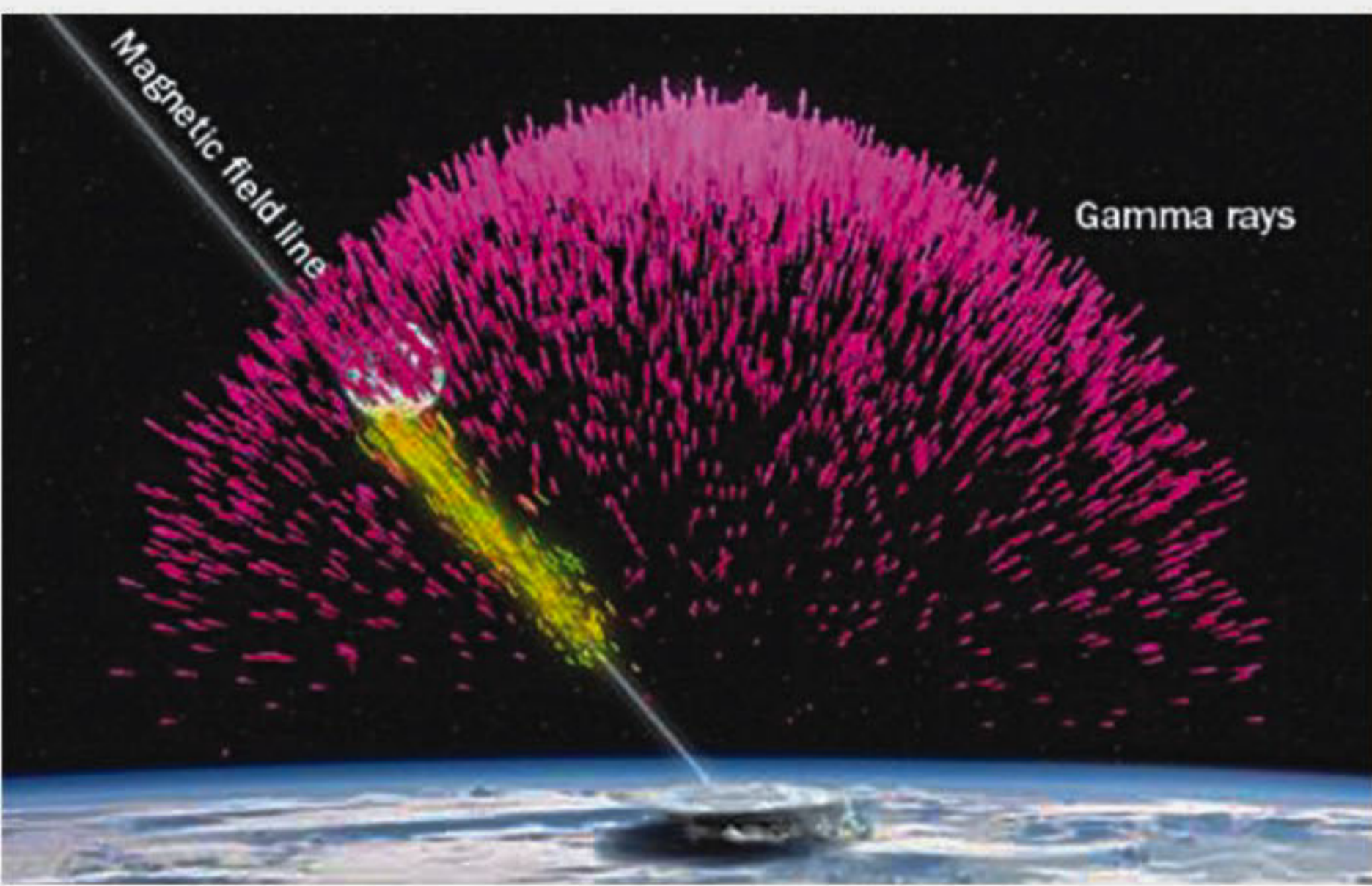


SCIENCE & LIFE

DHAKA TUESDAY JANUARY 18, 2011, E-MAIL: science&life@thedailystar.net

Thunder begets antimatter!



A computer simulation shows terrestrial gamma-ray flashes associated with lightning storms

FORGET about gamma rays from the hearts of distant galaxies. Scientists now believe gamma rays, as well as beams of energetic particles of antimatter, are common components of lightning storms right here on Earth.

In 2009, researchers announced that NASA's Fermi Gamma-ray Space Telescope had, for the first time, detected

gamma rays produced by antimatter generated in terrestrial lightning storms.

