

Multicultural Astronomy Resource Guide

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The teaching of astronomy often ignores, sidesteps or downplays the contributions of non-European and non-U.S. cultures. Few educators (formal or informal) receive much training in this area and often stick to what they know best, even when an increasing number of their students or listeners might be from cultures beyond those familiar to them. This collection of resources about other cultures and astronomy makes no claim to be comprehensive, but is designed to introduce materials that can be used both by educators and their students as well as public audiences. We include published and web-based materials, videos and, when available, classroom activities. While we have divided the guide by culture, for those just beginning their investigation, some of the general resources in the last section may be the best place to start.

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1. Astronomy of African-American and Hispanic-American Cultures

Published Materials:

Bedini, Silvio *The Life of Benjamin Banneker: The First African-American Man of Science*, 2nd ed. 2009, Maryland Historical Society.

Ferris, Jeri *What Are You Figuring Now?: A Story about Benjamin Banneker*. 1988, Carolrhoda Books. Children's book about 18th century black astronomer, mathematician, surveyor.

Price, J., et al. "American Minorities in Astronomy: Some Gains, A Long Way to Go" in *Mercury (the magazine of the Astronomical Society of the Pacific)*, May/June 1995, p. 11. Multi-author report, with some poignant anecdotal notes.

Rall, Gloria "The Stars of Freedom" in *Sky & Telescope*, Feb. 1995, p. 36. On how slaves used songs with the Big Dipper to show them escape routes from the South.

Stassun, Keivan "Building Bridges to Diversity" in *Mercury*, May/June 2005, p. 20. The Chair of the Committee on the Status on Minorities in Astronomy for the American Astronomical Society discusses what could be done to increase the number of minority astronomers.

"Have Minorities Broken Astronomy's Glass Ceiling" -- a roundtable in *Astronomy* magazine, May 2003, pp. 55-58.

Websites and Online Articles:

Follow the Drinking Gourd Educator's Guide (about how slaves used a song about the Big Dipper to find their way North in the U.S.; note however, the next reference in our list for some doubts about the modern song's antiquity): <http://www.rapides.k12.la.us/schooltech/david/UR/Educator%20Guide%201.doc>
<http://www.rapides.k12.la.us/schooltech/david/UR/Educator%20Guide%203%20Drinking%20Gourd.doc>

Follow the Drinking Gourd Website: <http://www.followthedrinkinggourd.org/>

An amateur music scholar has researched the history of the song about the Big Dipper more thoroughly and presents his work here.

Fikes, R. "From Banneker to Best: Some Stellar Careers in Astronomy and Astrophysics" (about African-American astronomers): <http://www.math.buffalo.edu/mad/special/Black.Astronomers-Fikes.pdf>

Who are the Black Astronomers and Astrophysicists? (profiles of 20th and 21st century African-American astronomers): <http://www.math.buffalo.edu/mad/physics/astronomy-peeps.html>

Profile of Jose Francisco Salgado, astronomer and educator, born in Puerto Rico:

<http://nbclatino.com/2012/07/03/an-astronomer-who-urges-not-to-have-limits/>

Videos:

Hubble's Diverse Universe (a video about the research of African-American and Hispanic-American astronomers & astrophysicists) [1 hr. 52 min]: <http://www.hdumovie.com/>

Reaching to the Stars: African American Astronomers (in celebration of Black History Month in 2011, Swarthmore hosted three African-American scientists: Derrick Pitts (Fels Planetarium), Eric Wilcott (U. of Wisconsin) and astronaut Mae Jemison, discussing the future of the field.) [90 min]: <http://www.youtube.com/watch?v=9q8I3bU68Gw>

A Story about Race (Neil deGrasse Tyson reflects on cultural issues that arose during his college and graduate years) [12 min]: <http://www.youtube.com/watch?v=wPf03T8YN-4>

2. Astronomy of Native North American Cultures

Published Materials:

Bol, Marcia, ed. *Stars Above, Earth Below: American Indians and Nature*. 1993, Carnegie Museum of Natural History. Collection of essays describing how indigenous groups examine the natural world, with a chapter on astronomy.

