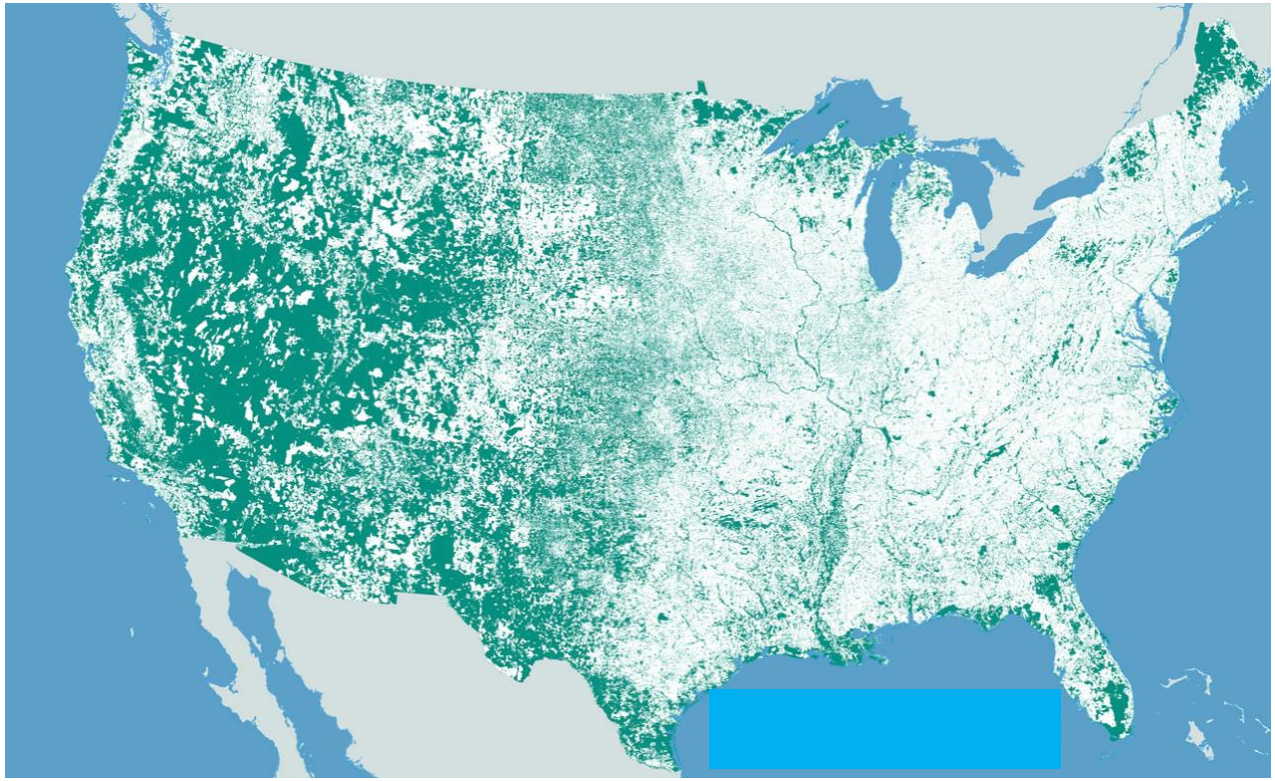
Welcome to ASTR 250

an initial course in astrophysics



What does this map represent?

What kind of arithmetic is this?

- 1 + 2 = 3
- 3 + 4 = 7
- 5 + 6 = 11
- 7 + 8 = 3
- 9 + 10 = 7
- 11 + 11 = 10

ASTR 250
"Fundamentals of Astronomy"

ASTR 250 is a calculus-based introductory course in astronomy and astrophysics, aimed at sophomore astronomy majors and science majors from other departments.

Define "astrophysics" in a single sentence.

Your Pilot and His Teaching Style

Bring astronomy to "life" !

"We can't teach people anything… we can only help them discover it within themselves."

Galileo Galilei

- **Face your misconceptions.**
- **Minimize memorization.**
- **Maximize thinking.**
- **Student "ownership."**
- **Reward long term learning.**
- **You should always attend class.**
- **Utilize opportunities.**

Meet Your Graduate Teaching Assistant

Solve this problem. – Win a T-shirt!

