Space News Update
— February 22, 2013 —

Contents

In the News

Story 1:
NASA’s SDO Observes Fast-Growing Sunspot

Story 2:
Russia Asteroid Impact: ESA Update and Assessment

Story 3:
Kepler Telescope Spots Smallest Exoplanet Yet

Departments

The Night Sky
ISS Sighting Opportunities
Space Calendar
NASA-TV Highlights
Food for Thought
Space Image of the Week
1. NASA's SDO Observes Fast-Growing Sunspot

As magnetic fields on the sun rearrange and realign, dark spots known as sunspots can appear on its surface. Over the course of Feb. 19-20, 2013, scientists watched a giant sunspot form in under 48 hours. It has grown to over six Earth diameters across but its full extent is hard to judge since the spot lies on a sphere not a flat disk.

The spot quickly evolved into what's called a delta region, in which the lighter areas around the sunspot, the penumbra, exhibit magnetic fields that point in the opposite direction of those fields in the center, dark area. This is a fairly unstable configuration that scientists know can lead to eruptions of radiation on the sun called solar flares.

Source: NASA
The first firm details of the 15 February asteroid impact in Russia, the largest in more than a century, are becoming clear. ESA is carefully assessing the information as crucial input for developing the Agency's asteroid-hunting effort.

At 03:20 GMT on 15 February, a natural object entered the atmosphere and disintegrated in the skies over Chelyabinsk, Russia.

Extensive video records indicate a northeast to southwest path at a shallow angle of 20° above the horizontal. The entry speed is estimated at around 18 km/s - more than 64 000 km/h.

According to calculations by Peter Brown at the University of Western Ontario, Canada, drawing on extremely low-frequency sound waves detected by a global network, the object is estimated to have been about 17 m across with a mass of 7000-10 000 tonnes when it hit atmosphere.

It exploded with a force of nearly 500 kilotons of TNT - some 30 times the energy released by the Hiroshima atomic bomb - around 15-20 km above the ground.

With our current understanding of near-Earth objects, events of this magnitude are expected once every several of tens to 100 years.
Questions and answers with ESA's near-Earth object team

Nicolas Bobrinsky, Head of ESA's Space Situational Awareness (SSA) programme, and Detlef Koschny, responsible for the programme's Near-Earth Object activity, responded to questions about the event. Was this event related to the predicted flyby of asteroid 2012 DA14, which passed Earth at 19:27 GMT that same day at just 28 000 km?

DVK: The trajectory, the location of entry into the atmosphere and the large time separation between the two events indicate that the Russian object was unrelated to 2012 DA14.

What caused the damage on the ground? Did pieces hit people or buildings?

DVK: Many media reported that an airburst caused window breakage and some structural damage in downtown Chelyabinsk. Normally, some damage begins to occur at around five times normal air pressure at sea level. Widespread window damage is expected around 10-20 times this value.

As the explosion and fireball progressed along a shallow trajectory, the cylindrical blast wave would have propagated directly to the ground and would have been intense.

The terminal part of the explosion probably occurred almost directly over Chelyabinsk. This was perhaps the single greatest contributor to the blast damage.

We are waiting for confirmation from the Russian authorities that pieces of the object - bits of meteorite - have been found in the region. We're unaware of any media reports of anyone or any structure being hit by any debris from the object itself.

Source: Spaceref.com

Return to Contents
3. Kepler Telescope Spots Smallest Exoplanet Yet

NASA's Kepler spacecraft, patiently measuring the light of distant suns to find the tell-tale dimming caused by the passage of unseen planets, has discovered a solar system 210 light years from Earth with the smallest planet yet found orbiting another sun-like star, NASA announced Wednesday.

Dubbed Kepler-37b, the planet is smaller than Mercury and only slightly larger than the moon. The Kepler data also revealed two other planets, one slightly smaller than Earth and one twice as large.

All three orbit their host star closer than Mercury orbits the sun. Kepler-37b takes just 13 days to complete one orbit -- Mercury takes 88 days to circle the sun -- giving the newly discovered world an estimated temperature of more than 800 degrees Fahrenheit.

The other two planets are only slightly farther out, with Kepler-37c orbiting every 21 days and Kepler-37d taking 40 days to complete a circuit.

