OpenStax Astronomy 2e

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Transition Guide

Astronomy was revised to increase currency and accuracy in order to continue fostering meaningful and memorable student learning experiences. Based on extensive and valuable feedback from the community, the author team retained the book structure and sequence while enhancing and updating the narrative and examples. To make the transition between the first and second editions as seamless as possible, we undertook significant effort to retain the order (numbering) of chapters, sections, problems, and related elements. (Note that due to newly added images, many figure numbers have changed.)

The following overall and chapter-by-chapter lists of changes are designed to aid faculty in their incorporation of the new material. Additional changes – often relatively minor edits regarding errata – have been made over the course of the first edition's publication; while most of those improvements are not listed below, they have been carried into the second edition

Overall Changes

- Direct links to the Web have been revised and updated throughout the book
    - These include links to astronomy software apps and other visualizations, particularly those that previously relied on Flash. Links and suggestions for new apps have also been added for student exploration and enjoyment.
- New images have been added to show recently acquired planetary vistas
- New figures have been added when there have been new discoveries, such as the much wider range of known gravitational-wave events
- Statistics have been updated on topics such as the number of known moons in the solar system, the numbers of exoplanets of different types, the number of black-hole mergers we have observed, and so on.
- In several sections, the authors have clarified that the origin of the elements is now more accurately understood. For example, more of the heavier elements are attributed to the results of neutron star collisions.

Chapter Changes

Chapter 6: Astronomical Instruments

- Added the launch of the James Webb Space Telescope
- Discussed the collapse of the Arecibo Radio Dish and the building of the largest radio dish in China
- Brief preview of the Vera Rubin Observatory
- Added information on the threat of satellite swarms to a box and to the resources at chapter's end

Chapter 7: Other Worlds: An Introduction to the Solar System

- Updated solar system statistics

Chapter 9: Cratered Worlds: The Moon and Mercury

- Mentioned alternate idea about the origin of Mercury

Chapter 10: Earth-Like Planets: Venus and Mars

- Results added from the Mars Insight and Perseverance/Ingenuity Missions
- Image and caption added from the Chinese Mars lander and Zhurong rover
- A reference to the location of the film *The Martian*

Chapter 11: The Giant Planets

- Text and image added from the Juno Mission to Jupiter
- Brief discussion of Juno observations of the Great Red Spot

Chapter 12: Rings, Moons, and Pluto

- Brief updates on plans for the Europa Clipper mission and the Titan Dragonfly mission
- Updated information on the Sputnik depression and glaciers on Pluto

Chapter 13: Comets and Asteroids: Debris of the Solar System

- Added information on Hayubusa-2 mission to the asteroid Ryugu, and OSIRIS-Rex to asteroid Bennu
- Preview of the DART mission
- Updated information on the number of asteroids visited by spacecraft
- Updated statistics on the numbers of known Earth-crossing asteroids
- Updated the information on the number of known Jupiter impact events
- Added information on Oumuamua and 2I/Borisov, interstellar visitors to our solar system
- Discussion of the object previously known as "Ultima Thule" and now named "Arrokoth"

Chapter 15: The Sun: The Star that Really Matters

- Added spectacular close-up image of a sunspot from the Daniel Inouye Solar Telescope

Chapter 16: The Sun: A Nuclear Powerhouse

- Updated with the Borexino neutrino experiment results

Chapter 17: Analyzing Starlight

- Updated information on the number of Type Y brown dwarfs known

Chapter 19: Celestial Distances

- Added information about the Gaia mission and what it is doing

Chapter 21: The Birth of Stars and the Discovery of Planets Outside the Solar System

- Updated numbers and statistics on exoplanet discoveries
- Discussion of the end of the Kepler mission
- Included information on the TESS mission and its first discoveries

Chapter 23: The Death of Stars

- Updated information on observations of gamma-ray bursts

Chapter 24: Black Holes and Curved Spacetime

- A new section on gravitational wave observations with the advanced LIGO and VIRGO instruments
- Updates on the observations of gravitational wave events, with the most recent numbers and discoveries
- A new figure summarizing what we learn from gravitational wave observations of black hole mergers

Chapter 26: Galaxies

- Added a footnote about the IAU recommendation that it would be more fair to call the Hubble Law the Hubble-Lemaitre law

Chapter 27: Active Galaxies, Quasars and Giant Black Holes

- Added the Event Horizon Telescope image of the black hole in M87

Chapter 28: The Evolution and Distribution of Galaxies

- Updated the predicted time of the Milky Way-Andromeda collision

Chapter 30: Life in the Universe

- Added the concept of a “technosignature” a broader idea than just radio signals.
- Added information about the Breakthrough: Listen project

Appendix B: Astronomy Websites, Images, and Apps

- Corrected many links and updated information

Appendix F: Physical and Orbital Data for the Planets

- Updated with new numbers

Appendix I: The Nearest Stars, Brown Dwarfs, White Dwarfs

- Updated with the nearby brown dwarfs that have been recently identified