You applied the "scientific method."

hypothesis

procedure

experiment & observation

collect data

interpretation

conclusion & assessment

Where is your T

Mr. Michael Hammer

"The scientific method allows ordinary people to do extraordinary things."
Francis Bacon

Did this exercise reveal any incorrect assumptions or any misconceptions?

What are some characteristics of the scientific method?

NASA's New Probe Sails Into the Solar Wind

By Angela V. Olinto

The astrophysicist Eugene Parker found only doubters 60 years ago when he proposed that a type of "wind" flows from the sun. Now NASA is sending up a spacecraft named in his honor. The Parker Solar Probe, set to launch Saturday, will fly closer to the sun than any previous mission. It will investigate why the sun's atmosphere is hotter than the sun itself, how to protect earthly electric grids from space weather, and more.

I came to know Eugene Parker in the 1990s as a fellow astrophysicist at the University of Chicago. By that time he was a legend who had built a completely new field. No one had expected that when he first proposed the concept of solar wind in 1958.

Back then, scientists tended to believe that the space between our sun and the planets was empty. Mr. Parker suggested instead that it contained a wind of the sun's particles and magnetic fields. When he submitted his paper to the Astrophysical Journal, it was rejected. The paper saw the light of day only because the journal's editor, future Nobel laureate Subrahmanyan Chandrasekhar, agreed to publish it over the reviewers' objections.

Its namesake, Eugene Parker, is a living legend of astrophysics.

But Mr. Parker never wavered, and no one could find a problem with his physics or math. He was vindicated four years later, when NASA's Mariner 2 probe confirmed the existence of solar wind.

For this breakthrough and his work since, Mr. Parker is regarded as the father of modern heliophysics. As NASA scientists tell it, the decision to name the new probe after him—the first time that honor has been bestowed on a living person—was easy.

Great advances in science often stem from a willingness to challenge convention. Galileo was convicted of heresy in 1633 after he insisted that the sun was the center of the solar system. Everyone scoffed at the 19th-century physician Ignaz Semmelweis when he argued that doctors ought to wash their hands between patients. The science of plate tectonics, proposed by Alfred Wegener in 1912, didn't become widely accepted until the 1970s.

Scientists can be narrow-minded like anyone else. But the scientific method overcomes this failing, as new theories and ideas are constantly tested against data. Science demands a willingness to challenge and be challenged.

At 91, Mr. Parker still loves the unexpected. Discussing the solar probe recently, he said that "we have to be prepared for some surprises—things that we never thought of, or things that we thought of but were not correct."

The launch of the Parker Solar Probe vindicates not only Eugene Parker's ideas but also his vision of science as an arena for both uncommon daring and humility. It's never clear where the next great advance will come from, or how it may challenge today's assumptions. To forge new paths, scientists must be brave enough to try new ideas—and confident enough to risk being proven wrong.

Ms. Olinto is dean of the Division of the Physical Sciences at the University of Chicago.