"We uncovered a planet smaller than any in our solar system orbiting one of the few stars that is both bright and quiet, where signal detection was possible," Thomas Barclay, a Kepler scientist at the Bay Area Environmental Research Institute in Sonoma, Calif., said in a NASA statement. "This discovery shows close-in planets can be smaller, as well as much larger, than planets orbiting our sun."

The findings are presented in the journal Nature.

Launched in 2009, the Kepler space telescope is equipped with a 95-megapixel camera that acts as an ultra-sensitive photometer, continually monitoring the light from more than 150,000 stars in a patch of sky in the constellation Lyra.

Planets passing in front of targeted stars cause a very slight dimming, roughly comparable to watching a flea creep across a car's headlight at night. By timing repeated cycles, computer analysis can ferret out new worlds, including potential Earth-like planets orbiting in a star's habitable zone where water can exist as a liquid.
The probability of finding sun-like stars with Earth-like planets in orbits similar to ours - and aligned so that Kepler can "see" them - is about one-half of 1 percent. Given the sample size, however, that still leaves hundreds of potential discoveries.

To accurately measure a planet's size, however, astronomers must first know the size of the star in question. The Kepler science team determined the size of the star Kepler-37 by precisely measuring subtle flickering caused by sound waves moving through the star.

Researchers determined Kepler-37 is three quarters the size of the sun with an uncertainty of just 3 percent, a new record in the fast-moving search for exoplanets.

"Even Kepler can only detect such a tiny world around the brightest stars it observes," Jack Lissauer, a planetary scientist at NASA's Ames Research Center, said in NASA's statement. "The fact we've discovered tiny Kepler-37b suggests such little planets are common, and more planetary wonders await as we continue to gather and analyze additional data."

Since launch, Kepler has discovered 114 confirmed exoplanets and nearly 3,000 planet candidates requiring additional observations. Combined with other searches, astronomers have identified some 700 exoplanets to date.

Source: Spaceflight Now
The Night Sky

Friday, February 22

- Look to the right of the gibbous Moon this evening for Procyon, and above the Moon for Pollux and (higher) Castor. The Moon is 1.3 light-seconds from Earth; Procyon, Pollux, and Castor are 11, 34, and 52 light-years in the background, respectively.

Saturday, February 23

- At this time of year, the Big Dipper stands on its handle in the northeast during evening. The top of the Dipper — the two Pointer stars, pointing left to Polaris — are now at exactly Polaris's height around 8 p.m. (depending on where you live in your time zone).

Sunday, February 24

After dinnertime at this time of year, four carnivore constellations stand in a row from the northeast to south. They're all seen in profile with their noses pointed up and their feet (if any) to the right: Ursa Major in the northeast (with the Big Dipper as its brightest part), Leo in the east, Hydra the Sea Serpent in the southeast, and Canis Major in the south.

- Telescope users in eastern North America can watch Jupiter's moon Europa reappear out of eclipse from Jupiter's shadow around 6:59 p.m. EST. Then Io reappears out of eclipse around 8:55 p.m. EST. Both events happen just east of the planet.

Monday, February 25

- Full Moon this evening (exactly full at 3:26 p.m. EST). The Moon is south of Leo: in the dim constellation Sextans for part of the night.

Sky & Telescope

Return to Contents
### ISS Sighting Opportunities

For Denver:

<table>
<thead>
<tr>
<th>SATELLITE</th>
<th>DATE/TIME</th>
<th>LOCAL DURATION</th>
<th>MAX ELEV (DEG)</th>
<th>APPROACH (DEG-DIR)</th>
<th>DEPARTURE (DEG-DIR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISS</td>
<td>Fri Feb 22/06:47 PM</td>
<td>3</td>
<td>23</td>
<td>11 above NNW</td>
<td>21 above NE</td>
</tr>
<tr>
<td>ISS</td>
<td>Fri Feb 22/08:23 PM</td>
<td>&lt; 1</td>
<td>12</td>
<td>12 above WNW</td>
<td>12 above WNW</td>
</tr>
<tr>
<td>ISS</td>
<td>Sat Feb 23/07:32 PM</td>
<td>3</td>
<td>55</td>
<td>10 above NW</td>
<td>55 above NW</td>
</tr>
<tr>
<td>ISS</td>
<td>Sun Feb 24/06:41 PM</td>
<td>5</td>
<td>45</td>
<td>10 above NW</td>
<td>22 above E</td>
</tr>
<tr>
<td>ISS</td>
<td>Sun Feb 24/08:19 PM</td>
<td>&lt; 1</td>
<td>13</td>
<td>13 above W</td>
<td>13 above W</td>
</tr>
<tr>
<td>ISS</td>
<td>Mon Feb 25/07:29 PM</td>
<td>2</td>
<td>35</td>
<td>26 above W</td>
<td>29 above S</td>
</tr>
</tbody>
</table>

Sighting information for other cities can be found at NASA’s [Satellite Sighting Information](#).

