Smoky Mountain Astronomical Society

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S.C.R.A.P.S.

Society's **C**h**R**onological **A**stronomical **P**aper**S**

Jan. 12th SMAS Meeting

PSTCC, Main Campus
Hardin Valley Road
7:30 pm, Alexander Bldg, Room 223

From the President - Lee Erickson

Last month I wrote about the December, winter solstice or the time of the year when the sun traces its lowest path across the sky.

This month we have another solar event, the Perihelion. Perihelion is the moment of the year that the Earth is closest to the sun. It happens on January 3 at 20 hours UCT. (According to the US Naval Observatory web site.) About 6 months later, the earth is farthest away from the sun in an event called Aphelion. You should note that the proximity in time of the perihelion to the winter solstice is coincidental. As the earth's axis of rotation precesses in its 26,000 year cycle, the time between the dates of the winter solstice and the perihelion gradually changes.

Currently, in the northern winter, Perihelion brings the sun closer than average. It reaches a radius of 0.98 AU. AU is the astronomical unit or average distance between the earth and sun. Because the apparent size (or angular area) of the sun in the sky varies as the square of the distance, the illumination of the sun and also the heating effect of the sun changes. The size of this change is 0.98 times 0.98 or 0.96 a change of 4%. Therefore the sun is about 4% brighter and warmer on January 3 than average. It is dimmer and cooler than average by a similar amount in July.

A nice image showing the change to apparent size is at http://www.perseus.gr/Astro-Solar-Scenes-Aph-Perihelion.htm (*see picture page 2*)

Still we are colder in January than July, why? We are colder because the effect of the tilt of the earth's rotational axis, away from the sun, causes a larger cooling effect than the warming effect of the Perihelion.

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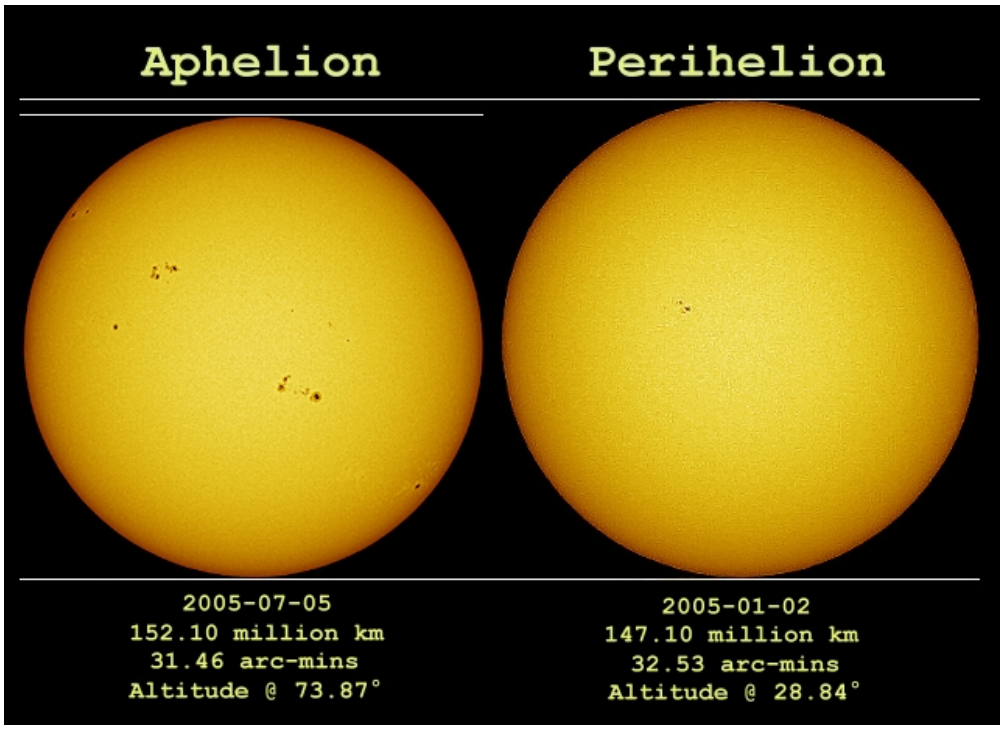
I am going to illustrate my guess at the relative size for the effects by taking the special case of an observer in St. Paul Minnesota, where I grew up. At midday, in mid to late March when the sun is straight overhead at the equator, in St. Paul it is 45 degrees south of straight up. This is because St. Paul's latitude is 45 degrees. The heating effect in St. Paul relative to the equator will be reduced by the cosine of 45 degrees to about 0.71. That is why St. Paul is cooler than the tropics on average. However, at the winter solstice the sun is 23 degrees south of straight up at the equator. This reduced the heating at
the equator to about 0.92 of the March heating. In St. Paul the sun is 45+23 = 68 degrees south of straight up. The cosine of 68 degrees is 0.37. Therefore, the solstice heating is reduced relative to March by (0.71-0.37)/0.71 or 0.34/0.71= 0.48 or 48%.