Meet your Peers

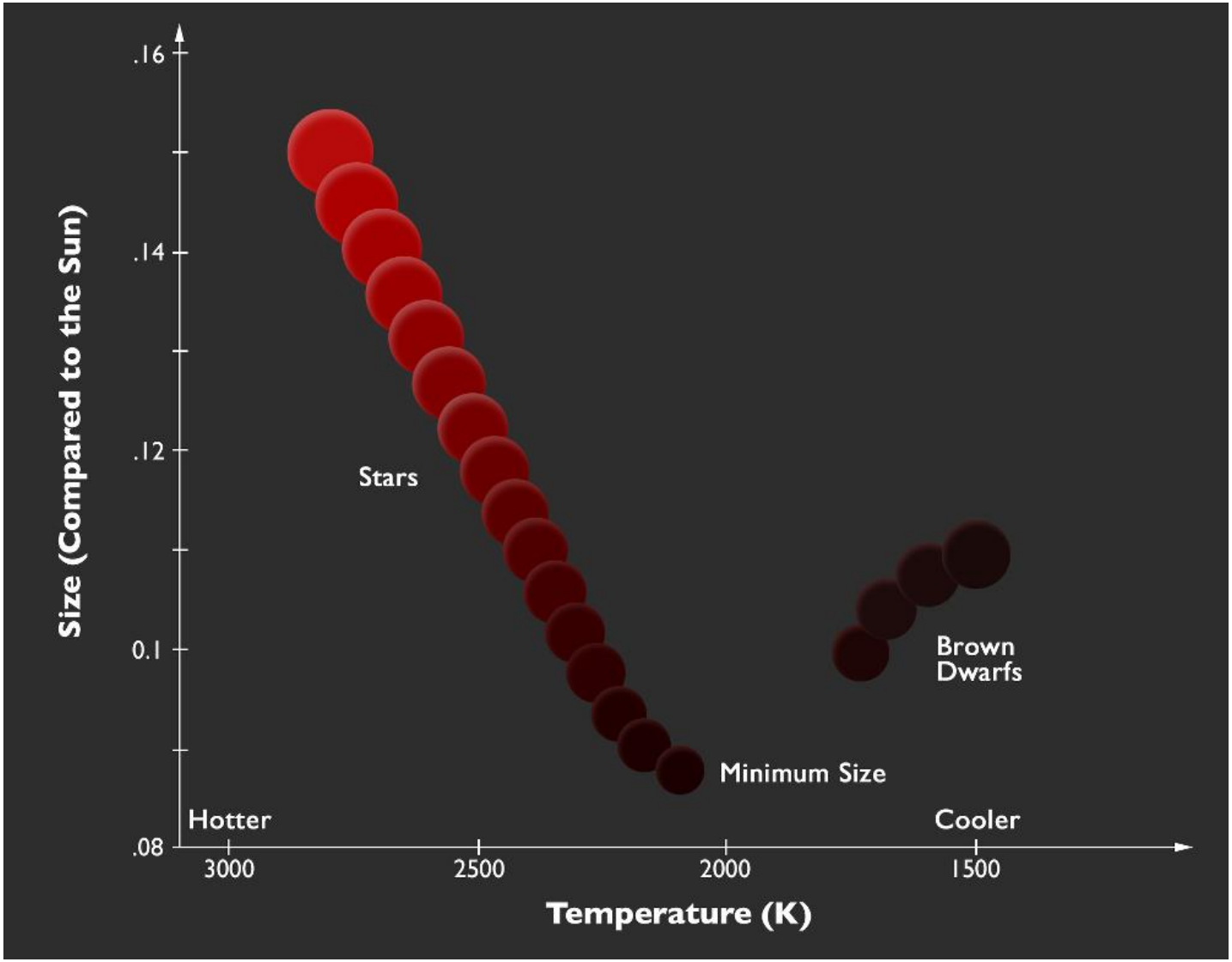
Pretend our Sun is a tennis ball.
How large is the smallest main-sequence star?

A. 0.3 inch
B. 6 mm
C. 2 cm
D. 0.5 mm

Work together!

A "sense of scale" is important in science.

Main-sequence Stars and Brown Dwarfs
(Dr. Todd Henry – Georgia State)



Our Web site

http://lavinia.arizona.edu/~dmccarthy/ASTR196/index.html

Minor Presence on D2L

THE UNIVERSITY OF ARIZONA | ASTR 250 SP20 001 | Donald W McCarthy

Course Home | Content | Assignments | Discussions | Quizzes | Grades | Classlist | UA Tools | Library Tools | Course Admin

ASTR 250 SP20 001

Announcements

Welcome to Astronomy 250 !!

Posted Jan 13, 2020 12:36 AM

Hi everyone!

I am looking forward to working with you this semester as we dig deeper into astronomy, astrophysics, and problem solving techniques, with the benefit of your more advanced background in physics and math. You will also learn more about our University's Department of Astronomy and its research branch known as Steward Observatory. Our primary point of contact will be the Web site listed below, not D2L. Please read the Welcome Letter (Welcome.pdf) that was also emailed to you, so you can come prepared for the first class.