Canby, T. "The Anasazi: Riddles in the Ruins" in *National Geographic*, Nov. 1982, p. 554.

Carlson, J. "America's Ancient Skywatchers" in *National Geographic*, vol 177, #3, Mar 1990, p. 76.

Krupp, E. "Whiter Shade of Pale" in *Sky & Telescope*, July 2000, p. 86. A rock that looks like the Milky Way and was used in ceremonies by Native Americans in California.

MacDonald, John *The Arctic Sky: Inuit Astronomy, Star Lore and Legend*. 1998, Royal Ontario Museum. Astronomical stories and explanations from Northern Canada and Alaska, including a discussion of interpretations of the aurora.

Malville, J.M. & Putnam, Claudia *Prehistoric Astronomy in the Southwest*. 1993, Johnson Books. A nice introductory book about cultures and monuments in the Arizona area.

Maryboy, Nancy & David Begay *Sharing the Skies: Navajo and Western Cosmos*. 2006, Indigenous Education Institute & World Hope Foundation (available from amazon.com). An authoritative compilation by Navajo and Western astronomers of illustrations, stories, and observations of Navajo constellations coupled with stories from corresponding Greek constellations and Hubble Space Telescope images of objects found in that part of the sky. This is a kit that includes an audio CD, a small poster of the Dine Universe, and learning activities.

McLeary, Timothy *The Stars We Know*, 2nd ed. 2012, Waveland. An examination of the astronomy in the traditions and world view of the Crow people.

Miller, Dorcas *Stars of the First People: Native American Star Myths and Constellations*. 1997, Pruett.

Monroe, Jean & Williamson, Ray *They Dance the Sky: Native American Star Myths*. 1987, Houghton Mifflin. Skylore from a number of tribes retold.

Schulz, T. "Mask of Black God: The Pleiades in Navajo Cosmology" in *Journal of College Science Teaching*, Oct. 2005, p. 30.

Williamson, Ray *Living the Sky: The Cosmos of the American Indian*. 1984, Houghton Mifflin/University of Oklahoma Press. The sky world of the Native Americans, through their tales and their observing sites.

Websites and Online Articles:

Aboriginal Star Knowledge: Native American Astronomy: <http://www.kstrom.net/isk/stars/starmenu.html>

American Indian Starlore (compiled by Brad Snowden, Western Washington U.):

<http://www.wvu.edu/depts/skywise/legends.html>

Exploratorium Chaco Canyon Site: <http://www.exploratorium.edu/chaco/index.html>

Garmany, Catharine *Resources for Astronomy Outreach Providers and Teachers of Native Americans* (helpful ideas and materials, from the National Optical Astronomy Observatories):

<http://www.noao.edu/education/nativeamerican/>

Profile of Native American astronomer Dennis Lamenti:

<http://indiancountrytodaymedianetwork.com/2011/08/07/the-native-astronomer-46049>

Resource Guide for Canadian Aboriginal Astronomy (by Prune Harris):

[http://www.integrativescience.ca/uploads/articles/2010May-Harris-Canadian-Aboriginal-astronomy-resource-list\(in-press\).pdf](http://www.integrativescience.ca/uploads/articles/2010May-Harris-Canadian-Aboriginal-astronomy-resource-list(in-press).pdf)

Solar Astronomy in the Pre-historic Southwest (P. Charbonneau, et al):

<http://www.hao.ucar.edu/education/archoIndex.php>

Videos:

Animated story of “Coyote and Eagle Steal the Sun and Moon” (from Zuni tradition) [~2 min]:

<http://www.youtube.com/watch?v=EwyVDadt7QE>

“Grandmother Spider Brings the Sun to the Earth” (from the Cherokee tradition, told by Elaine Cohen)

[~9 min]: <http://www.youtube.com/watch?v=rNBNGl9uLCI> (A shorter version is at:

<http://www.youtube.com/watch?v=rbTkP0gbNGQ>)

NASA Connect: Indigenous Astronomers (a segment of NASA Connect’s Ancient Observatories episode follows Native American educators Nancy Maryboy and David Begay as they show examples of structures used to track the sun in the sky) [~7 min]: <http://archive.org/details/NasaConnect-Ao-IndigenousAstronomers>

