1 Deep optical observations contemporaneous with emission from the periodic FRB 180916.J0158+65

arXiv:2011.07561
Date: Sun, 15 Nov 2020 15:43:17 GMT (1180kb,D)
Title: Deep optical observations contemporaneous with emission from the periodic FRB 180916.J0158+65
Authors: Charles D. Kilpatrick, Joseph N. Burchett, David O. Jones, Ben Margalit, Russet McMillan, Wen-fai Fong, Kasper E. Heintz, Nicolas Tejos, and Alicia Rouco Escorial
Categories: astro-ph.HE
Comments: submitted to ApJL
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We present deep Apache Point Observatory optical observations within seconds of the outburst of the periodic fast radio burst (FRB) 180916.J0158+65 obtained on 3 September 2020. **FRB 180916.J0158+65 is located in a nearby spiral galaxy 150 Mpc away and has an "active phase" with a well-measured period of approximately 16.3 days.** Targeting the FRB at the peak of its expected active phase and during a recent 30 minute observing window by the Canadian Hydrogen Intensity Mapping Experiment (CHIME), we did not detect any transient optical emission at m_i=24.7~mag (3-sigma) from 2.2 to 1938.1 seconds after the burst arrival time in optical bands (corrected for dispersion). Comparing our limiting magnitudes to models of a synchrotron maser formed in the circumburst environment of FRB 180916+J0158.65, we constrain scenarios where the burst energy was >1e44 erg and the circumburst density was >1e4 cm-3.
\\ (https://arxiv.org/abs/2011.07561 , 1180kb)

2 Influence of a Galactic Gamma-Ray Burst on Ocean Plankton

arXiv:2011.08433
Date: Sat, 14 Nov 2020 17:49:51 GMT (297kb,D)

Title: Influence of a Galactic Gamma-Ray Burst on Ocean Plankton
Authors: Lien Rodr\'iguez-L\'opez (EULA, U. Concepci\'on, Chile), Rolando Cardenas (UCLV, Santa Clara, Cuba), Lisdelys Gonz\'alez-Rodr\'iguez (Faculty of Engineering, U. Concepci\'on, Chile), Mayrene Guimarais (UNAM, M\'exico) and J.E. Horvath (IAG-USP, S\~ao Paulo, Brazil)
Categories: astro-ph.HE
Comments: Contributed paper to the IWARA Conference, M\'exico September 2020, to be published by Astron. Nach. arXiv admin note: substantial text overlap
with arXiv:1010.0727
\\
The hypothesis that one or more biodiversity drops in the Phanerozoic eon, evident in the geological record, might have been caused by the most powerful kind of stellar explosion so far known Gamma Ray Bursts (GRB) has been discussed in several works. These stellar explosions could have left an imprint in the biological evolution on Earth and in other habitable planets. In this work we calculate the short-term lethality that a GRB would produce in the aquatic primary producers on Earth. This effect on life appears because of ultraviolet (UV) retransmission in the atmosphere of a fraction of the gamma energy, resulting in an intense UV flash capable of penetrating tens of meters in the water column in the ocean. We focus on the action of the UV flash on phytoplankton, as they are the main contributors to global aquatic primary productivity. Our results suggest that the UV flash could cause a significant reduction of phytoplankton biomass in the upper mixed layer of the World Ocean.
\\ (https://arxiv.org/abs/2011.08433 , 297kb)

3 What determines the structure of short gamma-ray burst jets?

arXiv:2011.06729
Date: Fri, 13 Nov 2020 02:33:24 GMT (3194kb,D)

Title: What determines the structure of short gamma-ray burst jets?
Authors: Gerardo Urrutia, Fabio De Colle, Ariadna Murguia-Berthier and Enrico Ramirez-Ruiz
Categories: astro-ph.HE
Comments: 9 pages, 7 Figures, submitted to MNRAS
\\