CLASS WEB SITE: https://lavinia.as.arizona.edu/~dmccarthy/ASTR250/course.html

Thanks! - Don McCarthy (Professor) and Michael Hammer (Graduate Teaching Assistant)

Calendar

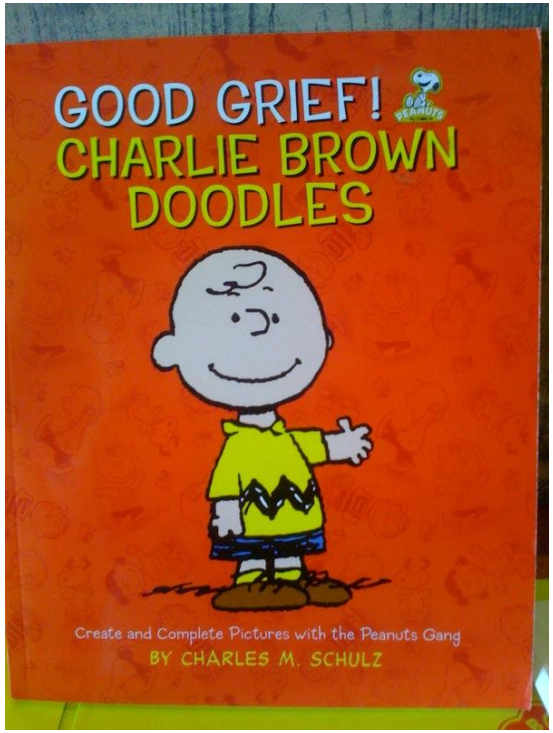
Tuesday, January 14, 2020

Upcoming events

Your "Doodle Sheet"

a daily requirement

label with your "Star Name"



- **Real-time comments**
- **Reactions**
- **Opinions**
- **Suggestions**
- **Drawings**

- **Be sure to answer:**
  - **Could you attend a "Majors Meeting" Friday 31 at 4 pm?**
  - **What is the most surprising thing you learned today?**
  - **What are you most worried about this semester?**

Skim the Course Syllabus

What are some major highlights of this course?

What are some major deadlines?

Change my office hours to Tuesdays

- **Daily homework is a major emphasis of this course**
  - **Must be formatted correctly, well organized, and legible**
  - **Find Friday's assignments**

- **ATOMM: *"Astronomy Tutoring of Majors and Minors"***
  - **3rd floor library (Parker Room) across from N305**
    - **Tuesday (2-4 pm) – Michael Hammer**
    - **Wednesday (3-5 pm) – Rixin Li**
    - **Thursday (1:30-3:30 pm) – Rachel Smullen**

- **Astronomy Club: Jan 24 (?) at 4 pm**

- **61" telescope: April 17, 18**

"How to Solve It"

Polya, 1945

Experts in different fields share a common problem-solving approach.

Understand the problem.

Devise a plan.

Carry out the plan and check each step along the way.

Look back and examine the solution.

Homework #8 | Messier 52 ASTR196

4) Understanding the Problem

- Calculate the temperatures of the two debris disks surrounding 49 Ceti using a graph of their blackbody curves

Homework #8 | Messier 52 ASTR196

4 cont.) ⑧ $D_{Disk\,B} = \sqrt{0.7 \cdot \frac{9.5 \cdot 10^{27}\,W}{16\pi \cdot 5.67 \cdot 10^{-8}\,W/m^2 \cdot (100)^4}}$

⑨ $D_{Disk\,B} = \frac{4.8 \cdot 10^{12}\,m}{10^3\,m} = \frac{4.8 \cdot 10^{9}\,km}{1.496 \cdot 10^{8}\,km} = \boxed{32\,AU}$

Looking Back

My results for the distance of each debris disk from 49 Ceti are logical. Because Disk A has a lesser temperature than [illegible] I attributed its albedo valve to be less than that of Disk B since [illegible] indicates its absorbing efficiency (albedo) is less than the absorbing efficiency of Disk B.

Given this and the temperatures of the disks, it makes sense for Disk A to be further away from 49 Ceti than Disk B because it does not absorb as much light and, therefore energy, as Disk B and thus is cooler.

- Disk A = 0.50
- Disk B = 0.30

⑦ $D^2_{Disk\,B} = (1-0.3) \cdot \sqrt{\frac{25 \cdot 3.8 \cdot 10^{26}\,W}{16\pi \cdot 5.67 \cdot 10^{-8}\,W/m^2/K^4 \cdot (100K)^4}}$

Homework format

Jimmy Lilly

graduating senior

The Evening Sky Map

FREE* EACH MONTH FOR YOU TO EXPLORE, LEARN & ENJOY THE NIGHT SKY

WWW.SKYMAPS.COM

NORTHERN HEMISPHERE
AUGUST 2018

Sky Calendar – August 2018

Get Sky Calendar on Twitter
http://twitter.com/skymaps

4 **Last Quarter Moon** at 18:19 UT.

