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A Review of: "The data book of astronomy"

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Book Review

THE DATA BOOK OF ASTRONOMY

by Patrick Moore

Institute of Physics Publishing, Bristol and Philadelphia, 2000, 529 pp.

(Received January 23, 2001)

Patrick Moore is a well-known astronomer and popularizer of science. He is the author of over 100 books and presents Britain's longest running television series, *The Sky at Night*, which has been running for 43 years. He is a famous scientist in the fields of lunar and planetary astronomy, as well as spacecraft exploration.

This book not only contains current data collected by spacecraft but also gives a lot of information seldom cited in scientific literature on the Moon and the Sun, the planets and stars, our Galaxy and numerous other galaxies. It also reveals the latest scientific discoveries about black holes, quasars and the origin of the Universe. The book is extremely useful for amateurs and young scientists wishing to widen their awareness and knowledge of current trends in science.

The content of the book resembles that of *A Handbook of Amateur of Astronomy* by P.G. Kulikovskiy (Nauka, Moscow, 1971) but, naturally, surpasses it, since it contains an encyclopedic quantity of up-to-date material.

The book is not a standard collection of astronomical information. Hoping to attract the greatest possible range of readers, we have decided to present the book's content in detail.

The first part of the book is devoted to the Sun and the Solar System. Chapter 1, 'The Solar System' (3 pp.) discusses the main characteristics of the Solar System as a whole, gives a short description of its development and summarizes and defines the morphological structures on the surfaces of planets and satellites. These data are very useful for anyone who has an interest in planets.

Chapter 2, 'The Sun' (23 pp.) begins with a table giving numerical parameters of the Sun together with discussions of astronomical unit (a.u.) estimation, the study of solar rotation and the determination of the Solar Constant. The author describes the detection and main characteristics of sunspots, spicules, and flares. The story of the discovery of solar activity is also related. A table gives sunspot maxima and

minima for the period 1718–1999. The author describes the solar spectrum and radiation and discusses helioseismology. A table of solar cosmic missions between 1959 and 1998 is presented. The author gives a short description of the structure of the solar atmosphere and the detection and observation of solar winds by spacecrafts. Rather a long passage is devoted to the description of solar eclipses: several tables of total, partial, and annular eclipses are presented and there is a separate list of eclipses which may be seen in Britain. The chapter closes with a rather brief essay on solar evolution. In general, the chapter is devoted to phenomenological solar characteristics and should be very interesting for non-specialists. The presentation doesn't aim to be complete, but is nevertheless quite informative.

Chapter 3, 'The Moon' (47 pp.) is the longest in the whole book (excluding the Star Catalogue in Chapter 29). This definitely reflects the main interest of the author. As well as tables of lunar parameters, a table of legendary names of the full Moon for every month is given. The author cites historical anecdotes and legends connected with Moon, which will undoubtedly give pleasure to the reader. The problems of lunar rotation and its connection with the distance between the Earth and the Moon are described concisely, as are the problems of the Moon's origin and the possible existence of minor Earth satellites. The story of mapping the Moon and its surface features, its geology and cosmic missions to the Moon are described. Some information on the lunar atmosphere and tables of lunar eclipses (1960–2019) are given. A substantial part of the chapter is occupied by a very informative catalog of lunar surface features. In addition to coordinates, it contains brief information on objects and an explanation of the origin of crater names (although these can sometimes be disputed). The catalog of lunar craters looks at selected craters for the near and far sides of Moon. Unfortunately, the principle of crater selection is not described. Outline maps are given for both hemispheres of the Moon; besides, the near side is represented by four quadrant photomaps with names of objects.

Chapters 4–7 and 9–13 are dedicated to the planets: 'Mercury' (12 pp.), 'Venus' (13 pp), 'Earth' (4 pp.), 'Mars' (28 pp.), 'Jupiter' (24 pp.), 'Saturn' (17 pp.), 'Uranus' (16 pp.), 'Neptune' (11 pp.), and 'Pluto' (7 pp.). Each chapter is structured in the same way, featuring fundamental data, motion, maps, atmosphere, internal structure and magnetic field, rotation, satellites, surface features and very high quality photomaps. If a planet has been explored by spacecrafts, the table of missions to it is given and the results of researches are briefly described.