---

### NASA-TV Highlights

*(all times Eastern Daylight Time)*

**No Special Programming**

Watch NASA TV on the Net by going to the [NASA website](#).

[Return to Contents](#)
Space Calendar

- Feb 22 - SARAL/ Sapphire/ CanX-3/ Tugsat 1 (Brite-Austria) PSLV-C20 Launch
- Feb 22 - Comet 120P/Mueller Perihelion (2.729 AU)
- Feb 22 - Asteroid 469 Argentina Occults HIP 25363 (6.8 Magnitude Star)
- Feb 22 - Asteroid 2002 Euler Closest Approach To Earth (1.399 AU)
- Feb 22 - Kuiper Belt Object 90482 Orcus At Opposition (47.053 AU)
- Feb 23 - Mars Winter Solstice
- Feb 23 - Comet 274P/Tombaugh-Tenagra Perihelion (2.442 AU)
- Feb 23 - Asteroid 3291 Dunlap Occults HIP 62915 (6.4 Magnitude Star)
- Feb 23 - Asteroid 21 Lutetia Occults 2UCAC 40479037 (11.7 Magnitude Star)
- Feb 23 - Asteroid 1501 Baade Closest Approach To Earth (1.836 AU)
- Feb 23 - Asteroid 6714 Montreal Closest Approach To Earth (1.919 AU)
- Feb 24 - Cassini, Orbital Trim Maneuver #341 (OTM-341)
- Feb 24 - Mercury Passes 4.2 Degrees From Mars
- Feb 24 - Comet C/2012 T5 (Bressi) Perihelion (0.323 AU)
- Feb 24 - [Feb 21] Asteroid 2013 DG1 Near-Earth Flyby (0.029 AU)
- Feb 24 - Asteroid 5430 Luu Closest Approach To Earth (1.335 AU)
- Feb 24 - Asteroid 8672 Morse Closest Approach To Earth (1.704 AU)
- Feb 24 - Asteroid 10916 Okina-Ouna Closest Approach To Earth (1.923 AU)
- Feb 24 - 45th Anniversary (1968), Jocelyn Bell's Discovery of Pulsars
- Feb 25 - Cassini, Distant Flyby of Titan
- Feb 25 - Pluto Moons Naming Contest Ends
- Feb 25 - Comet P/2007 T2 (Kowalski) Perihelion (0.695 AU)
- Feb 25 - Comet C/2012 T5 (Bressi) Closest Approach To Earth (0.913 AU)
- Feb 25 - Asteroid 5841 Stone Closest Approach To Earth (1.050 AU)
- Feb 25 - Asteroid 1896 Beer Closest Approach To Earth (1.836 AU)
- Feb 25 - Asteroid 12759 Joule Closest Approach To Earth (2.006 AU)
- Feb 25 - Asteroid 9340 Williamholden Closest Approach To Earth (2.241 AU)

Dame Jocelyn Bell Burnell

Source: JPL Space Calendar
Food for Thought
Scientists Propose System to Vaporize Threatening Asteroids

As an asteroid roughly half as large as a football field -- and with energy equal to a large hydrogen bomb -- readies for a fly-by of Earth on Friday, two California scientists are unveiling their proposal for a system that could eliminate a threat of this size in an hour. The same system could destroy asteroids 10 times larger than the one known as 2012 DA14 in about a year, with evaporation starting at a distance as far away as the Sun.

UC Santa Barbara physicist and professor Philip M. Lubin, and Gary B. Hughes, a researcher and professor from California Polytechnic State University, San Luis Obispo, conceived DE-STAR, or Directed Energy Solar Targeting of Asteroids and exploRation, as a realistic means of mitigating potential threats posed to the Earth by asteroids and comets.