6 **Moon near the Pleiades** at 3h UT (morning sky).

6 **Moon near Aldebaran** (morning sky) at 19h UT.

9 **Mercury at inferior conjunction** with the Sun at 2h UT. Mercury passes into the morning sky. Not visible.

9 **Moon near Castor** (morning sky) at 15h UT.

9 **Moon near Pollux** (morning sky) at 19h UT.

10 **Moon at perigee** (closest to Earth) at 18:10 UT (358,078 km; angular size 33.4').

11 **Partial Eclipse of the Sun** at 9:46 UT (greatest). Visible from northern Europe and NE Asia. Begins at 8:02 and ends at 11:31 UT.

11 **New Moon** at 9:58 UT. Start of lunation 1183.

12 **Perseid meteor shower peaks** at 20h UT. Peak lasts about 12 hours. Active from July 17 to August 24. Produces swift, bright meteors (50 to 100 per hour) many with persistent trains. Best viewing is after midnight. Favorable conditions in 2018.

12 **Moon near Regulus** (evening sky) at 4h UT.

14 **Moon near Venus** (evening sky) at 18h UT. Mag. –4.3.

15 **Moon near Spica** (evening sky) at 22h UT.

17 **Moon near Jupiter** (evening sky) at 13h UT. Mag. –2.0.

17 **Venus at greatest elongation east** (46° from Sun, evening sky) at 17h UT. Mag. –4.3.

18 **First Quarter Moon** at 7:49 UT.

19 **Moon near Antares** (evening sky) at 13h UT.

21 **Moon near Saturn** (evening sky) at 10h UT. Mag. 0.3.

23 **Moon at apogee** (farthest from Earth) at 11h UT (distance 405,746 km; angular size 29.4').

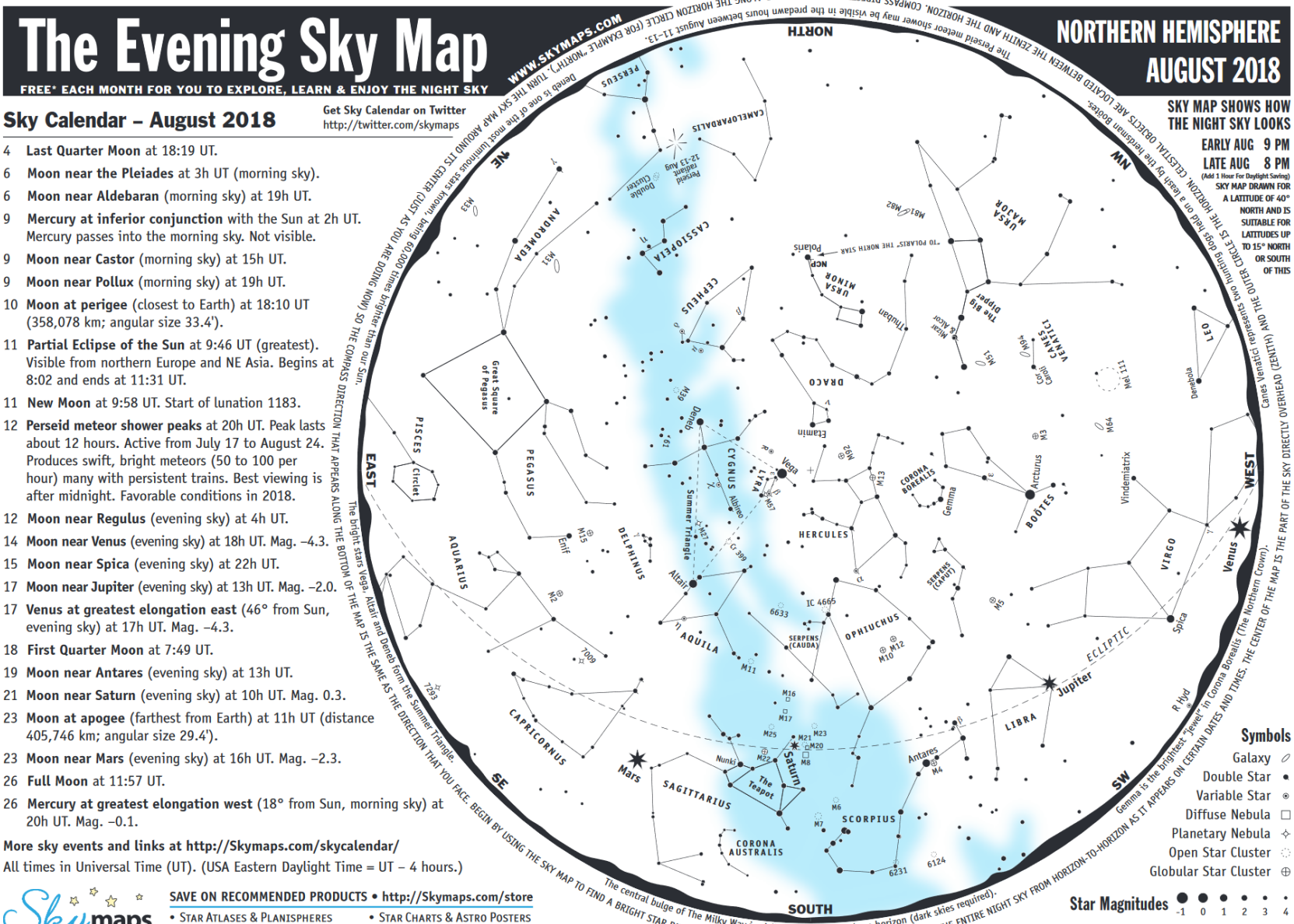
23 **Moon near Mars** (evening sky) at 16h UT. Mag. –2.3.

