

## Astronomy Release Notes 2018

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8 (1196 TO 2014)

### Errata:

Location	Detail	Resolution Notes	Error Type
Ch 1: Science and the Universe : A Brief Tour, Sec 6: A Tour of the Universe	Where it says "not because the astronomers were thinking slowly", I believe it should say "astronauts" rather than "astronomers".	Revise "This was not because the astronomers were thinking slowly" to "This was not because the astronauts were thinking slowly".	Other factual inaccuracy in content
Ch 2: Observing the Sky: The Birth of Astronomy, Sec 1: The Sky Above	On page 36, there is the phrase "... called the ecliptic (figure 2.5)." However, figure 2.5 has nothing to do with the ecliptic. The ecliptic is illustrated in figure 2.6. The content of figure 2.5 is discussed earlier on page 34 without reference to the figure.	Update figure references.	Typo
Ch 2: Observing the Sky: The Birth of Astronomy, For Further Exploration	Galileo's Battle for the Heavens: <a href="https://www.youtube.com/watch?v=VnEH9rbrlkk">https://www.youtube.com/watch?v=VnEH9rbrlkk</a> A NOVA episode on PBS (1:48:55)  This video no longer is available so this link probably shouldn't be in the textbook anymore	Revise the URL to <a href="https://www.youtube.com/watch?v=jv1r2iMWQyc">https://www.youtube.com/watch?v=jv1r2iMWQyc</a> .	Broken link
Ch 4: Earth, Moon, and Sky, Sec 2: The Seasons, Figure 4.8	I would suggest revising Fig. 4.9 so the earth is tilted the same sense as in 4.8, and show the sunlight coming from the right.  One of the persistent misconceptions for students is that the earth's axis tilt changes through the year. Aside from the long-term precession, I would suggest emphasizing its fixed orientation over a year.  If this change were made, I suggest noting it explicitly in the text (sunlight from opposite side since earth is on opposite side of its orbit around the	Revise Figure 4.9 as suggested.	General/pedagogical suggestion or question

	Sun).		
Ch 4: Earth, Moon, and Sky, Sec 3: Keeping Time, Subsec: Mean Solar Time and Standard Time	Section 4.3, subsection "Mean Solar Time and Standard Time", paragraph 5, second sentence, change to: "Also, China officially uses only one time zone, so all the clocks in this vast country keep the same time." (So we eliminate the mention of Russia, which is not doing this anymore!)	Revise the 2nd sentence to "Also, China officially uses only one time zone, so all the clocks in that country keep the same time."	General/pe dagogical suggestion or question
Ch 4: Earth, Moon, and Sky, Sec 4: The Calendar	<p>The end of page 117: The lunar month is defined as the time for the moon to complete one cycle of phases, about 29.5306 days.</p> <p>Page 123: The solar month is defined as the time interval in which the phases repeat, about 29.5306 days.</p> <p>Since the textbook is defining these two terms as exactly the same length of time, it would be helpful to the student to explicitly state that these terms are synonyms.</p> <p>If these terms are not synonyms, then the appropriate corrections are needed.</p>	In the 2nd paragraph, revise "lunar month" to "month".	General/pe dagogical suggestion or question
Ch 5: Radiatio n and Spectra, Sec 2: The Electrom agnetic Spectru m	<p><a href="https://openstax.org//30elmagsp1">https://openstax.org//30elmagsp1</a></p> <p>Update to: <a href="https://science.nasa.gov/ems/01_intro">https://science.nasa.gov/ems/01_intro</a></p>	Update URL for ( <a href="https://openstax.org//30elmagsp1">https://openstax.org//30elmagsp1</a> ) to: <a href="https://science.nasa.gov/ems/01_intro">https://science.nasa.gov/ems/01_intro</a> .	Broken link
Ch 5: Radiatio n and Spectra, Sec 2: The Electrom agnetic Spectru m, Figure 5.8	<p>Figure 3 of section 5.2 needs to have the temperature labels corrected. For example, the grey box in this section demonstrates that a blackbody peaking at 1200nm corresponds to a temperature of 2500K, however, the figure labels the orange curve that peaks at 1200nm as 3000K.</p> <p>From the bottom to the top, the temperature labels should be: 2500 K, 3400K, 4400 K, and 5500 K.</p> <p>Customer service ticket #18594</p>	Revise Figure 5.8 as suggested.	Typo
Ch 5: Radiatio n and Spectra,	The following link needs a new target: ( <a href="https://openstax.org//30elmagsp1">https://openstax.org//30elmagsp1</a> )	Revise the URL for <a href="https://openstax.org//30elmagsp1">https://openstax.org//30elmagsp1</a> to: <a href="https://science.nasa.gov/ems/01_intro">https://science.nasa.gov/ems/01_intro</a>	Broken link

Sec 2: The Electromagnetic Spectrum			
Ch 5: Radiation and Spectra, Sec 6: The Doppler Effect, Figure 5.22	Figure 5.22 on page 178 in the textbook: The caption for Panel (B) states that wave crest 1 was emitted when the source was at position S4. I believe this should state that wave crest 1 was emitted when the source was at position S1.	Revise the 3rd sentence of the caption as follows: "Wave crest 1 was emitted when the source was at position S1, crest 2 at position S2, and so forth."	Typo
Ch 7: Other Worlds: An Introduction to the Solar System, Sec 3: Dating Planetary Surfaces	The following link needs a new target: ( <a href="https://openstaxcollege.org/l/30billnyevideo">https://openstaxcollege.org/l/30billnyevideo</a> )	Revise URL for <a href="https://openstaxcollege.org/l/30billnyevideo">https://openstaxcollege.org/l/30billnyevideo</a> to: <a href="https://www.sciencechannel.com/tv-shows/greatest-discoveries/videos/radiometric-dating">https://www.sciencechannel.com/tv-shows/greatest-discoveries/videos/radiometric-dating</a>	Broken link
Ch 7: Other Worlds: An Introduction to the Solar System, For Further Exploration	This link ( <a href="http://www.planetary.org/explore/space-topics/compare/">http://www.planetary.org/explore/space-topics/compare/</a> ) under websites is broken	Revise the URL to: <a href="http://www.planetary.org/explore/space-topics/">http://www.planetary.org/explore/space-topics/</a>	Broken link
Ch 8: Earth as a Planet, Sec 4: Life, Chemical Evolution, and Climate Change	Chapter 8, section 8.4, subsection "Evolution of the Earth's Atmosphere", paragraph 2, last line: Correct "Tthis" and make it "This"	Revise "Tthis" to "This".	Typo
Ch 9: Cratered Worlds, Sec 1: General Properties of the Moon	The following link needs a new target: ( <a href="https://openstax.org/l/30greatmoonhoax">https://openstax.org/l/30greatmoonhoax</a> )	Revise the URL for <a href="https://openstax.org/l/30greatmoonhoax">https://openstax.org/l/30greatmoonhoax</a> to: <a href="https://www.smithsonianmag.com/smithsonian-institution/great-moon-hoax-was-simply-sign-its-time-180955761/">https://www.smithsonianmag.com/smithsonian-institution/great-moon-hoax-was-simply-sign-its-time-180955761/</a>	Broken link