The discovery of GRB 170817A, the first unambiguous off-axis short gamma-ray burst arising from a neutron star merger, has challenged our understanding of the angular structure of relativistic jets. The late afterglow of GRB 170817A has been described by a structured jet seen slightly off-axis (at an observer angle of $\approx 20^\circ$--30°). **Studies of the jet dynamics and propagation usually assume that the jet is ejected from the central engine with a top-hat structure and its final structure, which determines the observed light curve and spectra, is primarily regulated by the interaction with the nearby environment.** However, relativistic jets are expected to be produced with a structure that is more complex than a simple top-hat, as shown by global accretion simulations. In this work, we present results of numerical simulations of short GRBs launched with a wide range of initial structures, durations, luminosities, and ejection time histories. We follow the interaction of the jet with the pre-collapse, merger remnant wind and compute its final structure at distances $\gtrsim 10^{11}$~cm from the central engine. We show that the final jet structure, as well as the resulting afterglow emission (at much larger distances), depend strongly on the initial structure of the jet, its luminosity and duration. We find that the initial structure at the jet is preserved for long-lasting SGRBs, while it is strongly modified for jets barely making their way through the wind. This illustrates the importance of combining the results of global simulations with propagation studies in order to better predict the expected afterglow signatures from neutron star mergers. Structured jets provide a reasonable description of the GRB 170817A afterglow emission with an off-axis angle $\theta_{\rm obs} \approx 22.5^\circ$ while top-hat jets do not.
\\ (https://arxiv.org/abs/2011.06729 , 3194kb)

4 The Search for Fast Transients with CZT

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arXiv:2011.07067
Date: Fri, 13 Nov 2020 18:59:59 GMT (800kb,D)

Title: The Search for Fast Transients with CZTI
Authors: Y. Sharma (1 and 2), A. Marathe (2 and 3), V. Bhalerao (2), V. Shenoy (2), G. Waratkar (2), D. Nadella (3), P. Page (2), P. Hebbar (2 and 4), A Vibhute (5), D. Bhattacharya (5), A.R. Rao (6), S. Vadawale (7) ((1) Division of Physics Mathematics and Astronomy California Institute of Technology, (2) Indian Institute of Technology Bombay, (3) National Institute of Technology Karnataka, (4) University of Alberta Edmonton, (5) Inter-University Centre for Astronomy and Astrophysics India, (6) Tata Institute of Fundamental Research India, (7) Physical Research Laboratory India) Categories: astro-ph.HE
Comments: Submitted to the "AstroSat - 5 years" special issue of the Journal of Astrophysics and Astronomy
\\
The Cadmium Zinc Telluride Imager on AstroSat has proven to be a very effective all-sky monitor in the hard X-ray regime, detecting over three hundred GRBs and putting highly competitive upper limits on X-ray emissions from gravitational wave sources and fast radio bursts. We present the algorithms used for searching for such transient sources in CZTI data, and for calculating upper limits in case of non-detections. We introduce CIFT: the CZTI Interface for Fast Transients, a framework used to streamline these processes. We present details of 88 new GRBs detected by this framework that were previously not detected in CZTI.
\\ (https://arxiv.org/abs/2011.07067 , 800kb)

5 Can we constrain the extragalactic magnetic field from very high energy observations of GRB 190114C?

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arXiv:2002.06918
replaced with revised version Fri, 13 Nov 2020 18:17:43 GMT (174kb)

