National Aeronautics and Space Administration

Issue 7
April 2007

Swift Newsletter

Welcome Message from PI Neil Gehrels

Welcome to the spring 2007 issue of the Swift newsletter. We had wonderful news in January that the Swift team was awarded the Bruno Rossi Prize of the American Astronomical Society (AAS). The prize is sponsored by the High Energy Astrophysics Division of the AAS and was announced at the AAS meeting in Seattle. The citation states that the award is for gamma-ray burst discoveries of the mission, particularly calling out the breakthrough in our understanding of short bursts and the afterglows of bursts.

While the Rossi prizes looks back at the accomplishments of the past two years, the team is busy analyzing today's data and planning ahead to the future. As one important step in the future planning is a workshop that will be held at Penn State on May 1-2 (a time of typically beautiful weather in mid-Pennsylvania). The one and only topic of the public workshop is to gather input from the astronomical community about how best to use Swift's capabilities over the coming years to advance our understanding of the universe.

The meeting will focus not only on gamma-ray burst science, but also on non-burst opportunities. You may not be aware, but about 1/3 of the Swift observing time is used for non-GRB observations when bursts are not visible. A large and growing percentage of non-GRB time is spent on "Target of Opportunity" (ToO) observations based on urgent requests that come in via the internet. Here is an example: Suppose an astronomer has access to data in the optical band from a black hole or neutron star system in our Galaxy and sees that the source is brightening dramatically. This kind of event happens frequently in our variable universe. She or he then fills out a form on the Swift web site requesting a Swift ToO observation of the source. Depending on the urgency, the web site initiates cell phone alerts to the duty scientist, the operations engineer at Penn State, and to me. We then quickly arrange a repointing of the satellite to observe the outburst. The fastest response to date has been ~30 minutes between alert and Swift data taking. The rate of such requests has been ramping up and is now at about one every other day.

I'm getting off track describing this exciting aspect of Swift operations ... the point is that we will discuss GRB and non-GRB science at the Penn State workshop and gather community opinions on what topics should be emphasized the most in the future. I predict we will continue to spend most of the Swift observing time on GRBs, but we may make small changes in the balance and will definitely tune the kinds and methods of GRB and non-GRB observations. It occurred to me just this week how precious this time is, with Swift fully operational and powerful telescopes all over the world and in space participating in Swift science. Optimizing the use of Swift observing time is a priority. I will report to you on the outcome of the May workshop in the next newsletter.

Swift scientists interviews online!
http://swift.sonoma.edu/resources/multimedia/audio

Swift in the News

by Lynn Cominsky, SSU E/PO

1/16/07 - Top High-Energy Astronomy Prize Awarded for Swift Discoveries

The Bruno Rossi Prize, the top honor given by the High Energy Astrophysics Division of the American Astronomical Society, was awarded to Neil Gehrels and the Swift team "for major advances in the scientific understanding of gamma-ray bursts. These include ground-breaking observations to determine precise location of short gamma-ray bursts, and the discovery of enormously bright X-ray flares in the early afterglows.

2/7/07 - Magnetic Explosions in the Distant Universe

A new theory to explain the high-energy gamma-ray emissions from collapsing stars has been put forward by Pawan Kumar from the University of Texas, and appeared in the Monthly Notices of the Royal Astronomical Society.

3/8/07 - Gamma-Ray Birth Cries Suggest Massive Magnetic Engines

Studies of two peculiar gamma-ray bursts: GRB060729 and GRB070110 have led to conjectures that magnetic engines are behind unusually long-lived x-ray afterglows.

3/15/07 - Robotic Telescope unravels mystery of cosmic blasts

Scientists from Liverpool John Moores University and colleagues in the UK, Italy, France and Slovenia used the world's largest robotic telescope, the Liverpool Telescope on the island of La Palma, and its novel new polarimeter, RINGO, to perform the earliest-ever measurement (203 seconds) of the optical polarization following detection of a burst by NASA's Swift satellite. The article by Carole Mundell et al. appeared online in Science magazine.