Classroom Activities:

Ancient Eyes Looked to the Skies: Sunwatchers of the Southwest (Activities in Archaeoastronomy for the Classroom, Grades 4-8, from the Chabot Science Center):

<http://www.chabotspace.org/assets/teacher/sunwatchers.pdf>

Time-telling activity that incorporates Navajo culture and history (for grades 3 – 5):

http://www.teachervision.fen.com/tv/printables/allynbacon/Ward_020551409x_104-109.pdf

3. Astronomy of African Cultures

Published Materials:

DeVries, Dan “Teaching Across Cultures” in *Mercury (the magazine of the Astronomical Society of the Pacific)*, Jul/Aug. 2005, p. 12. A physicist recounts his experience teaching science in Botswana.

Doyle, Laurence and Frank, Edward “Astronomy of Africa” in *Encyclopaedia of the History of Science, Technology and Medicine in Non-Western Cultures*. Edited by H. Selin (2008, Springer)

Holbrook, Jarita, et al., eds. *African Cultural Astronomy*. 2008, Springer. A variety of papers with much useful information.

Holbrook, Jarita “Sun Gods and Moon Deities of Africa” in Campion, N. & Curry, P., eds. *Sky and Psyche*. 2006, Floris Books.

Schilling, G. “The Star-Pyramid Connection” in *Mercury*, Jul/Aug. 2001, p. 28. On the Egyptian pyramids and their astronomical orientation.

Snedegar, Keith “Ikhwezi is the Morning Star” in *Mercury*, Nov/Dec. 1997, p. 12. On African myths related to the sky.

Websites and Online Articles:

The Dogon Tribe and the so-called “Sirius Mystery”: <http://www.ramtops.co.uk/dogon.html> and http://chandra.harvard.edu/chronicle/0400/sirius_part2.html
Holbrook, Jarita “African Astronomy”: <http://www.wam.umd.edu/~tlaloc/archastro/ae28.html> A brief overview of astronomical ideas in African tradition. (Jarita Holbrook specializes in this area and keeps the field updated at: <http://www.u.arizona.edu/~holbrook/>)
The African Astronomical Society (the organization of research astronomers in Africa, with a few things about amateur astronomy groups as well): <http://www.africanastronomicalsociety.org/>

Classroom Activity:

Lawrence Hall of Science African Mythology Curriculum Guide (although originally developed for the STARLAB portable planetarium, some of these activities can be adapted for classroom use): <http://www.lhs.berkeley.edu/pass/passv05/AfricanCurric.pdf>

4. Astronomy of Islamic Cultures

Published Materials:

Ahmad, I. & Khalid Shaukat, S. "Muslim Moon Sightings" in *Mercury (the magazine of the Astronomical Society of the Pacific)*, May/June 1995, p. 38. The Muslim calendar and sighting the first crescent moon.
Gingerich, Owen “Islamic Astronomy” in *Scientific American*, April 1986, vol. 254, p74. (Available on the web at: http://faculty.kfupm.edu.sa/PHYS/alshukri/PHYS215/Islamic_astronomy.htm)

Web Sites and Online Articles:

Arab and Islamic Astronomy (Leslie Welser): <http://www.starteachastronomy.com/arab.html>
The Role of Astronomy in Islam (Dr. Shirin Haque-Copilah): <http://moonsighting.com/articles/roleofislam.html>
Records of Eclipses in Muslim Astronomy: <http://www.muslimheritage.com/topics/default.cfm?ArticleID=810>
Ridpath, Ian: “Al-Sufi’s Constellations”: <http://www.ianridpath.com/startales/alsufi.htm>

5. Astronomy of Central and South American Cultures

Published Materials:

Aveni, Anthony "Emissaries to the Stars: The Astronomers of Ancient Maya" in *Mercury (the magazine of the Astronomical Society of the Pacific)*, Jan/Feb. 1995, p. 15. (See also the books by Aveni in the last section.)
Aveni, Anthony *The End of Time: The Maya Mystery of 2012*. 2009, University Press of Colorado. A fine introduction to Maya astronomy and debunking of the notion that their calendar means the end of the world in 2012.
Aveni, Anthony *Between the Lines: The Mystery of the Giant Ground Drawings of Ancient Nasca, Peru*. 2000, U. of Texas Press.
Barnhart, Edwin “Reconstructing the Heavens: Archaeoastronomy and the Ancient Maya World” in *Mercury*, Jan/Feb. 2004, p. 20. The Mayan calendar, sky observations, and monuments.
Bauer, Brian & David Dearborn *Astronomy and Empire in the Ancient Andes*. 1995, U. of Texas Press. Examines the role of astronomy among the Incas.
Kurtz, P. “An Astronomer Reads Archeology’s Message” in *Astronomy*, Oct. 2002, p. 48. Profile of Anthony Aveni, with a focus on his work on Mayan structures.

Milbrath, Susan *Star Gods of the Maya: Astronomy in Art, Folklore, and Calendars*. 2000, University of Texas Press. Scholarly monograph.

Websites and Online Articles:

Mayan Astronomy Page (Leslie Welser): <http://www.starteachastronomy.com/mayan.html>

The Maya Astronomy Page (Dawn Jenkins): <http://www.michielb.nl/maya/astronom.html>

Maya Exploration Center (Dr. Edwin Barnhart): <http://www.mayaexploration.org/> Includes tours of sites, resources, interviews, etc.

Mesoamerican Archaeoastronomy (James Jacobs):

http://www.jqjacobs.net/mesoamerica/meso_astro.html

Venus and the Maya (David Rosenthal): <http://www.ridgenet.net/~n6tst/maya/default.html>

Mark Van Stone's "It's Not the End of the World: What the Ancient Maya Tell Us About 2012" (a detailed analysis): <http://www.famsi.org/research/vanstone/2012/index.html> (Also, see his illuminating FAQ: <http://www.famsi.org/research/vanstone/2012/faq.html>.)

"Tales of Wandering Stars" (A tale from Inca Mythology, about the planets by Germán Puerta Restrepo):

http://unawe.org/resources/education/tales_of_the_wandering_star_eng/

The Birth of Venus (A traditional Aztec story, by Marcos Carías):

http://unawe.org/resources/education/birth_of_venus_eng/

Video:

Maya Astronomy and Mathematics (from NASA Connect, with Sten Odenwald) [8 min]:

<http://www.youtube.com/watch?v=5W9zFwBQb6c>

Anthony Aveni on "The End of Time" at Marlboro College (on the Mayan calendar and why the world will not end in 2012; delivered 9/13/2010; 1 hr 2 min):

<http://www.youtube.com/watch?v=exQGTvZ5aKw>

Classroom Activities:

Calendar in the Sky Lesson Plans:

<http://www.calendarinthesky.org/MultimediaResources/LessonPlans.aspx>

Activity from NOVA to figure out your birthday in the Maya calendar (if you were born 1980 or after):

http://www.pbs.org/wgbh/nova/teachers/activities/pdf/2804_maya.pdf

Online Maya Calendar Converter: <http://www.mayaskies.org/mayacalendar.html>

6. Astronomy of Hawaiian, Polynesian, and Native Australian Cultures

Published Materials:

Bryan, E.H. & Crowe, Richard *Stars Over Hawaii*, 2nd ed. 2002, Petroglyph Press (available from BasicallyBooks.com). An introduction to the stars as seen from Hawaii and their use as navigation aids in traditional Hawaiian voyaging.

Finney, Ben *Hokule'a: The Way to Tahiti*. 1976, Dodd Mead. An anthropologist describes recreating the voyages of the ancient Polynesians using the stars to navigate. Updated in his *Sailing in the Wake of the Ancestors: Reviving Polynesian Voyaging*. 2004, Bishop Museum Press.

Haynes, R. "Dreaming the Sky" in *Sky & Telescope*, Sep. 1997, p. 72. On the astronomical ideas in Australian aborigines culture.

Kyselka, Will & Ray Lanterman *North Star to Southern Cross*. 1976, University of Hawai'i Press. A geologist and planetarium educator recounts how he became part of the project to rediscover the ancient art of navigating by the stars and a voyage to see how it was done.