Title: Can we constrain the extragalactic magnetic field from very high energy observations of GRB 190114C?
Authors: T.A. Dzhatdoev, E.I. Podlesnyi, I.A. Vaiman Categories: astro-ph.HE
Comments: 8 pages, 4 figures. Accepted for publication in Phys. Rev. D
\\
Primary very high energy γ-rays from γ-ray bursts (GRBs) are partially absorbed on extragalactic background light (EBL) photons with subsequent formation of intergalactic electromagnetic cascades. Characteristics of the observable cascade γ-ray signal are sensitive to the strength and structure of the extragalactic magnetic field (EGMF). GRB 190114C was recently detected with the MAGIC imaging atmospheric Cherenkov telescopes, **for the first time allowing to estimate the observable cascade intensity.** We inquire whether any constraints on the EGMF strength and structure could be obtained from publicly-available γ-ray data on GRB 190114C. We present detailed calculations of the observable cascade signal for various EGMF configurations. We show that the sensitivity of the Fermi-LAT space γ-ray telescope is not sufficient to obtain such constraints on the EGMF parameters. However, next-generation space γ-ray observatories such as MAST would be able to detect pair echoes from GRBs similar to GRB 190114C for the EGMF strength below 10^{-17}--10^{-18} G.
\\ (https://arxiv.org/abs/2002.06918 , 174kb)

6 The distant, galaxy cluster environment of the short GRB 161104A at z∼0.8 and a comparison to the short GRB host population

arXiv:2007.10372
replaced with revised version Thu, 12 Nov 2020 15:49:03 GMT (18394kb,D)

Title: The distant, galaxy cluster environment of the short GRB 161104A at z∼0.8 and a comparison to the short GRB host population
Authors: Anya E. Nugent (Northwestern, CIERA), Wen-fai Fong, Yuxin Dong, Antonella Palmese, Joel Leja, Alicia Rouco Escorial, Peter K. Blanchard, Kerry Paterson, Ryan Chornock, Andrew Monson, Matt Nicholl, and Edo Berger
Categories: astro-ph.HE
Comments: 20 pages, 9 figures, submitted to ApJ
\\

We present optical observations of the Swift short-duration gamma-ray burst (GRB) GRB 161104A and its host galaxy at z=0.793±0.003. We model the multiband photometry and spectroscopy with the stellar population inference code Prospector, and explore the posterior using nested sampling. We find that the mass-weighted age tm=2.12+0.23−0.21~Gyr, Stellar mass log(M/M ⊙)=10.21±0.04, metallicity log(Z/Z⊙)=0.08+0.05−0.06, dust extinction AV=0.08+0.08−0.05 mag, and the star formation rate SFR=9.9×10−2M⊙~yr−1. These properties, along with a prominent 4000 Angstrom break and optical absorption lines classify this host as an early-type, quiescent galaxy. Using Dark Energy Survey galaxy catalogues, we demonstrate that the host of GRB 161104A resides on the outskirts of a galaxy cluster at z≈0.8, situated ≈1 Mpc from the likely brightest cluster galaxy. We also present new modeling for 20 additional short GRB hosts (≈33% of which are early-type galaxies), finding population medians of log(M/M⊙)=9.94+0.88−0.98 and tm=1.07+1.98−0.67~Gyr (68% confidence). We further find that the host of GRB 161104A is more distant, less massive, and younger than the four other short GRB hosts known to be associated with galaxy clusters. Cluster short GRBs have faint afterglows, in the lower ≈11% (≈30%) of observed X-ray (optical) luminosities. We place a lower limit on the fraction of short GRBs in galaxy clusters versus those in the field of ≈5−13%, consistent with the fraction of stellar mass ≈10−20% in galaxy clusters at redshifts 0.1≤z≤0.8.
\\ (https://arxiv.org/abs/2007.10372 , 18394kb)

7 On the energy and redshift distributions of fast radio bursts

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arXiv:2011.06151
Date: Thu, 12 Nov 2020 01:26:06 GMT (3625kb)