"We have to come to grips with discussing these issues in a logical and rational way," said Lubin, who began work on DE-STAR a year ago. "We need to be proactive rather than reactive in dealing with threats. Duck and cover is not an option. We can actually do something about it and it's credible to do something. So let's begin along this path. Let's start small and work our way up. There is no need to break the bank to start."

Described as a "directed energy orbital defense system," DE-STAR is designed to harness some of the power of the Sun and convert it into a massive phased array of laser beams that can destroy, or evaporate, asteroids posing a potential threat to Earth. It is equally capable of changing an asteroid's orbit -- deflecting it away from Earth, or into the Sun -- and may also prove to be a valuable tool for assessing an asteroid's composition, enabling lucrative, rare-element mining. And it's entirely based on current essential technology.

"This system is not some far-out idea from Star Trek," Hughes said. "All the components of this system pretty much exist today. Maybe not quite at the scale that we'd need -- scaling up would be the challenge -- but the basic elements are all there and ready to go. We just need to put them into a larger system to be effective, and once the system is there, it can do so many things."

The same system has a number of other uses, including aiding in planetary exploration.
In developing the proposal, Lubin and Hughes calculated the requirements and possibilities for DE-STAR systems of several sizes, ranging from a desktop device to one measuring 10 kilometers, or six miles, in diameter. Larger systems were also considered. The larger the system, the greater its capabilities.

For instance, DE-STAR 2 -- at 100 meters in diameter, about the size of the International Space Station -- "could start nudging comets or asteroids out of their orbits," Hughes said. But DE-STAR 4 -- at 10 kilometers in diameter, about 100 times the size of the ISS -- could deliver 1.4 megatons of energy per day to its target, said Lubin, obliterating an asteroid 500 meters across in one year.

The speed of interplanetary travel -- far beyond what is possible with chemical propellant rockets used today -- could be increased with this sized system, according to Lubin. It could also power advanced ion drive systems for deep space travel, he said. Able to engage multiple targets and missions at once, DE-STAR 4 "could simultaneously evaporate an asteroid, determine the composition of another, and propel a spacecraft."

Larger still, DE-STAR 6 could enable interstellar travel by functioning as a massive, orbiting power source and propulsion system for spacecraft. It could propel a 10-ton spacecraft at near the speed of light, allowing interstellar exploration to become a reality without waiting for science fiction technology such as "warp drive" to come along, Lubin said.

"Our proposal assumes a combination of baseline technology -- where we are today -- and where we almost certainly will be in the future, without asking for any miracles," he explained. "We've really tried to temper this with a realistic view of what we can do, and we approached it from that point of view. It does require very careful attention to a number of details, and it does require a will to do so, but it does not require a miracle."

Recent and rapid developments in highly efficient conversion of electrical power to light allow such a scenario now, Lubin said, when just 20 years ago it would not have been realistic to consider.

"These are not just back-of-the-envelope numbers," Hughes concurred. "They are actually based on detailed analysis, through solid calculations, justifying what is possible. And it's all available under current theory and current technology.

"There are large asteroids and comets that cross the Earth's orbit, and some very dangerous ones going to hit the Earth eventually," he added. "Many have hit in the past and many will hit in the future. We should feel compelled to do something about the risk. Realistic solutions need to be considered, and this is definitely one of those."

Three UCSB undergraduate students are assisting Lubin and Hughes with the DE-STAR project: Johanna Bible and Jesse Bublitz, both from the College of Creative Studies, and chemistry major Joshua Arriola.
Explanation: Why would clouds form a hexagon on Saturn? Nobody is sure. Originally discovered during the Voyager flybys of Saturn in the 1980s, nobody has ever seen anything like it anywhere else in the Solar System. If Saturn's South Pole wasn't strange enough with its rotating vortex, Saturn's North Pole might be considered even stranger. The bizarre cloud pattern is shown above in great detail by a recent image taken by the Saturn-orbiting Cassini spacecraft. This and similar images show the stability of the hexagon even 20+ years after Voyager. Movies of Saturn's North Pole show the cloud structure maintaining its hexagonal structure while rotating. Unlike individual clouds appearing like a hexagon on Earth, the Saturn cloud pattern appears to have six well defined sides of nearly equal length. Four Earths could fit inside the hexagon. Imaged from the side, the dark shadow of the Jovian planet is seen eclipsing part of its grand system of rings, partly visible on the upper right.

Credit: NASA/JPL-Caltech/Space Science Institute