Asteroids, Comets, Meteors --- and Impacts!

Asteroid belt -- between Mars and Jupiter
Comets -- large chunks of frozen gases and solid particles

Found in Kuiper belt and Oort Cloud

Due to perturbation of orbit, enter inner part of solar system, UV from Sun ionizes the frozen gases, and they fluoresce. Tail made up of glowing gases and solid particles that reflect sunlight.
Historically comets have been viewed as good and bad omens.
Composition: hydrogen, carbon & nitrogen compounds
Recurrent comets

Halley’s comet -- Sir Edmund Halley using Newton’s laws calculated orbit of comet of 1682, suggested it was same as previous comets and predicted return in 1758 -- 76 yr period

Giotto 1986
Meteor showers -- when Earth intersects debris from existing or extinct comet -- named for constellation the meteors appear to radiate

Leonids – Nov. – Tempel-Tuttle

Perseids – Aug – Swift-Tuttle
Meteors, Meteors, and Meteorites

Small solid particles, dust grains, rocks enter atmosphere everyday, most disintegrate, burn up due to friction -- “shooting star” -- meteor

Occasionally survive passage -- meteorite
A close encounter

Meteors 2, Cars 0

Either Earth is overpopulated with cars, or cosmic interlopers carry a dangerous geode. For the second time in 18 months, a meteorite has chosen a car as its target. Unlike the relatively benign Peacock Mountain meteorite (New York Times, February 1993, page 26), this rocky capsule carved a car in Spain — and injured its driver.

On the afternoon of June 21st, José Martín and his wife, Vicenta Core, were driving from Madrid to Marbella, where they hoped to spend a few days playing golf. As Martín neared south past the town of Getafe, a 1.4-kilogram meteorite crashed through the windshield on the driver's side. It ricocheted off the dashboard, bent the steering wheel, grazed the little finger of Martín's right hand, then flew between the couple's heads and landed on the back seat. Martín managed to pull over safely. Despite his shock and broken finger, he kept a sense of humor about the ordeal, later telling acquaintances curious about his finger cast that he was recovering from a tough round of bullfighting.

The rock was taken to the National Museum of Natural Sciences in Madrid and identified as a meteorite by mineralogist Jesús Martínez-Frias. He believes that the stone struck the car obliquely, giving its low angle of entrance into the windshield. Martínez-Frias later found more than 50 kilograms of additional fragments scattered within 200 meters of the impact site. The results of his analysis will be published in a few months.

Bursts, Flashes, and... Quasars?

Gamma-ray bursts and optical transients have always had a common trait: upon detecting either one, observers rush to find a source for the anomaly and usually come up with the same thing — nothing.

But a recent gamma-ray burst, named GRB 000219, has lured astronomers to a region of space that may hold a key to explaining both phenomena. Frederick J. Vrba (U. S. Naval Observatory), René Hudec (Astronomical Institute, Ondrejov, Czech Republic), and their colleagues describe their studies in the March 20th Astrophysical Journal and April 11th Astronomy and Astrophysics.

Looking into a 1999 gamma-ray burst found by the WATCH detector on the Soviet space observatory Granat, the researchers discovered that an optical transient — a short, bright visual flare that quickly faded to obscurity — had popped off in 1990 very close to the area where the burst was detected 8 years later. And, as if that weren't enough, a dim quasar was found in the same region.

Could the quasar be the culprit behind both of these unexplained events? The evidence is tempting, but the researchers have doubts. The positions of the burst, the transient, and the quasar are similar, but their precise locations are uncertain enough to allow the possibility of no relation at all.

Discrepancies with other gamma-ray detectors and mechanical problems with the Granat satellite have made pinpointing the burst difficult. Estimates place the quasar within 14 to 21 arc minutes of the gamma-ray source. However, the quasar is within the arc-minute-wide region where the visual flash was seen in 1990 — an association that has about a 0.5% chance of occurring randomly, and evidence that at least the quasar and the optical transient may be linked.

If the quasar, at a redshift of 1.78, was indeed the source of the flash, its energy...
Current Events -- Feb 15, 2013, Chelyabinsk, Russia

Meteorite impact area: Chelyabinsk, Russia
*this event is unrelated to the 2012 DA14 asteroid flyby
Impacts!

Barringer Crater
Tunguska event 1908 in Siberia

Small asteroid ~ 40m
The K-T event -- 65 million years ago

Iridium layer, Chicxulub crater in Yucatan 100 – 200 km diameter, \( \rightarrow \) 10 km asteroid or comet

75% extinction
A Close Encounter – a very close call --- 2012 DA14
Comet Shoemaker – Levy 9 (SL9) 1994 impacts Jupiter
WHAT DO YOU MEAN, YOU "MIssed"...???
Hollywood gets in the act:

Meteor --- 1979
Night of the Comet --- 1984
Asteroid --- 1997
Armageddon --- 1997
Deep Impact --- 1998