Ch 9: Cratered Worlds, Sec 5: Mercury, Figure 9.24	The caption of this picture talks about the scarps on the surface of Mercury. In the last sentence, the phrase "plank's surface" should be replaced by "Mercury's surface".	In the caption, revise "plank's" to "planet's".	Typo
Ch 9: Cratered Worlds, Sec 5: Mercury, Subsec: Composi tion and Structure	In section 9.5, subsection "Composition and Structure", first sentence, please change "one-eighth" to "one-eighteenth"	Revise the 1st sentence of subsection Composition and Structure to: "Mercury's mass is one-eighteenth that of Earth, making it the smallest terrestrial planet."	Typo
Ch 10: Earthlike Planets: Venus and Mars, Section: Water and Life on Mars, Subsecti on: Atmosph ere and Clouds on Mars	Chapter 10, p. 360, the last line above the header The Polar Caps: the temperature in degrees Celsius needs a minus sign, so it reads: about 150 K or about -125 degrees C) - Andy Fraknoi	Our reviewers accepted this change.	Typo
Ch 10: Earthlike Planets: Venus and Mars, Section: Water and Life on Mars, Subsecti on: The Polar Caps	Chapter 10, p. 362, first line: Controllers knew that is should be Controllers knew that it - Andrew Fraknoi	Our reviewers accepted this change.	Typo
Ch 10: Earthlike Planets: Venus and Mars, Sec 5: Water and Life on Mars, Figure 10.30	In Section 10.5, rename sub-section on "Ancient Lakes" to "Ancient Lakes and Glaciers". Then add a short paragraph at the end: "Even today there is evidence of large quantities of ice just below the surface of Mars. In the mid-latitudes, high-resolution photos from orbit have revealed glaciers covered with dirt and dust. In some cliffs, the ice is observed directly (see Figure). These glaciers are thought to have formed during warm periods, when the atmospheric pressure was greater and snow and ice could precipitate. They	Rename subsection "Ancient Lakes" to "Ancient Lakes and Glaciers".  Add a paragraph before Figure 10.30 as follows:  Even today there is evidence of large quantities of ice just below the surface of Mars. In the mid-latitudes, high-resolution photos from orbit have revealed glaciers covered with dirt and dust. In some cliffs, the ice is observed directly (see Figure 10.30c). These glaciers are thought to have formed during warm periods, when the atmospheric pressure was greater and snow and ice could precipitate. They also suggest readily available	General/pe dagogical suggestion or question

	<p>also suggest readily available frozen water that could support future human exploration of the planet.” If possible, add the following photo: <a href="https://photojournal.jpl.nasa.gov/catalog/PIA22077">https://photojournal.jpl.nasa.gov/catalog/PIA22077</a> Caption: Ice bands a hundred meters tall are visible in blue in a cliff-face on Mars, suggesting large deposits of frozen water buried just a few meters below the surface. Note that the blue color has been exaggerated in this photo, taken by the Mars Reconnaissance Orbiter...</p>	<p>frozen water that could support future human exploration of the planet.</p> <p>Update Figure 10.30, and revise the caption to add a part c as follows:</p> <p>Figure 10.30 Gale Crater and Underground Ice Deposits. (a) This scene... formed. (c) Ice bands a hundred meters tall are visible in blue in a cliff-face on Mars, suggesting large deposits of frozen water buried just a few meters below the surface. Note that the blue color has been exaggerated in this photo, taken by the Mars Reconnaissance Orbiter spacecraft. (credit a: modification of work by NASA/JPL-Caltech/MSSS; credit b: modification of work by NASA/JPL-Caltech/MSSS; credit c: modification of work by NASA/JPL-Caltech/UA/USGS)</p>	
<p>Ch 11: The Giant Planets, Sec 1: Exploring the Outer Planets, Subsec: Enter the Orbiters</p>	<p>1) Change title of subsection to “Enter the Orbiters: Galileo, Cassini, and Juno” 2) Paragraph 1, change sentence 3 to: “For Jupiter and Saturn, these orbiters have been the Galileo, Cassini, and Juno spacecraft.” 3) Paragraph 3, change reference to Figure 11.3 to Figure 11.3a. 4) At the end of the section, update the text. 5) Add Figure 11.3b next to the current 11.3: <a href="https://photojournal.jpl.nasa.gov/catalog/PIA21382">https://photojournal.jpl.nasa.gov/catalog/PIA21382</a> 6) Change the Fig. 11.3 caption to: Figure 11.3. Galileo Probe and Juno Image of Jupiter’s South Pole. a) [same as current caption] b) This Juno image, taken in 2017 from about 100,000 km above the cloudtops, shows the south polar region of Jupiter with its dramatic complex of storms and clouds. The enhanced-color image was processed for NASA/JPL by citizen scientist John Landino.</p>	<p>Revise subsection "Enter the Orbiters: Galileo and Cassini" to "Enter the Orbiters: Galileo, Cassini, and Juno".</p> <p>Revise the 3rd sentence to "For Jupiter and Saturn, these orbiters were the Galileo, Cassini, and Juno spacecraft."</p> <p>Revise reference to Figure 11.3 in the 3rd paragraph to Figure 11.3a.</p> <p>Update Figure 11.3, and revise caption as follows: Galileo Probe and Juno Image of Jupiter’s South Pole. (a) This artist’s depiction shows the Galileo probe descending into the clouds via parachute just after the protective heat shield separated. The probe made its measurements of Jupiter’s atmosphere on December 7, 1995. (b) This Juno image, taken in 2017 from about 100,000 kilometers above the cloudtops, shows the south polar region of Jupiter with its dramatic complex of storms and clouds. The enhanced-color image was processed for NASA/JPL by citizen scientist John Landino. (credit a: modification of work by NASA/Ames Research Center; credit b: modification of work by NASA/JPL-Caltech/SwRI/MSSS/John Landino)</p> <p>At the end of the section, add the following paragraphs:</p> <p>The Voyager and Galileo missions to Jupiter were primarily designed to study the moons and the atmosphere of the planet. The next NASA mission, an orbiter called Juno, arrived at Jupiter in July 2016. In order to meet its objectives of studying the jovian magnetosphere, it has a very elongated (eccentric) 55-day orbit, that takes it from 4 thousand kilometers above the cloud tops out to 76 thousand kilometers. The orbit takes the craft over Jupiter’s poles, giving us remarkable close-ups of the polar regions (previous spacecraft viewed the planet from lower latitudes).</p>	<p>General/pe dagogical suggestion or question</p>