For links to all of these press releases and images, see: *http://swift.gsfc.nasa.gov/docs/swift/news/*

GRBeaming

By: Dirk Grupe, Penn State University

Gamma-ray bursts (GRBs) are the most energetic transient objects in the Universe. Within seconds, they release more energy than our Sun does in its entire 10 billion year lifetime. As we know today, GRBs are explosions of very massive stars, in many ways similar to a normal supernova. However, their total energy seems to be a hundred or a thousand times larger than that of a typical supernova, and this energy is released over the course of less than a minute, while a normal supernova lasts for weeks. How can this be?

Theorists found a solution for this problem by having the emission from the GRB concentrated in a well-collimated light beam, what's called a "jet". Like looking down the beam of a flashlight, we are looking down the jet of a GRB when we observe it. This solves the energy problem of a GRB: if we assume the total energy of the GRB is emitted in every direction (more like a lantern than a flashlight), then it has to be extremely powerful, far more than we can understand. But if the energy is concentrated into a narrow beam, the total power emitted can be far, far less and still account for our observations.

The crucial issue here is the opening angle of that jet – the angle that describes how the jet spreads out over distance. The smaller the opening angle – the narrower the jet is – the smaller the total amount of energy is needed to explain the measured flux from the source. Going back to our previous example, we would need 2000 Watts of power from a lantern – which emits in all directions – to equal the amount of light we'd see from a flashlight powered by only 4 Watts, assuming the flashlight beam has an opening angle of a modest 5 degrees.

The same applies for GRBs. Because the light we see is like a light beam from a flashlight, the total energy needed is much less than what is

expected if the emission is isotropic. One crucial confirmation of the jet theory is the occurrence of what's called the "jet break". As the jet plows through the dust and gas between stars, it loses energy. It gives off X-rays as it does so, and after some time – usually a few days – the amount of X-rays detected drops suddenly. The jet break depends on the opening angle of the jet and the amount of energy in the burst itself, and has been seen in almost all the GRBs in which X-rays have been detected.

GRB 060729 was a burst detected by the Swift Burst Alert Telescope on July 29th, 2006, and it seems to challenge this standard theory of GRBs and jets. Swift was still able to detect the X-ray afterglow of this burst even four months after the explosion, the current record for an afterglow follow-up by Swift. During that time no sign of a transition to a more rapid decay in the X-ray flux was detected: no jet break was seen for at least 125 days after the burst.

This length of time indicates that the opening angle of the jet has to be at least 28 degrees, far wider than ever seen before. Because the opening angle is so wide this burst requires an enormous energy reservoir. One possible solution to this dilemma is that there is a continuous energy injection from a central magnetar, a neutron star with a very powerful magnetic field. This magnetic field works like an electromagnetic brake, taking the energy from the rotation of the magnetar (and hence slowing it down) and injecting it into the initial blast wave, keeping it going for far longer than usual.

The results of the Swift observations of GRB 060729 will be published by Penn State's astronomer Dirk Grupe as the lead author in the June 20th, 2007 edition of the Astrophysical Journal. Further observations of the X-ray afterglow by NASA's Chandra X-ray satellite are also planned to extend the observations of this extraordinary X-ray afterglow beyond any GRB afterglow that has ever been detected

Image 1

1. *The core of a massive star in a distant galaxy collapses, ending its life – though there is little effect visible at the surface. Deep inside, twin beams of matter and energy begin to blast their way outward.*

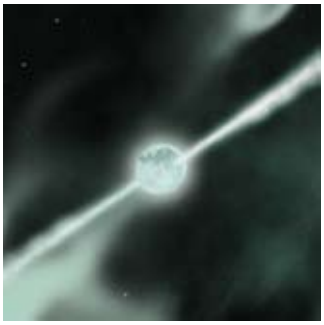

Image 2

2. *Within seconds, the beams have eaten their way outof the starm and observers at Earth see it as a gamma-ray burst, GRB 060729A.*