Title: On the energy and redshift distributions of fast radio bursts
Authors: Rachel C. Zhang, Bing Zhang, Ye Li, and Duncan R. Lorimer Categories: astro-ph.HE
Comments: MNRAS, in press
\\
Fast radio bursts (FRBs) are millisecond-duration radio transients from cosmological distances. Their isotropic energies follow a power-law distribution with a possible exponential cutoff, but their intrinsic redshift distribution, which contains information about the FRB sources, is not well understood. We attempt to constrain both distributions by means of Monte Carlo simulations and comparing the simulations results with the available FRB specific fluence distribution, dispersion measure (DM) distribution, and the estimated energy distribution data. Two redshift distribution models, one tracking the star formation history of the universe and another tracking compact binary mergers, are tested. For the latter model, we consider three merger delay timescale distribution (Gaussian, log-normal, and power law) models. Two FRB samples detected by Parkes and the Australian Square Kilometre Array Pathfinder (ASKAP), respectively, are used to confront the simulation results. We confirm the ~ -1.8 power law index for the energy distribution but the exponential cutoff energy of the distribution, if any, is unconstrained. For the best energy distribution model, none of the redshift distributions we considered are rejected by the data. A future, larger, uniform FRB sample (such as the one collected by the Canadian Hydrogen Intensity Mapping Experiment, CHIME) can provide better constraints on the intrinsic FRB redshift distribution using the methodology presented in this paper.
\\ (https://arxiv.org/abs/2011.06151 , 3625kb)

8 On the Non-detection of Circular Polarisation from Repeating Fast Radio Bursts

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arXiv:2011.03960
Date: Sun, 8 Nov 2020 11:54:27 GMT (299kb)

Title: On the Non-detection of Circular Polarisation from Repeating Fast Radio Bursts
Authors: Shi Dai, Jiguang Lu, Chen Wang, Weiyang Wang, Renxin Xu, Yuanpei Yang, Songbo Zhang, George Hobbs, Di Li and Rui Luo
Categories: astro-ph.HE astro-ph.SR
Comments: Submitted to ApJL. Comments are very welcome
\\
The nature of Fast Radio Bursts (FRBs) is still an open question. In this letter, we draw attention to the non-detection of circularly polarised radio emission from repeating FRBs, and suggest that this could be a key discriminant of the origin of repeating and non-repeating FRBs. We argue that if repeating FRBs are powered by fast rotating (e.g., sub-second) pulsars with ultra-strong magnetic fields, circular polarisation cannot be produced by propagation effects in the magnetosphere. Alternatively, if repeating FRBs originate from slow rotating (e.g., second) pulsars, we argue that the lack of circular polarisation suggests that the emission comes from relatively high altitudes in the magnetosphere. In any case, significant circular polarisation observed in non-repeating FRBs indicates that they either have a different origin or involve different radiation mechanisms compared to repeating FRBs.
\\ (https://arxiv.org/abs/2011.03960 , 299kb)

9 Differential Source Count for Gamma Ray Bursts

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arXiv:2011.03945
Date: Sun, 8 Nov 2020 10:22:55 GMT (474kb,D)

Title: Differential Source Count for Gamma Ray Bursts
Authors: Shreya Banerjee, David Eichler and Dafne Guetta
Categories: astro-ph.HE astro-ph.CO gr-qc
Comments: 15 pages, 5 figures
\\
In this work, we revisit our earlier attempt to quantify the intrinsic luminosity function N(L)dL of Gamma Ray Bursts (GRBs) using observational constraints on the distribution of intrinsic luminosities. In our earlier work, the median luminosity Lmedian(z) was calculated, as a function of redshift, of beamed, identical, detectable sources of known redshifts, and compared with the luminosities of nearby GRBs of known redshift. In this paper, we constrain N(L)dL from the observed flux distribution N(F)dF by calculating the expected N(F) from a sample of GRBs with {\it unknown} redshift. We compare our theoretical expectations from a physical model with Fermi GBM data and thus constrain the angular emission profile of the GRBs. We find that at wide angles, N(L) is consistent with having a subluminous component, but that it is inconsistent with {\it purely} on-axis viewing.
\\ (https://arxiv.org/abs/2011.03945 , 474kb)

10. Stringent Search for Precursor Emission in Short GRBs from Fermi/GBM data and Physical Implications

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arXiv:2010.05706
Date: Mon, 12 Oct 2020 13:35:12 GMT (496kb)

