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SWIFT - astronomers' alarm bell

NASA's SWIFT satellite is astronomers' early warning lookout in the sky, says S.Ananthanrayanan.

SWIFT, which was launched in 2003, is a facility dedicated to keep a lookout for a brilliant but short-lived cosmic phenomenon called the gamma ray burst (GRB) and to flash the information to thousands of astronomers, world-wide, so that they can get a look before the burst dies out. And on the 4th September 2005, SWIFT helped scientists study one such event, which took place almost just after the universe itself was born!

Birth and death of stars

Stars are conceived when vast, light-years-wide expanses of thinly distributed atoms, generally of hydrogen, begin to coalesce, under the force of gravity. As the gas crashes in, its pressure increases and it warms, and keeps warming as the crush gets greater and greater. This goes on till the pressure and temperature are so great that the hydrogen nuclei merge, to form helium nuclei. This reaction, which is what happens in the hydrogen bomb, releases immense energy.

With the energy released, the gravitational collapse gets reversed into an explosion and the star expands. As the star grows larger and larger, the pressure drops and it cools, and the expansion slows down. Till, finally, gravity takes over again and the star begins to collapse. This causes warming, more hydrogen fusion reactions, explosions, and so on.

When all the hydrogen is used up, the helium nuclei begin to fuse into heavier nuclei, and so on, till the star consists of all the elements, till the element, iron. Things stop at iron because fusion reactions after iron do not create more energy. When this stage is reached, with no more nuclear fuel available, the star collapses continuously under gravity, to become an intensely hot *white dwarf*. And this stage may continue till the star gets so compressed that it becomes a neutron star or worse, a black hole.

Either this or the star may capture some external, fusionable material and again go off in a final outburst of energy where millions of tonnes are spewed out into outer space. It is in this stage, of the supernova, as it is called, that energies are so high that the elements higher than iron, which consume, in place of giving off energy in their creation, are born.

The supernova and GRBs

The fireworks end of a star going off is a maelstrom of charged particles accelerated to near light speeds. There are hellish magnetic fields and the charged particles in motion veer and turn in loops and curves. Such motion of charged particles results in emission of electromagnetic radiation, in the same way as the movement of currents in a wireless antenna gives off radio waves.

But the energies are so huge in supernovae that the emission is in the shortest frequency, or the gamma ray range. A brilliant display of this most energetic radiation, the ***Gamma Ray Burst***, then continues so long as it does not burn out. And while it lasts, it is an opportunity for scientists and astronomers to see, first hand, this spectacle of a star in death throes.

Does not last long

The problem with GRBs is that they consume so much energy that even a supernova cannot sustain them for long. They may last a few minutes or in rare cases, weeks, but astronomers always wished they had got there faster. NASA's swift is a watchdog satellite that keeps a lookout for GRBs, to clang bells the world over, so that astronomers can drop ever everything and rush to their labs or observatories as soon as the show starts.