		Juno was originally designed without a camera, but fortunately scientists rectified this omission, adding a simple downward-looking color camera to use during close passes by Jupiter. Recognizing the value of such images, both scientific and artistic, it was decided to post the raw images and encourage “citizen scientists” to process them. The product has been many dramatic, brightly colored views of Jupiter, such as Figure 11.3b.	
Chapter 12 (Rings, Moons, and Pluto): Ring and Moon Systems Introduced, paragraph before figure 1	e' in 'retrograde' unitalicized	put e within emph tags	Typo
Ch 12: Rings, Moons, and Pluto, Introduction	<p>In Chapter 12, section 1 (Ring and Moon System Introduced) there is a sentence in the first section (Learning Objectives). The sentence is at the end of the second full paragraph and the last line before the picture Moons of the Solar System.</p> <p>"(Perhaps the fact that they were not born locally will excuse their ill-mannered behavior.)"</p> <p>While I understand this is meant as a joke, currently this is a very politically inclined statement, intentionally or not, and is very offensive to many of my students as well as myself.</p> <p>This statement should be removed from the book.</p> <p>Thank you.</p>	Our reviewers accepted this change.	None
Ch 12: Rings, Moons, and Pluto, For Further Exploration	This link ( <a href="https://www.youtube.com/watch?v=RJ8EErV6-6Q">https://www.youtube.com/watch?v=RJ8EErV6-6Q</a> ) under videos is not available	Remove the broken URL.	Broken link
Ch 13: Comets and Asteroids : Debris	<p>Revised paragraph 11, on Ceres:</p> <p>Ceres has not had a comparable history of giant impacts, so its surface is covered with craters that look more like</p>	<p>Revise the paragraph after Figure 13.11 as follows:</p> <p>Ceres has not had a comparable history of giant impacts, so its surface is covered with craters that look more like those from the lunar highlands. One</p>	General/pedagogical suggestion or question

<p>of the Solar System, Sec 1: Asteroids , Subsec: Asteroids Up Close</p>	<p>those from the lunar highlands. One big surprise at Ceres is the presence of very bright white spots, associated primarily with the central peaks of large craters (Figure 13.12a). The light-colored mineral is primarily salt, released from the interior. After repeated close flybys, data from the NASA Dawn spacecraft indicated that Ceres has (or has had) a subsurface ocean of water, with occasional eruptions on the surface. The most dramatic is the 4-km-tall ice volcano called Ahuna Mons (see Figure 13.12b). Add a Figure b next to the current Fig. 13.12: It should come from: <a href="https://photojournal.jpl.nasa.gov/catalog/PIA20348">https://photojournal.jpl.nasa.gov/catalog/PIA20348</a> (crop as shown below.) Caption: Ahuna Mons is an isolated mountain on Ceres, 4 km high. It is thought to be an intrusion of ice from the interior. (Work by NASA/JPL-Caltech/UCLA/MPS/DLR/IDA/PSI)</p>	<p>big surprise at Ceres is the presence of very bright white spots, associated primarily with the central peaks of large craters (Figure 13.12a). The light-colored mineral is primarily salt, released from the interior. After repeated close flybys, data from the NASA Dawn spacecraft indicated that Ceres has (or has had) a subsurface ocean of water, with occasional eruptions on the surface. The most dramatic is the 4 kilometer tall ice volcano called Ahuna Mons (see Figure 13.12b).  Revise the caption for Figure 13.12 as follows: White Spots in a Larger Crater on Ceres. (a) These bright features appear to be salt deposits in a Ceres crater called Occator, which is 92 kilometers across. (b) Ahuna Mons is an isolated mountain on Ceres, 4 kilometers high. It is thought to be an intrusion of ice from the interior. (credit a: modification of work by NASA/JPL-Caltech/UCLA/MPS/DLR/IDA; credit b: modification of work by NASA/JPL-Caltech/UCLA/MPS/DLR/IDA/PSI)</p>	
<p>Ch 13: Comets and Asteroids : Debris of the Solar System, Sec 1: Asteroids , Subsec: Discover y and Orbits of the Asteroids</p>	<p>add new material at the end of the section  In late 2017, something entirely new was discovered: an interstellar asteroid...  If possible, add a new Figure 13.3: <a href="https://www.eso.org/public/images/eso1737a/">https://www.eso.org/public/images/eso1737a/</a>  Figure caption: An artist rendering of 'Oumuamua. It was not close enough to Earth to be imaged, but its long slender shape was indicated by its rapid variation in brightness as it rotated. (Work from ESO/M. Kornmesser)</p>	<p>After Figure 13.14, add the following two paragraphs, followed by a link to learning (URL is <a href="https://www.eso.org/public/usa/images/eso1737a/">https://www.eso.org/public/usa/images/eso1737a/</a>):  In late 2017, something entirely new was discovered: an interstellar asteroid. This visitor was found at a distance of 33 million kilometers with a survey telescope on Haleakala, Hawaii. As astronomers followed up on the discovery, it quickly became apparent that this asteroid was travelling far too fast to be part of the Sun's family. Its orbit is a hyperbola, and when discovered it was already rapidly leaving the inner solar system. Although it was too distant for imaging by even large telescopes, its size and shape could be estimated from its brightness and rapid light fluctuations. It is highly elongated, with an approximately cylindrical shape. The nominal dimensions are about 200 meters in length and only 35 meters across, the most extreme of any natural object. Large objects, like planets and moons, are pulled by their own gravity into roughly spherical shapes, and even small asteroids and comets (often described as "potato-shaped") rarely have irregularities of more than a factor of two.  This asteroid was named 'Oumuamua, a Hawaiian word meaning "scout" or "first to reach out." In a way, the discovery of an interstellar asteroid or comet was not unexpected. Early in solar system history, before the planet orbits sorted themselves into stable, non-intersecting paths all in the same plane, we estimate that quite a lot of mass was ejected, either whole planets or more numerous smaller fragments. Even today, an occasional comet coming in from the outer edges of the solar system can have its orbit changed by gravitational interaction with Jupiter and the Sun, and some of</p>	<p>General/pe dagogical suggestion or question</p>

