

A year in the skies

During this school year the planet Mercury will circle the Sun three times, Earth and Mars will reach their closest point, and robotic emissaries will visit another planet, collect particles from a comet, and fall into Jupiter's atmosphere or approach Saturn. Our Moon will be eclipsed by the Earth's shadow and the Sun's light will be blocked during the coming eclipse year.

Exploring

Over the next year, there will once again be opportunities to virtually visit other worlds in our solar system. The Stardust spacecraft is scheduled for a rendezvous with Comet Wild 2 during January 2004, four spacecraft are currently on their way to Mars, while another, the Cassini spacecraft with the Huygens probe, is due to arrive at Saturn during July of 2004. The Mars-bound spacecraft are all due for arrival within about two months at the end of this year. Three of the four spacecraft heading toward Mars were launched this past summer and include the two NASA Mars Exploration Rovers (*Spirit* and *Opportunity*), and the European Space Agency's Mars Express (an orbiter with the *Beagle 2* lander). Also due for arrival at the red planet during the school year is the Japanese Space Agency's spacecraft *Nozomi* (meaning "hope"). Originally due for Martian orbital insertion in 1999, the spacecraft was launched in September 1998. Following a course maneuver using the Earth's gravity, the spacecraft not only did not have enough acceleration to reach Mars, but it was also left with limited maneuvering fuel as a result of two additional course correction attempts. However, the spacecraft was successfully placed in a four-year orbit that required gravity assistance from several Earth flybys to propel it toward a November 14th rendezvous with Mars.

Viewing

At the beginning of this school year, only the planet Mars is visible in the evening skies after sunset. However, by November, Saturn and Venus will join Mars and, by late December, so will Jupiter. The four planets will then spend the rest of the school year visible as evening planets. The swiftly-moving planet Mercury bounces back and forth from a morning planet to an evening planet several times. It will be visible as a morning planet during part of September and October, an evening planet around December, a morning planet during January, back to an evening planet during March, and finishes up as a morning planet in May. Whew!

The highlight of the year, however, will most likely be the continued exploration of Mars, along with the very

favorable viewing opportunities. This year Earth and Mars are about as close as possible, something that happens regularly about every two years as the planets orbit the Sun and the faster-moving Earth catches up with, and passes by, Mars. What brings them so close this year is that Earth has just passed aphelion (its maximum distance from the Sun), while at the same time Mars is at perihelion (its closest point to the Sun). Visibly, Mars is about as bright as it can be due to its proximity to Earth. However, as the school year moves along so does the faster moving Earth, and the distance between the two slowly but steadily increases while the size and brightness of Mars correspondingly decreases.

Eclipses

Eclipses typically occur in pairs, a lunar eclipse followed or preceded by a solar eclipse, which may be partial or total depending on the circumstances. Of the four eclipses occurring between September and May, only the November 9th lunar eclipse will be visible from North America. And for observers in the continental United States, the eclipse will already be in progress as the full Moon rises. Two weeks later, the companion total solar eclipse will only be visible from the Antarctic continent.

Visit a comet

During January, the Stardust spacecraft will rendezvous with Comet Wild 2 nearly five years after its February 1999 launch. This represents the first mission that is not only dedicated to comet study, but also to sample-return. Interstellar and comet dust will be collected and returned to Earth in 2006.

Another comet mission, Deep Impact, is not slated for launch until the end of 2004 and then a rendezvous with Comet Tempel 1 the following summer. Deep Impact, as its name may suggest, is a mission to see what a comet is made of on the inside. To study the inside, a 370 kg projectile made of copper called an *impactor* will collide with Comet Tempel 1 with enough force to blast out a fair-sized crater, revealing the fresh comet material below the surface. Another exciting component of the mission is an opportunity to have your name included on a disc that will be attached to the spacecraft (see Internet resources) during its travels.

Farewell to Galileo

The countdown clock is ticking away as the end of the Galileo mission to Jupiter approaches. Following a successful launch from the shuttle *Atlantis* in 1989 and a six-

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year voyage across the solar system, the Galileo space probe has been orbiting Jupiter and its moons since December 1995. Although the primary two-year mission has long since passed, NASA extended the Galileo mission three times. The final bit of activity occurred this past February as the mission team at the Jet Propulsion Lab prepared the spacecraft for one last orbit into an impact with Jupiter on the 21st of September.

Visible planets

- Mars is visible over the southeastern horizon at sunset and sets before sunrise.
- Saturn rises before midnight and is high over the eastern horizon at sunrise.

