the introduction of dark matter, to the cosmic web of structure formation.



The Catena Davy on the Moon, as captured in an image (AS12-51-7485) from Apollo 12.

Among the reviews on stellar systems, one on the formation of high mass stars and massive star clusters describes the multiscale nature of the phenomenon, and how recent observational surveys have led to new ideas. It also projects that submillimeter facilities will have a profound effect on this topic in the near future. Another review on globular clusters discusses a very puzzling phenomenon of variation in elemental abundances among stars, for which there has not been any satisfactory explanation.

Planetary astrophysics takes up a major chunk of the book with six extensive reviews. One review on the early solar system discusses the idea of a possible lost ice-giant, whose effect on the outward migration of Neptune could have left signatures on the orbits of Kuiper-belt objects. An interesting implication of this hypothesis is that asteroids probably did not cause the Late Heavy Bombardment, rather the left over planetesimals from the process of terrestrial planet formation were the culprits. Then there is an overview of the new findings from the New Horizons spacecraft, which flew by Pluto and its satellite Charon, and discovered their surface phenomena, as well as uncovered many new dynamical complexities of the Pluto sys-

tem. There is another review on relatively small asteroids, which have sizes between 200 m and 10 km, the so-called rubble pile asteroids. These objects are bound by self-gravity, but they are rather porous. Most of these asteroids are probably the by-products of collisions among the main asteroid belt. A review of disks formed around stars in the early stages of planetary formation discusses the structure, dynamics, properties of dust and gas and the connection between soon-to-be-formed planets and these disks. Lastly, there is a review on the models of formations of ‘hot jupiters’ – massive planets close to stars.

The topic of diffuse gas in the galaxies, called the interstellar medium, occupies a central part in modern astrophysics. One review in this volume brings out the details of microstructures in this diffuse gas, with length scales as small as thousand times the distance between Sun and Neptune. These tiny structures may have important roles to play in the energy budget and dynamics of the interstellar gas, and may be created by stellar processes, such as supernovae and winds. Another review on dust in the interstellar medium of nearby galaxies. The topic of dust grains embedded in gas is a complicated one, involving many different fields such as solid state physics, plasma physics and so on. Nearby galaxies are important in the study of cosmic dust, after Milky Way, because they allow astronomers to study dust in a variety of environments. The review discusses various observational diagnostics and how they constrain the microphysics of dust grains, and then discuss the overall evolution of dust in the universe and connect it to the evolution of other structures in the universe.

There are three reviews on different aspects of galaxies. The review on the connection between galaxies and their dark matter halos discusses the new findings from galaxy surveys. These studies have revealed some hitherto unknown properties of galaxies. For example, the fact that galaxies with the mass of Milky

Way hold a pivotal role in the universe – they are the ones with the largest fraction of stars (compared to the total mass). This is being called the ‘golden mass’ of galaxies in the universe. Lower and higher mass galaxies than Milky Way have smaller fraction of stars – a fact for which astrophysicists would have find an explanation. Another review on the bulge of the Milky Way – a spheroidal distribution of rather old stars around the central region, especially the chemical and dynamical history of its stars, points out the difficulties in modelling the system. It appears that the bulge stars formed within a relatively short timescale of about 2 billion years, but it has been difficult to come up with satisfactory models that can connect the bulge in the cosmological framework. The third review discusses active galactic nuclei that are obscured by dust grains. As revealed from the articles in this volume, dust grains in different environments – from planet formation to gas between galaxies to active galaxies – have become a major topic of research in astrophysics.

In comparison, cosmology is represented by a single review on weak lensing. The shapes of background galaxies are distorted by the variation of mass distribution in the universe, and this technique has been used to constrain cosmological models of the universe. The review discusses the difficulties involved in interpreting the data, and how they can be overcome in the near future.

Modern telescopes use adaptive optics in order to avoid the blurring caused by our atmosphere. Two reviews on this topic discuss various new techniques that have been developed and are being developed to broaden the capabilities of telescopes.

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