		<p>these escape on hyperbolic trajectories. As we have recently learned that planetary systems are common, the question became: where are similar debris objects ejected from other planetary systems? Now we have found one, and improved surveys will soon add others to this category.</p> <p>[Link to Learning] View an artist's rendering of the asteroid 'Oumuamua (<a href="https://www.openstax.org/l/30/oumuamua">https://www.openstax.org/l/30/oumuamua</a>) by the ESO. Although it was not close enough to Earth to be imaged, its long slender shape was indicated by its rapid variation in brightness as it rotated.</p> <p>[Link to Learning]</p>	
Ch. 13.3 Appearance of Comets	<p>"A comet is a are relatively small..."</p> <p>Should be "A comet is a relatively small..." or "Comets are relatively small..."</p>	Our reviewers accepted this change.	Typo
Ch 13: Comets and Asteroids : Debris of the Solar System, Sec 4: The Origin and Fate of Comets and Related Objects	<p>in paragraph 2, which star the "The short period", in that first sentence please REMOVE the parenthesis that says "such as Halley".</p> <p>subsection "Early Evolution of the Planetary System", paragraph 2, sentence 3, in the parenthesis, again remove "Halley". So the parenthesis should now be "(such as Hyakutake and Hale-Bopp)"</p>	<p>In Subsec: The Kuiper Belt and the Oort Cloud, delete "(such as Halley)".</p> <p>In Subsec: Early Evolution of the Planetary System, revise "(Halley, Hyakutake, Hale-Bopp)" to "(such as Hyakutake and Hale-Bopp)".</p>	Other factual inaccuracy in content
Ch 14: Cosmic Samples and the Origin of the Solar System, Sec 2: Meteorite s: Stones from Heaven, Subsec: Ages and Composi tions of Meteorite s	paragraph 2, line 2, change "uncertainly" to "uncertainty"	Revise "uncertainly" to "uncertainty".	Typo
Ch 16: The Sun: A Nuclear	<p>the second sentence of the caption: Change "The photon usually has a..." to "The resulting photon usually has a..."</p>	In the caption, revise "The photon" to "The resulting photon".	General/pe dagogical suggestion or question

Powerhouse, Figure 16.13			
Ch 16: The Sun: A Nuclear Powerhouse, Figuring for Yourself, Exercise 37	In OSX_Astronomy_Ch16_TheSunANuclearPowerhouse.docx  "37. Every second, the Sun converts 4 million tons of matter to energy. How long will it take the Sun to reduce its mass by 1% (the mass of the Sun is 2 1030)? "  missing "kg" before ")".	For exercise 37, add the units "kg" after the mass of the Sun.	Typo
Ch 17: Analyzing Starlight, Sec 4: Using Spectra to Measure Stellar Radius, Composition, and Motion, Figure 17.13	In figure 17.13, the space velocity vector is too long with the given transverse velocity and radial velocity. The space velocity should be the diagonal for the parallelogram made up of the transverse and radial velocities	In Figure 17.13 Space Velocity and Proper Motion, revise the vector for space velocity to be the correct diagonal.	Other factual inaccuracy in content
Ch 18: The Stars: A Celestial Census, Sec 1: A Stellar Census, Subsec: Small is Beautiful	the last line, change "26 light-years" to "21 light-years."	In the last line, revise "26 light-years" to "21 light-years."	Typo
Ch 18: The Stars: A Celestial Census, Sec 4: The H-R Diagram, Subsec: The White Dwarfs	2nd paragraph, starting at the second sentence, we need to change some numbers. Here is the revised text:  A good example of a typical white dwarf is the nearby star 40 Eridani B. Its surface temperature is a relatively hot 12,000 K, but its luminosity is only 1/275 L <sub>Sun</sub> . Calculations show that its radius is only 1.4% of the Sun's, or about the same as that of Earth, and its volume is $2.5 \times 10^{-6}$ that of the Sun. Its mass, however, is 0.57 times the Sun's mass, just a little more than half. To fit such a substantial mass into so tiny a volume, the star's density must be about 210,000 times the density of the Sun, or more than 300,000 g/cm <sup>3</sup> . A teaspoonful of	Revise as follows:  ... Its mass, however, is 0.57 times the Sun's mass, just a little more than half. To fit such a substantial mass into so tiny a volume, the star's density must be about 210,000 times the density of the Sun, or more than 300,000 g/cm <sup>3</sup> . A teaspoonful of this material would have a mass of some 1.6 tons!	None