Makemson, Maud *The Morning Star Rises: An Account of Polynesian Astronomy*. 1941, Yale University Press.

Websites and Online Articles:

Australian Aboriginal Astronomy: <http://www.atnf.csiro.au/research/AboriginalAstronomy/index.html>
Haynes, R. "Dreaming the Stars: Aboriginal Astronomy and the Southern Sky" (Chapter 1 of the book *Explorers of the Southern Sky; 1996, Cambridge U. Press*):
<http://www.atnf.csiro.au/research/AboriginalAstronomy/literature/Haynes1996.pdf>

Introduction to Maori Star Lore (New Zealand):

<http://www.astronomynz.org.nz/maori-astronomy/taatai-arorangi-maori-astronomy-2.html>

Polynesian Voyaging Society (tries to keep the tradition of navigating by the stars alive; has profile of the people who have duplicated some of the ancient voyages, navigating by the stars): <http://hokulea.org/>

Maori lunar calendar: <http://edu.rasnz.org.nz/downloads/Maori%20Lunar%20Calendar%20Activity.pdf>

Video:

Polynesian Wayfinders (a nice introduction to the ancient voyages and navigation by the stars) [10 min]:
<http://www.youtube.com/watch?v=k6j1J9-AurA>

7. Astronomy of Asian Cultures

Published Materials:

Nakayama, Shigeru *A History of Japanese Astronomy*. 1969, Harvard University Press. From ancient times through the 19th century, with a look at Chinese influences.

Pankenier, David "The Mandate of Heaven" in *Archaeology*, Mar./Apr. 1998, p. 26. On early Chinese astronomy, as recorded on art and artifacts.

Sinnott, Roger "Japan's Zany Passion for Telescopes," in *Sky & Telescope*, March 1992, pp. 267-273.

Spitz, Anna "Visiting the Moon Lady" in *Mercury*, Jul/Aug. 2006, p. 24. On Chinese moon legends and how they continue to be used in cultural celebrations.

Vowahsen, Andreas *Cosmic Architecture in India*. 2001, Prestel. On the astronomical and ceremonial observatories built by Jai Singh in the 17th & 18th centuries.

Websites and Online Articles:

Chinese Astronomy: <http://www.chinapage.com/astronomy/astronomy.html> (this site is potpourri of all kinds of information)

The Mathematics of the Chinese Calendar (by Helmer Aslaksen of the National University of Singapore):
<http://www.math.nus.edu.sg/aslaksen/calendar/chinese.shtml>

Copernicus in China (on the spread of Copernican ideas by Nathan Sivin of the University of Pennsylvania):
<http://ccat.sas.upenn.edu/~nsivin/cop.pdf>

Japanese Star Lore: <http://www2.gol.com/users/steve/jastro.html#Astro%20Lore>

The Lunar Calendar in Japan: <http://www2.gol.com/users/steve/calendar.htm>

Bibliography of Korean Astronomy:

http://www.hawaii.edu/korea/biblio/sci_astronomy.html (Articles, mostly in scholarly journals.)

Astronomy of India (Leslie Welser): <http://www.starteachastronomy.com/indian.html>

8. General Resources on the Astronomy of Several Cultures

Published Materials:

Aveni, A. "Archaeoastronomy: Past, Present and Future" in *Sky & Telescope*, Nov. 1986, p. 456.

Aveni, Anothony *Conversing with the Planets*. 1992, Times Books. Celebrates the myths of many cultures; emphasizes the importance of seeing them in their own context.

