Deciphering the Ancient Universe with Gamma- Ray Bursts" 邦題:「ガンマ線バーストで読み解く太古の宇宙」



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Gamma-Ray Bursts The Most Powerful Explosion in the Universe

Some Long GRBs are known to be associated with hypernova explosions whose explosion energy is 10^52 erg.

- = 10 times larger than the explosion energy of a supernova explosion.
- = 10 times larger than the energy emitted from the sun in its whole life.



Cartoon of GRB (Long Bursts) From NASA's HP

Explosion mechanism is still unknown.

Development of Follow-up System to See the Ancient Universe

8hours after

3days after



GRBs are bright, but they Become dim very soon (a few seconds or so).

Quick follow-up by multi-Band telescopes is Necessary.

12yrs ago: Follow-up was impossible.

5yrs ago: Follow-up could be done from about 5 hours after the bursts. Now: Follow-up can be done from a few seconds after the burst



New World Record: The most distant object in the Universe is GRB090423.



GRBs shed light on The Ancient Universe



GRBs may be useful to estimate the cosmological parameters.

Mysteries and Possibilities of GRBs



The central engine is still unknown. Black hole formation? How are non-thermal gamma-rays produced? Very High-Energy Gamma-Rays are coming from GRBs. But how? Very High-Energy Neutrinos are coming from GRBs? Ultra-High Energy Cosmic Rays are produced by GRBs? Exotic Nuclei are synthesized?

International Conference of GRB in Kyoto

- April 19-23 (2010).
- http://www-tap.scphys.kyoto-u.ac.jp/GRB2010
- Contacting address: grb2010@yukawa.kyoto-u.ac.jp
- SOC Chair: Nobuyuki Kawai, LOC Chair: S.N.
- Registration and Abstract submission is open now.

Volcano 100414

At the Conference Site



About 200 people participated in the Conference.

20 invited talks by Foreigners.10 invited talks by Japanese.40 contributed talks.120 poster presentations.



From Tanvir's slide







 $z=8.23\pm0.08$

Tanvir et al. (2009)

From Salvaterra's slides

GRB 090423: TNG spectrum







Telescopio Nazionale Galileo ~14hrs after trigger



Fermi GeV-Gamma Ray Satellite ('08~)

GRB 090510



Odd ball: GRB 090902B



Delayed Onset?

Thermal Component was seen?

Propagation of a GRB Jet





Time evolution of the Photo-sphere and Light Curve of Thermal Emission





Left: Evolution of the temperature at The photo-sphere viewed from the jet axis. Time is measured by the observer at rest at the center of the Progenitor.

Right: Beaming factor at the photo-sphere

Light Curve and SED of GRB 090902B



Simulation (preliminary)

observation

- Thermal component may be explained by our model.
- We will investigate non-thermal emission, too.

Simulation on Formation of a GRB Jet S.N. 2009 ApJ.



Density contour in logarithmic scale (g/cc)

Final time corresponds to 1.77sec. R=200 corresponds to 600km.

Dependence of Dynamics on Rotating Black Hole





Density Structure, at T=1.6sec. Upper left: a=0 (Schwartzschild BH) Upper right: a=0.5 Lower left: a=0.9.

This is not a time-sequence, but Comparison of simulations for Different Kerr-Parameters. S.N. (2010), in prep.

Conference Dinner

Thank You Very Much



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