	this material would have a mass of some 1.6 tons!"		
Ch 19: Celestial Distances, Sec 2: Surveying the Stars, Subsec: The Nearest Stars	Section 19.2, Subsection "The Nearest Stars" 2nd paragraph 2nd and 3rd sentences, change to: Low-mass red M dwarfs make up about 70% of all stars and dominate the census of stars within 10 parsecs (33 light-years) of the Sun. For example, a recent survey of the solar neighborhood counted 357 stars and brown dwarfs within 10 parsecs, and 248...	Revise the paragraph as follows: Proxima Centauri is an example of the most common type of star, and our most common type of stellar neighbor (as we saw in Stars: A Celestial Census.) Low-mass red M dwarfs make up about 70% of all stars and dominate the census of stars within 10 parsecs (33 light-years) of the Sun. For example, a recent survey of the solar neighborhood counted 357 stars and brown dwarfs within 10 parsecs, and 248 of these are red dwarfs. ...	General/pedagogical suggestion or question
Ch 19: Celestial Distances, For Further Exploration	This video link ( <a href="https://www.youtube.com/watch?v=4d8a75fs7KI">https://www.youtube.com/watch?v=4d8a75fs7KI</a> ) under videos is broken.	Revise URL to: <a href="http://www.esa.int/spaceinvideos/Videos/1997/05/Hipparcos_Route_Maps_to_the_Stars_May_97">http://www.esa.int/spaceinvideos/Videos/1997/05/Hipparcos_Route_Maps_to_the_Stars_May_97</a>	Broken link
Ch 19: Celestial Distances, Thought Questions, Exercise 25	Chapter 19: problem 25. When Henrietta Leavitt discovered the period-luminosity relationship, she used cepheid stars that were all located in the Large Magellanic Cloud. Why did she need to use stars in another galaxy and not cepheids located in the Milky Way?  It was the Small Magellanic Cloud as you can see in her 1912 paper, attached.  Thanks, Jack -- Jack C. Straton Associate Professor Physics & University Studies Portland State University Portland, OR, 97207-0751 503-725-5844 straton@pdx.edu	In Exercise 25, revise "Large Magellanic Cloud" to "Small Magellanic Cloud".	Typo
Ch 20: Between the Stars: Gas and Dust in Space, For Further Exploration	This link ( <a href="https://www.youtube.com/watch?v=8No6l0Uc3No">https://www.youtube.com/watch?v=8No6l0Uc3No</a> ) found under videos has been removed	Revise the URL to: <a href="https://www.youtube.com/watch?v=Faz5rgdQSo4">https://www.youtube.com/watch?v=Faz5rgdQSo4</a> .	Broken link
Ch 20: Between the Stars: Gas and Dust in Space, For	This link ( <a href="http://www-ssg.sr.unh.edu/ism/intro.htm">http://www-ssg.sr.unh.edu/ism/intro.htm</a> ) found under websites is broken.	Revise the URL to: <a href="http://www-ssg.sr.unh.edu/ism/">http://www-ssg.sr.unh.edu/ism/</a> .	Broken link

Further Explorati on			
Ch 21: The Birth of Stars and the Discovery of Planets outside the Solar System, Sec 4: Planets beyond the Solar System: Search and Discovery, Subsec: Transiting Planets	<p>In subsection Transiting Planets, add a new paragraph just above Figure 21.20, after the paragraph that ends "...1 day after it began observing.":</p> <p>This failure did not end the mission however. The Kepler telescope continued to observe for two more years, looking for short-period transits in different parts of the sky. A new NASA mission called TESS (Transiting Exoplanet Survey Satellite) will carry out a survey all over the sky of the nearer (and therefore brighter) stars, starting in 2018.</p>	<p>Add the following paragraph before Figure 21.20:</p> <p>However, this failure did not end the mission. The Kepler telescope continued to observe for two more years, looking for short-period transits in different parts of the sky. A new NASA mission called TESS (Transiting Exoplanet Survey Satellite) will carry out a survey all over the sky of the nearer (and therefore brighter) stars, starting in 2018.</p>	General/pe dagogical suggestion or question
Ch 21: The Birth of Stars and the Discovery of Planets outside the Solar System, Sec 5: Exoplanets Everywhere: What We Are Learning, Subsec: Exoplanetary Systems	<p>In subsection on Exoplanetary Systems, replace the final paragraph before the Kepler-62 figure (Fig. 21.26) as follows:</p> <p>By 2018, astronomers gathered data on nearly 3000 such exoplanet systems. Many have only two known planets, but a few have as many as five, and one has 8 (the same number of planets as our own solar system). For the most part, these are very compact systems with most of their planets closer to their star than Mercury is to the Sun. The figure below shows one of the largest exoplanet systems: that of the star called Kepler-62 (Figure 21.26). Our solar system is shown to the same scale, for comparison. (Note that the Kepler-62 planets are drawn with artistic license; we have no detailed images of any exoplanets).</p>	<p>Revise the paragraph before Figure 21.26 as follows:</p> <p>By 2018, astronomers gathered data on nearly 3000 such exoplanet systems. Many have only two known planets, but a few have as many as five, and one has eight (the same number of planets as our own solar system). For the most part, these are very compact systems with most of their planets closer to their star than Mercury is to the Sun. The figure below shows one of the largest exoplanet systems: that of the star called Kepler-62 (Figure 21.26). Our solar system is shown to the same scale, for comparison (note that the Kepler-62 planets are drawn with artistic license; we have no detailed images of any exoplanets).</p>	General/pe dagogical suggestion or question
Ch 22: Stars from Adolescence to Old Age, Sec 2: Star Clusters, Figure 22.5	<p>Caption says numbers give time to reach a black-dotted stage of evolution **after leaving the main sequence**.</p> <p>IMHO these numbers are actually total age of the star at the black-dotted point.</p> <p>Also- Most textbooks give 0.1 Gyr for the time it takes a sun-like star to become a red giant. The numbers in this figure make it more like 4 Gyr.</p>	<p>Revise the caption as follows:</p> <p>...The numbers show how many years each star takes to become a giant. The red line is the zero-age main sequence. While theorists debate the exact number of years shown here, our main point should be clear. The more massive the star, the shorter time it takes for each stage in its life.</p>	Other factual inaccuracy in content
Ch 23: The	<p>Paragraph 2, starting with the 4th sentence, here is the revised text:</p>	<p>Revise as follows:</p> <p>... Thus, they can build up elements that are more</p>	Other factual