Now, after analyzing additional gamma-ray signals produced by terrestrial positrons the antimatter counterpart to electrons Michael S. Briggs of the University of Alabama in Huntsville and his colleagues think that the antimatter beams do not require special conditions to be generated. Briggs presented the

latest findings during a news briefing January 10 at the winter meeting of the American Astronomical Society. Details will also appear in an upcoming Geophysical Research Letters.

"The idea that any planet has thunderstorms that not only produce antimatter but then launch it into space seems like something straight out of science fiction," commented Steven Cummer of Duke University in Durham, N.C., who was not part of the study. "That our own planet does this, and has probably done it for hundreds of millions of years, and that we've only just learned it, is amazing to me."

According to Briggs, positrons and electrons form in terrestrial gamma-ray flashes, short bursts of gamma rays produced inside thunderstorms. (First observed in the 1990s, gamma-ray flashes are still not well understood.) When the positrons meet up with the electrons, they annihilate each other, producing gamma rays of a specific energy: 511,000 electron volts.

The Fermi observatory has usually been located directly above thunderstorms when it has detected positron-generated gamma rays, but in four cases the lightning storms were thousands of kilometers away from the region on Earth that the telescope was observing.

In one striking event on December 14, 2009, Fermi was orbiting over Egypt when the only active storm was in Zambia, some 4,500 kilometers to the south. Because the storm was not in Fermi's line of sight, the craft could not have detected gamma rays that came directly from the terrestrial disturbance. Yet Fermi did record gamma rays characteristic of annihilation between electrons and positrons that lasted for 30 milliseconds, the longest it has ever recorded such terrestrial signals.

Briggs' team suggests that electrons and positrons produced in the Zambia storm surfed along Earth's magnetic field to strike the Fermi craft. Many of the positrons met up with electrons in the spacecraft and the two annihilated each other immediately, producing the telltale gamma rays. But some of the positrons continued on past Fermi and were magnetically reflected back toward the craft 23 milliseconds later, only then pairing off with electrons in the craft to produce the gamma rays.

The newly discovered antimatter beams "gives us some very important information that we can use to piece together what is going on when lightning initiates and propagates," Cummer said.

Source: Science News



'CHRONO CELL'

Relativity powers car battery!



Scientists found that 80-85% of the voltage of a lead-acid battery is due to relativistic effects

The physicists and chemists who performed the study Rajeev Ahuja, Andreas Blomqvist, and Peter Larsson from Uppsala University in Uppsala, Sweden, and Pekka Pyykkö and Patryk Zaleski-Ejgierd from the University of Helsinki have published their results in a recent issue of Physical Review Letters.

"This is a new, well-documented case of 'everyday relativity,'" Pyykkö told PhysOrg.com. As the scientists noted in their study, the finding essentially means that "cars start due to relativity."

The lead-acid battery is the oldest type of rechargeable battery, with the main component being lead. With an atomic number of 82, lead is a heavy element. In general, relativistic effects emerge when fast electrons move near a heavy nucleus, such as that of lead. These relativistic effects include anything that depends on the speed of light (or from a mathematical perspective, anything that involves the Dirac or Schrödinger equations).

The lead-acid battery contains a positive electrode made of lead dioxide, a negative electrode made of metallic lead, and an electrolyte made of sulfuric acid. Through their calculations, the scientists found that the battery's relativistic effects arise mainly from the lead dioxide in the positive electrode, and partly from the lead sulfate created during chemical reactions.

Source: Physorg.com



RINGED PAST



DAWN RUNNER

Roman history in tree



The study offers a link between changes to the climate and the rise and fall of human societies

AN extensive study of tree growth rings says there could be a link between the rise and fall of past civilisations and sudden shifts in Europe's climate.

A team of researchers based their findings on data from 9,000 wooden artifacts from the past 2,500 years.

They found that periods of warm, wet summers coincided with prosperity, while political turmoil occurred during times of climate instability.

"Looking back on 2,500 years, there are examples where climate change impacted human history," co-author Ulf Buntgen, a paleoclimatologist at the Swiss Federal Research Institute for Forest, Snow and Landscape, told the Science website.

The team capitalised on a system used to date material unearthed during excavations.

Distinct drying in the 3rd Century paralleled a period of serious crisis in the western Roman empire

"Archaeologists have developed oak ring width chronologies from Central Europe that cover nearly the entire Holocene and have used them for the purpose of dating artefacts, historical buildings, antique artwork and furniture," they wrote.

"Chronologies of living and relict oaks may reflect distinct patterns of summer precipitation and drought."