This change is larger and opposite to the change due to distance. However, in about 13 thousand years the two effects will be additive. This change to the relation of the axis tilt and the occurrence of perihelion and the unequal distribution of land mass between the
northern and southern hemispheres can drive overall climate change. It is thought that the interaction of these two effects and a third effect causing a slow change to the eccentricity of the earth's orbit drive the reoccurrence of ice ages. You can learn more about these so called, Milankovitch cycles on the internet. I recommend the entry at wikipedia, http://en.wikipedia.org/wiki/Milankovitch_cycles.

Finally, if you have trouble remembering the difference between perihelion and aphelion, a useful mnemonic is to recall that the words "away" and "aphelion" both begin with the letter "A".



Pictures from the SMAS Holiday Party 12/8/06

A Great Big Wreck

by Dr. Tony Phillips

People worry about asteroids. Being hit by a space rock can really ruin your day. But that's nothing. How would you like to be hit by a whole galaxy?

It could happen. Astronomers have long known that the Andromeda Galaxy is on a collision course with the Milky Way. In about 3 billion years, the two great star systems will crash together. Earth will be in the middle of the biggest wreck in our part of the Universe.

Astronomer John Hibbard isn't worried. "Galaxy collisions aren't so bad," he says. A typical spiral galaxy contains a hundred billion stars, yet when two such behemoths run into each other "very few stars collide. The stars are like pinpricks with lots of space between them. The chance of a direct hit, star vs. star, is very low."

Hibbard knows because he studies colliding galaxies, particularly a nearby pair called the Antennae. "The two galaxies of the Antennae system are about the same size and type as Andromeda and the Milky Way." He believes that the Antennae are giving us a preview of what's going to happen to our own galaxy.

The Antennae get their name from two vast streamers of stars that resemble the feelers on top of an insect's head. These streamers, called "tidal tails," are created by gravitational forces—one galaxy pulling stars from the other. The tails appear to be scenes of incredible violence.

But looks can be deceiving: "Actually, the tails are quiet places," says Hibbard. "They're the peaceful suburbs of the Antennae." He came to this conclusion using data from GALEX, an ultraviolet space telescope launched by NASA in 2003.

The true violence of colliding galaxies is star formation. While individual stars rarely collide, vast interstellar clouds of gas *do* smash together. These clouds collapse. Gravity pulls the infalling gas into denser knots until, finally, new stars are born. Young stars are difficult to be around. They emit intensely unpleasant radiation and tend to "go supernova."

GALEX can pinpoint hot young stars by the UV radiation they emit and, in combination with other data, measure the rate of star birth. "Surprisingly," Hibbard says, "star formation rates are low in the tidal tails, several times lower than what we experience here in the Milky Way." The merging cores of the Antennae, on the other hand, are sizzling with new stars, ready to explode.

So what should you do when *your* galaxy collides? A tip from GALEX: head for the tails.