<p>Death of Stars, Sec 2: Evolution of Massive Stars: An Explosive Finish, Subsec: The Supernova Giveth and the Supernova Taketh Away</p>	<p>"Thus, they can build up elements that are more massive than iron, possibly including such terrestrial favorites as gold, silver and uranium. Supernovae (and, as we will shortly see, the explosive mergers of neutron stars) are the only candidates we have for places where such heavier atoms can be made. Next time you wear some gold jewelry (or give some to your sweetheart), bear in mind that those gold atoms were forged long ago in these kinds of celestial explosions!"</p>	<p>massive than iron, possibly including such terrestrial favorites as gold, silver and uranium. Supernovae (and, as we will shortly see, the explosive mergers of neutron stars) are the only candidates we have for places where such heavier atoms can be made. Next time you wear some gold jewelry (or give some to your sweetheart), bear in mind that those gold atoms were forged long ago in these kinds of celestial explosions!</p>	<p>inaccuracy in content</p>
<p>Ch 23: The Death of Stars, Sec 3: Supernova Observations, Figure 23.12</p>	<p>Chapter 23, Fig. 23.12, change the first sentence of the caption to read: "These two images show a ring of gas expelled by a red giant star about 30,000 years before the star exploded and was observed as Supernova 1987A."</p>	<p>Revise the first sentence of the caption to "These two images show a ring of gas expelled by a red giant star about 30,000 years before the star exploded and was observed as Supernova 1987A."</p>	<p>General/pedagogical suggestion or question</p>
<p>Ch 23: The Death of Stars, Sec 5: The Evolution of Binary Star Systems, Subsec: Neutron Stars with Companions</p>	<p>4th paragraph, add at the end: "...will actually merge (see section 24.7 for our first observations of such a merger.)"</p>	<p>At the end of the 4th paragraph, add a reference to section 24.7 as follows: "... merge (see Gravitational Wave Astronomy for our first observations of such a merger)."</p>	<p>General/pedagogical suggestion or question</p>
<p>Ch 23: The Death of Stars, Sec 6: The Mystery of the Gamma-Ray Bursts, Subsec: Probing the Universe</p>	<p>Section 23.6, subsection (the last subsection) "Probing the Universe with Gamma-Ray Bursts": last paragraph, change the first sentence to read: So far, the most distant gamma-ray burst found (on April 29, 2009) was in a galaxy with a redshift that corresponds to a remarkable 13.2 billion light years—meaning it happened only 600 million years after the Big Bang itself.</p>	<p>Revise the 1st sentence of the paragraph as follows: So far, the most distant gamma-ray burst found (on April 29, 2009) was in a galaxy with a redshift that corresponds to a remarkable 13.2 billion light years—meaning it happened only 600 million years after the Big Bang itself.</p>	<p>General/pedagogical suggestion or question</p>

with Gamma-Ray Bursts			
Ch 23: The Death of Stars, Sec 6: The Mystery of the Gamma-Ray Bursts, Subsec: Short-Duration Gamma-Ray Bursts	<p>Revise the last two paragraphs: Astronomers identified two observations that would provide more direct evidence. Theoretical calculations indicate that when two neutron stars collide there will be a very special kind of explosion; neutrons stripped from the neutron stars during the violent final phase of the merger will fuse together into heavy elements and then release heat due to radioactivity, producing a short-lived but red supernova sometimes called a kilonova. (The term is used because it is about a thousand times brighter than an ordinary nova, but not quite as "super" as a traditional supernova.) Hubble observations of one short duration gamma-ray burst in 2013 showed suggestive evidence of such a signature, but needed to be confirmed by future observations.</p> <p>The second "smoking gun" is the detection of gravitational waves...</p>	<p>Revise the past two paragraphs as follows:</p> <p>Astronomers identified two observations that would provide more direct evidence. Theoretical calculations indicate that when two neutron stars collide there will be a very special kind of explosion; neutrons stripped from the neutron stars during the violent final phase of the merger will fuse together into heavy elements and then release heat due to radioactivity, producing a short-lived but red supernova sometimes called a kilonova. (The term is used because it is about a thousand times brighter than an ordinary nova, but not quite as "super" as a traditional supernova.) Hubble observations of one short-duration gamma-ray burst in 2013 showed suggestive evidence of such a signature, but needed to be confirmed by future observations.</p> <p>The second "smoking gun" is the detection of gravitational waves. As will be discussed in Black Holes and Curved Spacetime, gravitational waves are ripples in the fabric of spacetime that general relativity predicts should be produced by the acceleration of extremely massive and dense objects—such as two neutron stars or black holes spiraling toward each other and colliding. The construction of instruments to detect gravitational waves is very challenging technically, and gravitational wave astronomy became feasible only in 2015. The first few detected gravitational wave events were produced by mergers of black holes. In 2017, however, gravitational waves were observed from a source that was coincident in time and space with a gamma-ray burst. The source consisted of two objects with the masses of neutron stars. A red supernova was also observed at this location, and the ejected material was rich in heavy elements. This observation not only confirms the theory of the origin of short gamma-ray bursts, but also is a spectacular demonstration of the validity of Einstein's theory of general relativity.</p>	General/pe dagogical suggestion or question
Ch 24: Black Holes and Curved Spacetime, Sec 5: Black Holes	The following link needs a new target: ( <a href="https://openstax.org/l/30dischatidfor">https://openstax.org/l/30dischatidfor</a> )	<p>Revise the URL for <a href="https://openstax.org/l/30dischatidfor">https://openstax.org/l/30dischatidfor</a> to: <a href="https://www.discovery.com/tv-shows/discovery-presents/videos/birth-of-a-black-hole">https://www.discovery.com/tv-shows/discovery-presents/videos/birth-of-a-black-hole</a></p> <p>Revise text as follows: An overview of black holes is given in this Discovery Channel Video (<a href="https://openstax.org/l/30dischatidfor">https://openstax.org/l/30dischatidfor</a>) excerpt.</p>	Broken link
Ch 24: Black Holes and Curved Spacetime	In Section 24.7, subsection "Direct Observations": Paragraph 7, which starts "In the cataclysm": In the second sentence, change the number 50 to 10.	Revise to "this event produced power about 10 times the power produced by..."	Other factual inaccuracy in content