The chapters on the giant planets contain subdivisions touching upon satellites and rings. These subdivisions follow the same structure as the chapters on the planets. For the Earth, the author describes briefly the geological periods, the structure of the atmosphere and the magnetosphere. For Mars, together with description of spacecraft exploration, he describes in some detail the history of Earth-based observation. At the end of the chapter on 'Mars', the author tells the story of his conversation with I.S. Shklovsky, when he asked Shklovsky about his paper on hollow Phobos. Shklovsky replied that his original paper has been nothing more than a practical joke.

Chapter 8, 'The Minor Planets' (17 pp.) begins with the story of the discovery of the planets. The author tabulates the physical characteristics of the first four

asteroids, the orbital and physical parameters of the first hundred asteroids and some of their peculiarities. The classification of asteroids according to their orbits (Main Belt, Near-Earth Asteroids, Trojans, Centaurs, Kuiper Belt Objects) and their physical types is described. The largest asteroids are discussed separately. A special subdivision is devoted to the potential danger of asteroids (a list of selected potentially hazardous asteroids is given). As in other chapters, the author pays particular attention to the results of spacecraft studies of asteroids.

In Chapter 14, 'Comets' (18 pp.) after looking at fears and legends connected with comets, the author gives some information on the nature of comets, their nomenclature, and their structure. He presents tables of short-periodical and lost comets, of comets approaching the Earth, and predicted returns of comets with periods of over 25 years. A relatively long passage is devoted to Halley's Comet, and the study of comets with spacecrafts. The bright comets are described separately. Short lists of periodic and sun-grazing comets are also given. The chapter is completed with table of 140 periodic comets and remarks on the origin of comets and life in them.

Chapter 15, 'Meteors' (5 pp.) contains information on the discovery of meteors and early theories about their nature. Tables of principal and minor meteor showers are given.

Chapter 16, 'Meteorites' (7 pp.) summarizes the study of meteorites, and looks at the isotopic methods of determining their age and classifying them. The author mentions the theory that the disappearance of dinosaurs may be connected with the Chicxulub crater in the Gulf of Mexico. Lists of the largest meteorites are given, including a separate list of British ones. Brilliant fireballs, the Tunguska Fall, impact craters, micrometeorites and tektites are briefly described. A table of terrestrial meteorite craters is presented.

Chapter 17, 'Glows and Atmospheric Effects' (5 pp.) is the last of the chapters devoted to the Solar System. It mainly concerns the effects of aurorae in the Earth's atmosphere. The author describes briefly the study of aurorae: he discusses their structure and their connection with sunspots, their form and brilliance, their classification, auroral noise, the airglow and zodiacal light.

On the whole, the description of the Solar System occupies about half of the book. The second part of book is devoted to galactic astronomy – to stars and their subdivision, star clusters, nebulae, our Galaxy and other galaxies, the evolution of stars and the Universe as a whole.

Chapter 18, 'The Stars' (5 pp.) gives general information on the stars' distances (parallaxes), stellar motions, and radial velocities. Lists are given of the nearest stars, the brightest stars in the past and future, and the stars which change constellations because of their high proper motions. The list of the current brightest stars (i.e. those brighter than 1^m4) contains the names of the objects, stellar apparent magnitudes, luminosities, spectra, and distances in light-years. The given data are taken from the Cambridge catalog (*Sky Catalogue 2000*).

Chapter 19, 'Stellar Spectra and Evolution' (12 pp.) contains a short explanation of stellar spectral classification, and a description of the Hertzsprung–Russell (HR) diagram. The following characteristics of the main stellar spectral types are

tabulated: stellar surface temperature, description of spectra and examples of stars for each of tabulated spectral type. In two further tables the stellar luminosity classes and additional spectral classification parameters are given. The author devotes the main part of the chapter a picture of stellar evolution and a brief history of the problem. Along the way, he touches on the problem of stellar populations, the birth and death of stars with different masses, and describes the current concept of neutron stars, pulsars and black holes. This short description of such complicated subjects is quite popular.