The team looked at how weather over the past couple of centuries affected living trees' growth rings.

Source: BBC

At dawn of dinosaur era

A team of paleontologists and geologists from Argentina and the United States on Jan. 13 announced the discovery of a lanky dinosaur that roamed South America in search of prey as the age of dinosaurs began, approximately 230 million years ago.

Sporting a long neck and tail and weighing only 10 to 15 pounds, the new dinosaur has been named Eodromaeus, the "dawn runner."

"It really is the earliest look we have at the long line of meat eaters that would ultimately culminate in Tyrannosaurus rex near the end of the dinosaur era," said Paul Sereno, University of Chicago paleontologist and National Geographic Explorer-in-Residence. "Who could foretell what evolution had in store for the descendants of this pint-sized, fleet-footed predator?"

Sereno and his colleagues describe a near-complete skeleton of the new species, based on the rare discovery of two individuals found side-by-side, in the Jan. 14, 2011 issue of the journal Science. The paper presents a new snapshot of the dawn of the dinosaur era -- a key period that has garnered less attention than the dinosaurs' demise. "It's more complex than some had supposed," Sereno said.

Set in picturesque foothills of the Andes, the site of discovery is known as the "Valley of the Moon," said the report's lead author, Ricardo Martinez of Argentina's National University of San Juan. For dinosaur paleontologists, it is like no other.

"Two generations of field work have generated the single best view we have of the birth of the dinosaurs," Martinez said. "With a hike

across the valley, you literally walk over the graveyard of the earliest dinosaurs to a time when they ultimately dominate."

The area was once a rift valley in the southwest corner of the supercontinent Pangaea. Sediments covered skeletons over a period of five million years, eventually accumulating a thickness of more than 2,000 feet (700 meters).

Volcanoes associated with the nascent Andes Mountains occasionally spewed volcanic ash into the valley, allowing the team to use radioactive elements in the ash layers to determine the age of the sediments.

"Radioisotopes -- our clocks in the rocks -- not only placed the new species in time, about 230 million years ago, but also gave us perspective on the development of this key valley," said Paul Renne, director of the Berkeley Geochronology Center in California. "About five million years of time are represented in these layers, from one end to the other."

In the oldest rocks Eodromaeus lived alongside Eoraptor, a similar-sized, plant-eating dinosaur that Sereno and colleagues discovered in the valley in 1991. Eoraptor's descendants would eventually include the giant, long-necked sauropods. Eodromaeus, with stabbing canine teeth and sharp-clawed grasping hands, is the pint-sized precursor to later meat-eaters called theropods, and eventually to birds.

Source: Science Daily



Pint-sized Eodromaeus ("dawn runner") weighed only 10 to 15 pounds and measured about 4 feet in length from snout to tail tip. It lies very close to the ancestor of all meat-eating dinosaurs, including Tyrannosaurus.



HIDDEN BEAUTY



DO YOU KNOW?

'Fairy' insect wings



A female Closterocerus coffeellae, a fly, looks drab against a white background and shines against black

Tiny wasps and flies look bland at first glance like any drab brown insect you'd swat away without a second thought. But a closer look reveals a dazzling secret: Colorful wings that have gone unnoticed by scientists for decades.

Researchers at Lund University in Sweden have discovered that the insect species hymenoptera wasps and diptera flies they've been studying for decades reflect light off their wings in rainbow-like patterns. The effect is a bit like oil on water, but these patterns are permanent, suggesting they may play a role in insect communication.

Source: LiveScience

What is cosmophobia?



Cosmophobia is an irrational fear that the world is about to end, and is sparked off by a belief among people that a cosmic end is near. The fear is ancient, and people have been readying for doom on and off-expecting floods, earthquakes, epidemics, drought, or even a collision with another planet. The latest bout was set off by the movie 2012, where the Mayan calendar counts December 21, 2012 as the last day. Earlier, the 2000 millennium frenzy had everyone believe that the end was near. For ages now, there have been apocalyptic predictions which have fuelled cosmophobia, but until now, they have all come to naught.



ETERNAL WARMTH

Climate to change over millennia

RISEING carbon dioxide levels in the Earth's atmosphere will cause unstoppable changes to the climate for at least the next 1,000 years, a new study suggests.

The findings have led researchers to estimate a collapse of the West Antarctic ice sheet by the year 3000, and an eventual rise in the global sea level of at least four metres (yards).