e, Sec 7: Gravitational Wave Astronomy, Subsec: Direct Observations			
Ch 24: Black Holes and Curved Spacetime, Sec 7: Gravitational Wave Astronomy, Subsec: Direct Observations	Please replace everything after paragraph 8 (which starts: "This detection by LIGO (and....") with updated text.	Update section as appropriate.	General/pedagogical suggestion or question
25.1, p.897 of .pdf, and p.899 of text	Following Fig 25.8, Spelling of "Galaxy v. Glaxy". "One thing that helped enormously was the discovery that our Galaxy is not unique in its characteristics."	Fixed typo.	Typo
Ch 25: The Milky Way Galaxy, Sec 1: The Architecture of the Galaxy, Figure 25.5	Figure 25.5 (p. 896) is not consistent with Figure 25.10 (p. 25.10). Specifically, what is labelled the "Carina" Arm in Figure 25.5 is labelled the "Scutum-Centaurus Arm" or "Sagittarius Arm" in Figure 25.10.  My guess is Figure 25.5 is an older diagram, and Figure 25.10 an improvement upon it? As it stands, it's going to be confusing to students.	Remove label "Carina" from Figure 25.5 Schematic Representation of the Galaxy.	Other factual inaccuracy in content
Ch 25: The Milky Way Galaxy, Sec 1: The Architecture of the Galaxy, Subsec: Disks and Haloes	In Section 25.1, subsection "Disks and Haloes", paragraph 2, change the text to read: Figure 25.5 sketches what we would see if we could view the Galaxy face-on and edge-on. The brightest part of the Galaxy consists of a thin, circular, rotating disk of stars distributed across a region about 100,000 light-years in diameter and about 2000 light-years thick. (Given how thin the disk is, perhaps a CD is a more appropriate analogy than a wheel.) The very youngest stars, and the dust and gas from which stars form, are found typically within 100 light-years of the plane of the Milky Way Galaxy. The	Revise as follows:  Figure 25.5 sketches what we would see if we could view the Galaxy face-on and edge-on. The brightest part of the Galaxy consists of a thin, circular, rotating disk of stars distributed across a region about 100,000 light-years in diameter and about 2000 light-years thick. (Given how thin the disk is, perhaps a CD is a more appropriate analogy than a wheel.) The very youngest stars, and the dust and gas from which stars form, are found typically within 100 light-years of the plane of the Milky Way Galaxy. The mass of the interstellar matter is...	General/pedagogical suggestion or question

	mass if the interstellar matter is ...[the rest of the paragraph continues the way it is currently]		
Ch 25: The Milky Way Galaxy, Sec 6: The Formation of the Galaxy, Figure 25.25	Caption should state that these pictures are artist's conceptions, simulations, or photographs of objects other than MW and And. Believe me students do not get this.	Revise the 3rd sentence of the caption as follows: "These computer-simulated images show..."	General/pedagogical suggestion or question
Ch 25: The Milky Way Galaxy, Sec 6: The Formation of the Galaxy, Subsec: Collision Victims and the Multiple Mergers Model	In Section 25.6, subsection "Collision Victims and the Multiple Mergers Model", paragraph 2, change the first sentence and add a second sentence as follows: The Sagittarius galaxy is much smaller than the Milky Way and is about 10,000 less massive than our Galaxy. All of the stars in the Sagittarius dwarf galaxy seem destined to end up in the bulge and halo of the Milky Way. But don't sound... [the rest of the paragraph continues the way it is currently]	Revise the beginning of the paragraph as follows: The Sagittarius galaxy is much smaller than the Milky Way, and is about 10,000 times less massive than our Galaxy. All of the stars in the Sagittarius dwarf galaxy seem destined to end up in the bulge and halo of the Milky Way. But don't sound...	General/pedagogical suggestion or question
Ch 26: Galaxies, Introduction, Figure 26.1	Caption must identify the different sources of the two images and describe the difference in color coding.	Add the following sentence at the end of the caption as follows: "In the right-hand image, the x-rays coming from this galaxy are shown in purple, which has been added to other colors showing visible light. (Credit left: ..."	Other factual inaccuracy in content
Ch 26: Galaxies, Sec 1: The Discovery of Galaxies, Voyagers in Astronomy feature box	I am writing to note a small erratum in one of the profiles of an astronomer - Edwin Hubble. I mention it because it is one that might have students scratching their heads, as follows: on page 932, first paragraph, the text says Hubble was offered a job "at the soon-to-be-completed 5-meter telescope..." shortly before joining the US military efforts toward the end of WWI. In the third paragraph, same page, the text says "Hubble was instrumental ... in the planning and building of the 2.5-meter telescope on Palomar Mountain...". Someone has inadvertently swapped the two sizes - the smaller telescope, Mount Wilson's 2.5-m or 100 inch scope, came first (and coincidentally just celebrated its 100th anniversary of first light last Wednesday night, with a gathering in the closed dome, due to oppressive clouds clinging to the	Switch the 2.5 meter telescope and the 5 meter telescope so that the 2.5 meter telescope is mentioned first.	Typo