Chapter 20, 'Extra-solar Planets' (4 pp.) concerns the possible existence of other planetary systems in the Galaxy. At first, the difference between planets and brown dwarfs is considered. The author describes efforts to detect planets around a number of stars (even around pulsars) by means of various methods, and gives a selected list of apparently existing extra-solar planets. To end, he reminds us of Frank Drake's method of estimating mathematically the number of communicative civilizations in our Galaxy.

In Chapter 21, 'Double Stars' (5 pp.) the author divides double stars into two types: optical pairs and binaries (spectroscopic, astrometric, and eclipsing binaries) and points out that the binaries are much more frequent than the optical pairs. He briefly discusses double star observations, and enumerates several double star catalogs, including the 'Hipparcos astrometric satellite catalog'. A list of 100 prominent double stars is presented, and a very short explanation of the origin of binary systems is given.

In Chapter 22, 'Variable Stars' (15 pp.) the author considers seven major types of variable stars: eclipsing stars, pulsating, eruptive, cataclysmic, rotating and X-ray variables, and unclassifiable stars. In corresponding tables for each type and its subdivisions he gives the accepted abbreviated denominations and rather detailed descriptions of the type and its example stars. Of special interest are his descriptions and explanations of nova, Galactic and extragalactic supernova phenomena. Lists of bright variable stars, naked-eye novae, selected recurrent novae, and Galactic supernovae are supplied too.

In Chapter 23, 'Stellar Clusters' (9 pp.) the author first gives a short description of how stellar clusters and similar phenomena are cataloged, then presents two lists of such objects. The lists include the familiar astronomical nicknames, short descriptions of the objects and the names of their discoverers. The well-known Messier and Caldwell Catalogs are included too. All these catalogs include objects of quite different kinds: diffuse Galactic nebulae, planetary nebulae, and even other galaxies. Finally, the author describes the brightest examples of open and globular stellar clusters, touches upon the question of their difference and origin, and gives a list of the 35 brightest clusters.

Chapter 24, 'Nebulae' (3 pp.) contains concise but important information on planetary and diffuse nebula phenomena and mentions the best known objects. Unfortunately, the material on planetary nebulae seems to be quite incomplete. The diffuse nebulae are subdivided into three main types: emission nebulae (HII-regions), reflection nebulae, and absorption, or dark nebulae. The author touches briefly on the questions of star formation in Giant Molecular Clouds, protostars

(globulas), T Tauri stars, and so on. He also gives a selected list of prominent diffuse nebulae.

In Chapter 25, 'The Galaxy' (3 pp.) the author describes briefly the general structure and composition of our Galaxy (disk, bulge, halo, Populations I and II, interstellar matter). He also describes the history of investigations of the Galaxy, including some modern discoveries. Still, it must be noted that the author could spare little more than two pages for description of our stellar system (the Galaxy)!

Chapter 26, 'Galaxies' (6 pp.) concerns external stellar systems (i.e. other galaxies). Galactic discovery and their explanation is discussed. The author describes the subdivision of galaxies into spirals (Sa, Sb, and Sc), barred spirals (SBa, SBb and SBc), and elliptical systems. He describes active galaxies, their active nuclei, radio-galaxies, starburst galaxies, Seyfert galaxies, quasars and BL Lacerta objects, and blazars. He describes quasar detection, and gives an explanation of what they are and how they are studied (including the method which uses the 'gravitational lens' effect). At the same time, the author warns against making hasty conclusions about the solution of such problems! He discusses Hubble's 'tuning fork' diagram for galactic subdivisions and concludes that our knowledge of galactic evolution is still very incomplete. He describes the galactic clusters and, in particular, the Local Group of galaxies. A selected list of the Local Group system with the main characteristics of its members is given in a table. A description of our nearest galaxies (LMC, SMC, M31 – members of Local Group) and of some other galactic clusters is given too. The author touches upon the effect of galactical receding, the expansion of the Universe, and the problem of the 'Hubble constant'. The author quotes a few individual cases of the effect of collisions between galaxies.