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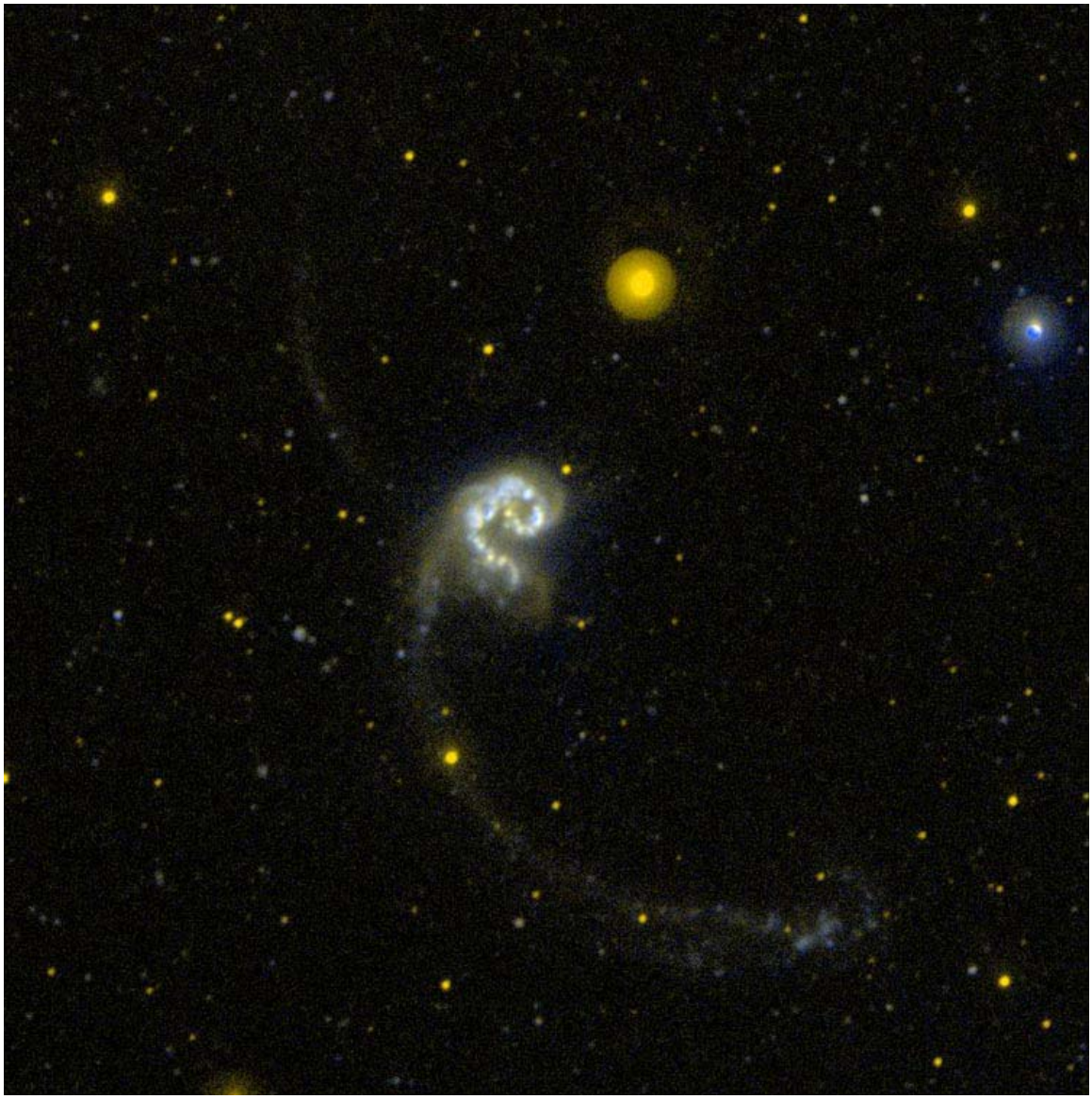
To see more GALEX images, visit www.galex.caltech.edu. Kids can read about galaxies and how a telescope can be a time machine at spaceplace.nasa.gov/en/educators/galex_puzzles.pdf.



This GALEX UV image of the colliding Antennae Galaxies shows areas of active star formation, which is not in the tidal tails as one might expect.

Announcement

My Son Sean, and his wife Michelle, have had a baby girl, Aurora

Born 1/10/07 4:40 pm
7 lbs, 6 oz
21 inchs long

Happy Birthday Aurora

Nanna and Grampa (Bill) Dittus

January 2007

SUN	MON	TUE	WED	THU	FRI	SAT
31	1 New Years	2 *Full Moon*	3	4	5 UTK	6 TAO
7	8	9	10	11	12 **SMAS Meeting PSTCC Rm 223 7:30 pm**	13
14	15	16	17	18	19 *New Moon* UTK	20 **SMAS Star Party @ TAO 9 pm**
21	22	23	24	25	26	27
28	29	30	31	1 *Full Moon*	2 UTK	3 TAO