	mountain). -- Paula C. Turner Professor of Physics Kenyon College		
Ch 26: Galaxies, For Further Explorati on	This link ( <a href="https://www.youtube.com/watch?v=HY_YgangrkZg">https://www.youtube.com/watch?v=HY_YgangrkZg</a> ) under videos no longer works because it's been blocked on copyright grounds	Revise the URL and text as follows: Galaxies: <a href="https://www.youtube.com/watch?v=l82ADyJC7wE">https://www.youtube.com/watch?v=l82ADyJC7wE</a> . An introduction.	Broken link
Ch 27: Active Galaxies, Quasars, and Superma ssive Black Holes	This link ( <a href="https://www.youtube.com/watch?v=Y_HgsFmwCeg">https://www.youtube.com/watch?v=Y_HgsFmwCeg</a> ) under videos doesn't work because the video has been taken down	Revise the URL to: <a href="https://vimeo.com/21079798">https://vimeo.com/21079798</a> .	Broken link
Ch 28: The Evolution and Distributi on of Galaxies, Sec 1: Observat ions of Distant Galaxies	Chapter 28, End of Chapter Summary for Section 28.1 in the second sentence, change "five percent" to "four percent"	In the summary for 28.1, revise "only about five percent as old" to "only about four percent as old".	General/pe dagogical suggestion or question
Ch 28: The Evolution and Distributi on of Galaxies, Sec 1: Observat ions of Distant Galaxies, Subsec: A Changin g Universe of Galaxies	Section 28.1, subsection "A Changing Universe of Galaxies", paragraph 6 (the one right after Fig. 28.5) change the beginning text to: It's not just the shapes that are different. Nearly all the galaxies with red-shifts that correspond to 11 billion light-years or more—that is, galaxies that we are seeing when they were less than 3 billion years old—are extremely blue,...	Revise the beginning of the paragraph as follows: It's not just the shapes that are different. Nearly all the galaxies with red-shifts that correspond to 11 billion light-years or more—that is, galaxies that we are seeing when they were less than 3 billion years old—are extremely blue...	General/pe dagogical suggestion or question
Ch 28: The Evolution and Distributi on of Galaxies, Sec 1: Observat	Section 28.1, the caption for Fig. 28.3 needs changing: This image was made with the Hubble Space Telescope and shows the field around a luminous galaxy at a redshift $z = 8.68$ , which corresponds to 13.2 billion light years. This means that we are seeing this galaxy as it appeared about 13.2 billion years ago. The galaxy itself is indicated	Revise the beginning of the caption as follows:  This image was made with the Hubble Space Telescope and shows the field around a luminous galaxy at a redshift $z = 8.68$ , which corresponds to 13.2 billion light years. This means that we are seeing this galaxy as it appeared about 13.2 billion years ago. The galaxy itself is indicated by the arrow. Long exposures...	General/pe dagogical suggestion or question

ions of Distant Galaxies, Figure 28.3	by the arrow....		
Ch 28: The Evolution and Distribution of Galaxies, Sec 1: Observations of Distant Galaxies	In Section 28.1, paragraph 6, last sentence, change the part of the sentence after the dash to read: ..more than 2 trillion (2000 billion) galaxies in the observable universe, each with about 100 billion stars.	Revise to "more than 2 trillion (2000 billion) galaxies in the observable universe...".	Typo
28.2, Fig 28.7	In Fig 28.7 the reference "(e)" is used twice. Change the second "(e)ARP 148..." to (f).	Fixed typo.	Typo
Ch 28: The Evolution and Distribution of Galaxies, Sec 3: The Distribution of Galaxies in Space, Subsec: The Local Group	Section 28.3, subsection "The Local Group", 1st paragraph, sentence 3 change "contains more than 54 members" to "contains 60 or so members".	Revise "contains more than 54 members" to "contains 60 or so members".	General/pedagogical suggestion or question
Ch 28: The Evolution and Distribution of Galaxies, Sec 3: The Distribution of Galaxies in Space, Subsec: Neighboring Groups and Clusters	Section 28.3, subsection "Neighboring Groups and Clusters", paragraph 3, change the beginning to: A good example of a cluster that is much larger than the Virgo complex is the Coma cluster, with a diameter of at least 10 million light-years (Figure 28.16). A little over 300 million light-years distant, this cluster is centered on two giant ellipticals whose luminosities equal about 400 billion Suns each. change the entry "Total Mass in Milky Way" to read "Mass in Milky Way within 80,000 light-years of the center"	Revise the 2nd sentence of the paragraph as follows: A little over 300 million light-years distant, this cluster is centered on two giant ellipticals whose luminosities equal about 400 billion Suns each.	General/pedagogical suggestion or question
Ch 28: The Evolution and	Section 28.4, Table 28.1, change the entry "Total Mass in Milky Way" to read "Mass in Milky Way within 80,000 light-years of the center"	In Table 28.1, revise the 4th row in the 1st column to "Mass in Milky Way within 80,000 light-years of the center".	General/pedagogical suggestion or question

Distribution of Galaxies, Sec 4: The Challenge of Dark Matter, Table 28.1			
Ch 28: The Evolution and Distribution of Galaxies, Key Terms	Chapter 28 Review, key terms The definitions of cold and hot dark matter contradict themselves, unless you eliminate "and that make most of the mass of galaxies...". Instead you could say that scientists are discussing which of the two is the major constituent of them. Change: Drop the phrase "and that make up most of the mass of galaxies and galaxy clusters" from the definitions of hot and cold dark matter.	Remove the phrase "and that make up most of the mass of galaxies and galaxy clusters" from the definitions of "cold dark matter" and "hot dark matter".	Other factual inaccuracy in content
Ch 29: The Big Bang, Sec 4: The Cosmic Microwave Background	Top of page 1064, "According to Wien's law, which relates wavelength and temperature, the expansion has correspondingly lowered the temperature by a factor of 1000 (see the chapter on Radiation and Spectra)." ADD after the last sentence, "The CMB is almost a perfect blackbody spectrum (Planck spectrum)."	Add the following sentence: "According to Wien's law, which relates wavelength and temperature, the expansion has correspondingly lowered the temperature by a factor of 1000 (see the chapter on Radiation and Spectra). The cosmic background behaves like a blackbody and should therefore have a spectrum that obeys Wien's Law."	General/pedagogical suggestion or question
Ch 35: The Milky Way Galaxy, Sec 3: The Mass of the Galaxy, Figure 25.13	1. blue Keplerian curve starts at 15kpc = 50 kLY, not 30 kLY as implied in caption. 2. Not a good idea to have axis labels in kpc and caption language in kLY.	In the caption, revise "30,000" to "50,000".	Other factual inaccuracy in content
Appendix H: Future Total Eclipses	This link ( <a href="http://home.cc.umanitoba.ca/~jander/">http://home.cc.umanitoba.ca/~jander/</a> ) under Additional Resources doesn't work	Revise the URL to: <a href="http://eclipsophile.com/total-solar-eclipses/total-solar-eclipse-2017-august-21/">http://eclipsophile.com/total-solar-eclipses/total-solar-eclipse-2017-august-21/</a> .	Broken link