The study, to appear in the Jan. 9 advance online edition of the research journal Nature Geoscience, is billed as the first full climate model simulation to make predictions so far ahead. It's based on best-case, "zero-emissions" scenarios simulated by scientists from the Canadian Centre for Climate Modelling and Analysis at the University of Victoria, and at the University of Calgary, also in Canada.

"We created 'what if' scenarios," said researcher Shawn Marshall of the University of Calgary. "What if we completely stopped using fossil fuels and put no more [carbon dioxide] in the atmosphere? How long would it then take to reverse current climate change trends and will things first become worse?"

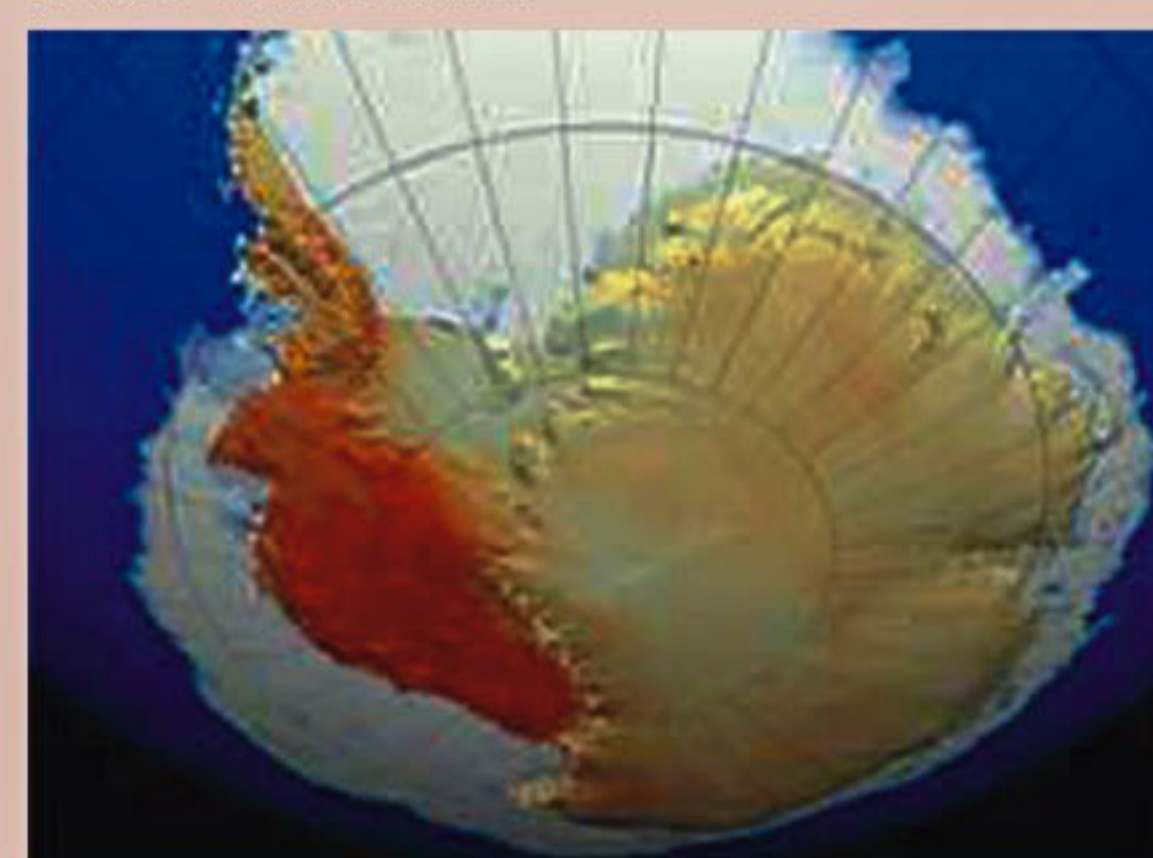
Excess carbon dioxide emissions, due to the burning of oil and other fossil fuels, are widely blamed by scientists as the main culprit for global warming.

The research team explored zero-emissions scenarios beginning in 2100 and in 2100.

The Northern Hemisphere fares better than the south in the computer simulations, with patterns of climate change reversing within the 1,000-year timeframe in places like Canada. At the same time parts of North Africa experience desertification as land dries out by up to 30 percent. Meanwhile, ocean warming of up to five degrees Celsius off of Antarctica is seen as likely to trigger widespread collapse of the West Antarctic ice sheet.

Researchers hypothesize that one reason for the difference between the North and South is the slow movement of ocean water from the North Atlantic to the South Atlantic.

Source: World Science.



At the South Pole lies the Antarctic Ice Sheet (shaded in red). It is vulnerable due to global warming