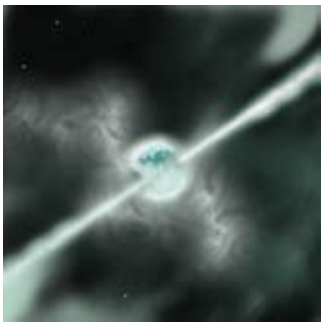

Image 3

3. *The outer envelope explodes outward, causing a supernova.*

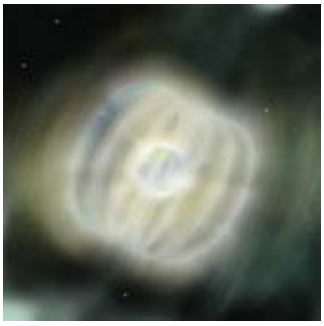

Image 4

4. *Deep at the heart of this event, the core has shrunk into a fantastically dense magnetar, a neutron star possessing a magnetic field trillions or even quadrillions of times stronger than Earth's. The magnetar could be what powers the long glow of X-rays seen by Earthbound scientists.*

Illustrations by Aurore Simonnet

E/PO Update - MySpace and Cafe Press

By: Phil Plait, SSU E/PO

In the E/PO world, a lot of time is spent on the **E** – Education – and forget about the **PO** – Public Outreach. For Swift, communicating with the public (which includes students outside the classroom) is never far from our minds. It allows us to be less formal, more fun, and experiment with outlets we might not otherwise employ.

On the web, one of the best ways to communicate with people is through social networking sites — places where people can gather virtually to chat, read bulletin boards, and find out what's new with their friends. The premier site for this is, of course, MySpace, so we decided to create MySpace pages for all the satellites we support: XMM-Newton, GLAST, and of course Swift (and SNAP, too, though that's still in the mission concept stage).

MySpace pages are actually an excellent venue for E/PO. We have information about the satellites there, and can keep people up-to-date on news through the inline blog. But that's not to say this has to be stuffy. Tongue firmly planted in cheek, we created these pages as if the satellites are alive, and post accordingly. XMM-Newton is the oldest (having launched in 1999) so is the most mature. Swift is next, and is tolerant though often miffed at its little brother GLAST, which is jealous that Swift is already in orbit. SNAP is the youngest — it's not even built yet!

On MySpace, people (and satellites) can collect "friends", who can read the blog and exchange comments and messages. Currently, Swift has 53 friends, which isn't too bad for something that's not even technically alive. We encourage everyone on the team (and especially younger family members) to take a look and sign up! It's a fun way to keep current on Swift's progress.

Also, for people who want to show off their affiliation on the team, we have opened an online store with Swift swag on CafePress. You can buy Swift hats, shirts, mugs, even an apron, a teddy bear, and Swift US Mail stamps!

We make no profit off of sales, and prices are reasonable (T-shirts run about $15US). The advantage of this process is that CafePress makes each item individually, so that you make your order and it's sent out right away; we don't have to collect many orders and do them all at once. Another advantage is that we can easily create a new product. If you want a different logo, a different image, or a different product, just let us know! We'll see what we can do.

http://www.cafepress.com/Swiftsatellite

We hope you enjoyed this quarterly publication. The Swift Newsletter was produced by the Swift Education and Public Outreach group at Sonoma State University. You can find all the Swift newsletters online at:
http://swift.sonoma.edu/resources/multimedia/newsletter/index.html

This newsletter is a quarterly electronic publication. If you are not a subscriber to this newsletter and would like to subscribe please visit our signup page at:
http://swift.sonoma.edu/resources/multimedia/newsletter/signup.html

For more information, please visit these Swift websites:

- ***Swift Mission:*** *http://swift.gsfc.nasa.gov*
- ***Swift Education and Public Outreach:*** *http://swift.sonoma.edu*
- ***Gamma-Ray Burst Real-time Update:*** *http://grb.sonoma.edu*
- ***Global Telescope Network:*** *http://gtn.sonoma.edu*

http://www.nasa.gov/swift