- Aveni, Anthony *Empires of Time*. 1989, Basic Books. A discussion of calendars, clocks, and cultures, with chapters on the Maya, Aztecs, Incas, Ancient Chinese, and several other early civilizations.
- Aveni, Anthony *Stairways to the Stars: Skywatching in Three Great Ancient Cultures*. 1997, John Wiley. Focuses of the monuments and astronomy of the people who built Stonehenge, plus the Maya and the Inca.
- Gleiser, Marcelo *The Dancing Universe: From Creation Myths to the Big Bang*. 1997, Dutton/Penguin. An exploration by a physicist of ideas from many cultures of how the universe came to be, including ancient legends and modern science.
- Hadingham, Evan *Early Man and the Cosmos*. 1984, Walker & Co. A clear primer on the subject of ancient sites and the astronomical thinking of ancient cultures around the world.
- Krupp, Edwin *Beyond the Blue Horizon: Myths and Legends of the Sun, Moon, Stars, and Planets*. 1991, HarperCollins. Superb collection of astronomical tales from many cultures. Best book to start with.
- Krupp, Edwin *Skywatchers, Shamans, & Kings: Astronomy and the Archaeology of Power*. 1997, J. Wiley. Fine guide to sites around the world, written for beginners with humor and verve.
- Krupp, Edwin *Echoes of the Ancient Skies: The Astronomy of Lost Civilizations*. 1983, Harper & Row. An excellent introduction on the thoughts and monuments of earlier cultures.
- Percy, John & Batten, Alan "Chasing the Dream: Astronomy in Developing Countries" in *Mercury (the magazine of the Astronomical Society of the Pacific)*, Mar/Apr. 1995, p. 14. What is happening in the study of astronomy in third-world countries and how others can help.
- Ruggles, Clive *Ancient Astronomy: An Encyclopedia of Cosmologies and Myth*. 2005, ABC-Clío. Mammoth A-Z compilation of the ancient knowledge of a wide range of cultures.
- Walker, Christopher, ed. *Astronomy Before the Telescope*. 1996, St. Martin's Press. 17 essays on how people observed and interpreted the sky before modern instruments.
- Zeitlin, Steve *The Four Corners of the Sky: Creation Stories and Cosmologies from Around the World*. 2000, Henry Holt. Short book introducing and retelling the stories.

Websites and Articles on the Web:

- Ancient Observatories, Timeless Knowledge from the Stanford Solar Center (An introduction to ancient sites where the movements of celestial objects were tracked over the years, with a special focus on tracking the Sun.): <http://solar-center.stanford.edu/AO/>
- Astronomy Before History* by Clive Ruggles and Michael Hoskin (from the *Cambridge Concise History of Astronomy*) -- a nice pdf file with a well-written introduction to ancient astronomy: <http://assets.cambridge.org/052157/2916/sample/0521572916web.pdf>
- The Center for Archaeoastronomy at the University of Maryland (Good site to learn more about the serious study of the astronomical relics of ancient cultures; some parts for the public, some for professionals in the field): <http://www.wam.umd.edu/~tlaloc/archastro/>
- Cultural Astronomy Web Exhibit (Modules and resources on many cultures that have an astronomical tradition, created with the assistance of Chicago's Adler Planetarium): http://ecuip.lib.uchicago.edu/diglib/science/cultural_astronomy/
- An Introduction to Archaeoastronomy (Clive Ruggles' 2003 Introductory Course Notes and Images at the University of Leicester): <http://www.le.ac.uk/archaeology/rug/aa/a3015/index.html>
- Multicultural Cosmology Education Resource Center at Pomona College (Bryan Penprase and his collaborators have made this useful introductory site, which includes a world atlas of ancient astronomy, course outlines, a timeline and links to other resources): <http://www.astronomy.pomona.edu/archeo/intro.html>
- Orion* by Philip Glass (a musical composition created for the 2004 Olympics which is based on the mythology of Orion in a variety of cultures from around the world): <http://www.philipglass.com/music/compositions/orion.php>
- Traditions of the Sun (The NASA Sun-Earth Connection Education Forum site offers virtual visits to Mayan astronomical sites and Chaco Canyon placed in appropriate historical, cultural, and scientific contexts): <http://www.traditionsofthesun.org/>

Classroom Activities:

Indiana Jones and the Astronomy of Yore (Issue of the Astronomical Society of the Pacific newsletter on teaching astronomy, by Louis Winkler, focusing on archaeoastronomy):

<http://www.astrosociety.org/education/publications/tnl/31/31.html>

Using Multicultural Dimensions to Teach Astronomy (by Nalini Chandra and John Percy):

<http://www.astrosociety.org/education/publications/tnl/53/multicultural.html>

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