26 **Full Moon** at 11:57 UT.

26 **Mercury at greatest elongation west** (18° from Sun, morning sky) at 20h UT. Mag. –0.1.

More sky events and links at http://Skymaps.com/skycalendar/

All times in Universal Time (UT). (USA Eastern Daylight Time = UT – 4 hours.)



Deneb is one of the most luminous stars known, being 60,000 times brighter than our Sun.

The bright stars Vega, Altair and Deneb form the Summer Triangle.

The Perseid meteor shower may be visible in the predawn hours between August 11-13. COMPASS DIRECTIONS ARE INDICATED ALONG THE HORIZON CIRCLE (FOR EXAMPLE, "NORTH"). TURN THE SKY MAP AROUND ITS CENTER (JUST AS YOU ARE DOING NOW) SO THE COMPASS DIRECTION THAT APPEARS ALONG THE BOTTOM OF THE MAP IS THE SAME AS THE DIRECTION THAT YOU FACE. BEGIN BY USING THE SKY MAP TO FIND A BRIGHT STAR PATTERN IN THE SKY.

The central bulge of The Milky Way is visible above the southern horizon (dark skies required).

INSTRUCTIONS: THE SKY MAP SHOWS THE ENTIRE NIGHT SKY FROM HORIZON-TO-HORIZON AS IT APPEARS ON CERTAIN DATES AND TIMES. THE CENTER OF THE MAP IS THE PART OF THE SKY DIRECTLY OVERHEAD (ZENITH), AND THE OUTER CIRCLE IS THE HORIZON. CELESTIAL OBJECTS ARE LOCATED BETWEEN THE ZENITH AND THE HORIZON. Canes Venatici (the Hunting Dogs) is located by the fearless Boötes, Gemma is the brightest "jewel" in Corona Borealis (The Northern Crown).

SKY MAP SHOWS HOW THE NIGHT SKY LOOKS

EARLY AUG 9 PM
LATE AUG 8 PM
(Add 1 Hour For Daylight Saving)

SKY MAP DRAWN FOR A LATITUDE OF 40° NORTH AND IS SUITABLE FOR LATITUDES UP TO 15° NORTH OR SOUTH OF THIS

Symbols

- Galaxy
- Double Star
- Variable Star
- Diffuse Nebula
- Planetary Nebula
- Open Star Cluster
- Globular Star Cluster

Star Magnitudes -1 0 1 2 3 4 5 6

Define the word “angle”

- **What units?**
- **How many dimensions?**