Moon phases

First quarter	9/03
Full Moon	9/10
Last quarter	9/18
New Moon	9/26

Internet resources

Launch of *Gravity Probe B*—einstein.stanford.edu
 Solar System Educator Program—www.ssep.org
 End of Galileo mission to Jupiter—www.jpl.nasa.gov/galileo/countdown
 September equinox—www.equinox-and-solstice.com/html/autumnal_equinox.html

World Space Week—www.spaceweek.org
 Daylight savings—scienceworld.wolfram.com/astronomy/DaylightSavingTime.html
 Nozomi spacecraft—nssdc.gsfc.nasa.gov/database/MasterCatalog?sc=1998-041A
 Total lunar eclipse—sunearth.gsfc.nasa.gov/eclipse/OH/OH2003.html#LE2003Nov09T
 Leonids meteor shower—www.comets.amsmeteors.org/meteors/showers/leonids.html
 Total solar eclipse—sunearth.gsfc.nasa.gov/eclipse/TSE2003/TSE2003.html
 Launch of the *Swift* satellite—swift.gsfc.nasa.gov
 Geminid meteor shower—www.comets.amsmeteors.org/meteors/showers/geminids.html
 Deep Impact—deepimpact.jpl.nasa.gov/tech/impactor.html
 Mars Express—www.esa.int/SPECIALS/Mars_Express
 December solstice—www.equinox-and-solstice.com/html/winter_solstice.html
 Stardust mission to Comet Wild 2—stardust.jpl.nasa.gov
 Quadrantid meteor shower peak—www.comets.amsmeteors.org/meteors/showers/quadrantids.html
 Mars Exploration Rovers—mars.jpl.nasa.gov/mer
 March equinox—www.equinox-and-solstice.com/html/vernal_equinox.html
 Partial solar eclipse—sunearth.gsfc.nasa.gov/eclipse/SEplot/SEplot2001/SE2004Apr19P.gif
 Astronomy Day—www.astroleague.org/all/astroday/astroday.html
 Total lunar eclipse—sunearth.gsfc.nasa.gov/eclipse/LEplot/LEplot2001/LE2004May04T.gif
 Send your name to a comet—deepimpact.jpl.nasa.gov/sendyourname/index.html

The school year in space: 2003–2004

September

9/03 First quarter
 9/09 Mars near Moon
 9/10 Full Moon
 9/11 Mercury at inferior conjunction
 9/18 Last quarter
 9/18 Launch of *Gravity Probe B*
 9/21 Galileo impacts with Jupiter
 9/23 September equinox
 9/24 Jupiter near Moon
 9/26 New Moon
 9/27 Mercury at greatest elongation

October

10/01 NASA's 45th Birthday
 10/02 First quarter

10/04–10 World Space Week
 10/06 Mars near Moon
 10/10 Full Moon
 10/18 Last quarter
 10/21 Jupiter near Moon
 10/25 Mercury at superior conjunction
 10/25 New Moon
 10/26 Venus near Moon
 10/26 Daylight savings

November

11/01 First quarter
 11/03 Mars near Moon
 11/09 Full Moon
 11/09 Total lunar eclipse
 11/14 *Nozomi* spacecraft arrives at Mars

11/17 Last quarter
 11/18 Jupiter near Moon
 11/23 New Moon
 11/23 Total solar eclipse
 11/25 Mercury near Moon
 11/30 First quarter

December

12/01 Mars near Moon
 12/05 Launch of *Swift* satellite
 12/08 Full Moon
 12/09 Mercury at greatest eastern elongation
 12/13 Geminid meteor shower peak
 12/16 Jupiter near Moon
 12/16 Last quarter
 12/21 *Beagle 2* lands on Mars
 12/22 December solstice
 12/23 New Moon
 12/25 Venus near Moon
 12/27 Mercury at inferior conjunction
 12/30 Mars near Moon
 12/30 First quarter
 12/31 Saturn at opposition

January

1/02 Stardust spacecraft encounter with Comet Wild 2
 1/03 Quadrantid meteor shower peak
 1/04 Earth at perihelion
 1/04 Mars Exploration Rover *Spirit* lands on Mars
 1/07 Full Moon
 1/12 Jupiter near Moon
 1/15 Last quarter
 1/17 Mercury at greatest elongation
 1/20 Mercury near Moon
 1/21 New Moon
 1/24 Venus near Moon
 1/25 Mars Exploration Rover *Opportunity* lands on Mars
 1/28 Mars near Moon
 1/29 First quarter

February

2/02 Neptune-Sun conjunction
 2/03 Saturn 4.5° S of Moon
 2/06 Full Moon
 2/08 Jupiter near Moon
 2/13 Last quarter

2/20 New Moon
 2/22 Uranus-Sun conjunction
 2/23 Venus near Moon
 2/26 Mars near Moon
 2/28 First quarter

March

3/04 Mercury at superior conjunction
 3/04 Jupiter at opposition
 3/06 Jupiter near Moon
 3/06 Full Moon
 3/13 Last quarter
 3/20 March equinox
 3/20 New Moon
 3/21 Venus at perihelion
 3/24 Venus near Moon
 3/26 Mars near Moon
 3/28 First quarter
 3/29 Mercury at greatest eastern elongation
 3/29 Venus at greatest eastern elongation

April

4/02 Jupiter near Moon
 4/05 Full Moon
 4/12 Last quarter
 4/17 Mercury at inferior conjunction
 4/19 New Moon
 4/19 Partial solar eclipse
 4/23 Venus near Moon
 4/23 Mars near Moon
 4/24 Astronomy Day
 4/27 First quarter
 4/30 Jupiter near Moon

May

5/04 Full Moon
 5/04 Total lunar eclipse
 5/11 Last quarter
 5/14 Mercury at greatest western elongation
 5/16 Mercury near Moon
 5/19 New Moon
 5/21 Venus near Moon
 5/22 Mars near Moon
 5/25 Mercury near Saturn
 5/27 First quarter
 5/27 Jupiter near Moon