In Chapter 27, 'The Evolution of the Universe' (3 pp.), the author gives a short description of the development of theories on the evolution of the Universe. He touches on the concept of the 'Big Bang' and subjects connected with it, looks at the problem of 'dark matter', and considers problems of the open, closed and flat Universe. Modern observations on these questions are mentioned. The author concludes that our present knowledge of the evolution of the Universe is very incomplete, no theory can explain the initial appearance of the matter, and therefore we can study only the development of the Universe instead of explaining its origin.

Chapter 28, 'The Constellations' (5 pp.) describes the appearance of the idea of patterned constellations and its changes over time. A list of 88 constellations now in use is presented in a table; 48 of them date from the time of Ptolemy. A list of constellations rejected in the past is given too. Post-Ptolemaic constellations are added, together with the names of their founders.

Chapter 29, 'The Star Catalogue' (133 pp.) is the largest chapter in the whole book. The catalog, compiled from various sources, contains bright astronomical objects which can be observed with modest telescopes. It is arranged according to stellar constellations given in alphabetical order. For constellations, the following information is given as well as short description: brightest stars (down to 4^m75), variable and double stars, open and globular clusters, planetary and diffuse nebulae, and galaxies. The catalog gives the main data for the objects: their coordinates

(R.A. and Dec. for 2000.0), magnitudes, luminosities or absolute magnitudes (if they are known), spectra, distances (in light-years), dimensions for extended objects, types of objects, and other useful data. The catalog also provides excellent finding charts for each constellation, making it especially useful for observations. The author notes that his list does not pretend to be complete; nevertheless, this catalog will be of interest not only to amateurs, but to specialists also.

Chapter 30, 'Telescopes and Observatories' (10 pp.) gives a short history of observatory foundations. A list of 145 large, modern observatories with their names and locations is given in the table. There is also a description of planetaria as educational devices. The author gives a short history of telescope building, including modern telescopes and the Hubble Space Telescope. A list of the 66 largest ground-based optical telescopes (reflectors, refractors and Schmidt telescopes) and their locations is tabulated.

In Chapter 31, 'Non-optical Astronomy' (8 pp.) the author gives an account of modern methods of astronomical study in all wavelengths – from long radio waves to very short gamma-rays. He describes the following branches of astronomy: cosmic-ray, gamma-ray, X-ray, ultra-violet, infra-red, microwave, and radio astronomy. He gives a short history of their development and outlines the main results obtained to date, especially by spacecrafts and satellites (IUE, IRAS, HST and others). One table gives a selected list of X-ray satellites; another lists famous radio observatories.

Chapter 32, 'The History of Astronomy' (10 pp.) gives a wide survey of astronomical research. After a short introduction concerning advances made by ancient astronomy (Mesopotamian, Egyptian, Chinese, Indian, Arabian and Grecian) the author presents in chronological order the important dates in the history of astronomy from Copernicus up to the year 2000. The history of space research is also discussed in chronological order, up to the present date.

In Chapter 33, 'Astronomers' (19 pp.) the author offers a list of 268 famous astronomers and space researchers from history, with short biographical notes.

The book closes with useful glossary.

One of the main characteristics of this book is the extensive range of problems discussed – from the smallest particles and minor planets to the infinite Universe! Even the most complicated questions are discussed briefly and clearly. Of course, the book is rather subjective, as it reflects the author's own scientific interests – the Solar System and space research. Therefore, information on classical astronomical objects, our Galaxy, stellar populations, stellar spectra, nebulae, and other galaxies seems to be rather scant. One can also find some contradictions in the data, if one compares the different chapters. The text contains several misprints, in particular, in astronomers' names and some terms.

As a whole, the book is not just another boring textbook. It is an involving work by a very erudite man, a world famous expert in current knowledge of Solar System. Although this is not too honest, we do feel that the choice of subjects and anecdotes distinctly reflect the author's own interests. It would be unreasonable to expect this book to cover all the topics in their entity (especially where non-cosmic research is concerned) but it does give a good contemporary picture of our Solar System and Universe, without going into unnecessary details or splitting hairs.

The book will be very useful and accessible for amateurs, and could also be helpful to professional astronomers. There are no references, but at the beginning of the book there is the list of websites offering further information.

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