Title: Stringent Search for Precursor Emission in Short GRBs from Fermi/GBM data and Physical Implications
Authors: Jie-Shuang Wang, Zong-Kai Peng, Jin-Hang Zou, Bin-Bin Zhang, and Bing Zhang
Categories: astro-ph.HE gr-qc
Comments: 11 pages, 5 figures, and 1 table. To appear in ApJL
\\
We perform a stringent search for precursor emission of short gamma-ray bursts (SGRBs) from the Fermi/GBM data and find 16 precursor events with $\gtrsim 4.5\sigma$ significance. We find that the durations of the main SGRB emission (TGRB) and the precursor emission (Tpre), as well as the waiting time (Twt) in between, are roughly comparable to each other, with $T_{\rm wt} \approx 2.8 T_{\rm GRB}^{1.2}$ approximately satisfied for most cases except one significant outlier. We also perform spectral analyses to the precursors and SGRBs, and find that the spectra of precursor emission can be fitted with the blackbody, non-thermal cutoff power law and/or power law models. We consider several possible models for precursor emission in SGRBs and find that the luminosity and spectral shape may be explained by the the shock breakout or the photospheric radiation of a fireball launched after the merger for thermal precursors, or magnetospheric interaction between two NSs prior to the merger for non-thermal precursors. For the fireball photospheric model, a matter-dominated jet is preferred and a constraint on the fireball Lorentz factor can be placed as $\Gamma \sim 30$. For the magnetospheric interaction model, jet launching mechanism may be constrained. In particular, those events with Twt/TGRB$\gg$1 (e.g. GRB191221802) require the formation of a supramassive or stable neutron star after the merger, with the delay time defined by the timescale for an initially baryon-loaded jet to become magnetically dominated and relativistic.
\\ (https://arxiv.org/abs/2010.05706 , 496kb)

11 Magnetar giant flare origin for GRB 200415A inferred from a new scaling relation and its implications

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arXiv:2008.05097
replaced with revised version Mon, 19 Oct 2020 14:09:01 GMT (266kb)

Title: Magnetar giant flare origin for GRB 200415A inferred from a new scaling relation and its implications
Authors: Hai-Ming Zhang, Ruo-Yu Liu, Shu-Qing Zhong and Xiang-Yu Wang
Categories: astro-ph.HE
Comments: Accepted by ApJL, 8 pages, 4 figures
\\
Soft gamma-ray repeaters (SGRs) are mainly a Galactic population and originate from neutron stars with intense (B≃1015 G) magnetic fields ('magnetars'). Occasionally, a giant flare occurs with enormous intensity, displaying a short hard spike, followed by a weaker, oscillatory phase which exhibits the rotational period of the neutron star. If the magnetar giant flares occur in nearby galaxies, they would appear as cosmic short-hard gamma-ray bursts (GRBs) without detecting the weak oscillatory phase. Recently, a short-hard GRB named GRB 200415A was detected, with a position coincident with the Sculptor Galaxy (NGC 253), rasing the question whether it is a classic short GRB or a magentar giant flare. Here we show that magnetar giant flares follow a scaling relation between the spectral peak energy and the isotropic energy in 1keV−10MeV, i.e., Ep∝E1/4iso, and locate in a distinct region of the Ep−Eiso plane from that of classic short GRBs. The relation can be well understood in the model that giant flares arise from the photosphere emissions of relativistically expanding fireball. GRB 200415A, together with two other candidate giant flares (GRB 051103 and GRB 070201) follow this relation, which strongly favor the giant flare origin of these GRBs. The GeV emission detected by \emph{Fermi}/LAT from GRB 200415A at 18−285s can also be explained in the giant flare scenario. The total energy in the GeV emission implies a baryon load of ∼1023g in the giant flare fireball of GRB 200415A.
\\ (https://arxiv.org/abs/2008.05097 , 266kb)