PROCEEDINGS OF SCIENCE

Preface

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This describes the motivation and aim of the conference, and acknowledges the support obtained.

Gamma-Ray Bursts 2012 Conference -GRB2012,
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PoS(GRB 2012)001

The combined Fermi/Swift Gamma-Ray Burst (GRB) conference "GRB2012-Munich" was held in the Künstlerhaus in downtown Munich (Germany), between May 7-11, 2012. It covered recent advances in all aspects of gamma-ray burst observations and theory. This conference followed similar previous combined Fermi/Swift meetings in Huntsville (October 2008) and Annapolis (November 2010), with the next one just being announced for Nashville (April 2013).

Gamma-ray bursts are the most energetic explosions in the Universe known to man kind, and are thought to be associated to the formation of some of the stellar mass black holes in the Universe. This is an exciting time in the GRB field as various missions provide a wealth of new data on this still puzzling phenomenon. The Fermi misson provides unprecedented spectral coverage over 7 decades in energy, and among others discovered new spectral components which challenge our standard picture of the prompt emission. The Swift mission continuous to swiftly monitor and locate GRBs in multiple wavebands, providing the basis for all ground-based follow-up observations towards redshift measurements and afterglow and host property investigations. AGILE, INTEGRAL, Suzaku and Konus continue to provide crucial information on GRB properties, and the MAXI mission provides an all sky X-ray monitoring of transients. There is also growing capability for follow-up observations by ground-based telescopes at basically all wavelengths. Besides the classical optical/infrared/radio observations, searches are underway for TeV emission, neutrinos and gravitational waves. Moreover, new experiments have returned first data, among others IKAROS on the prompt polarization properties. Complementing all these new observational results, a huge theoretical effort is underway to understand the GRB phenomenon and keep up with the constant new puzzles coming from the data.

This conference brought together astrophysicists, neutrino physicists and gravitational wave scientists to discuss the latest data and theories, to build synergistic collaborations between the fields and across wavelengths, and beyond better understanding the GRB phenomenon to develop GRBs as a powerful probe of a variety of fundamental questions in present-day research.

In our unavoidably subjective view, the highlights of the conference were

- the paradigm shift from synchrotron-emitting colliding shells to a multi-component, multi-emission site process which generates the prompt gamma-ray radiation [4, 8, 7, 6]. The observational evidence for a thermal component has now become very convincing, both in long- and short-duration GRBs. In conjunction, substantial progress has been achieved in the theoretical understanding on the possible physical effects leading to such a thermal component in the framework of an optically thick fireball.

- the significant detection of gamma-ray polarization in a few GRBs by the GAP experiment on IKAROS [9]. Such measurements have been hard to come by with previous instrumentation, and the new dedicated GAP polarimeter has finally achieved the break-through. Polarization is known to be key in pinpointing the emission process in GRBs.

- the IceCube upper limits on TeV neutrinos associated with the prompt emission of GRBs as obtained in the observing periods 2008-2010 and published just 2 weeks prior to this conference [1] are challenging for theory [2, 3, 5]. Neutrinos are thought to be produced in the decay of charged pions which according to the GRB fireball scenario are created in the interaction of accelerated protons and gamma-rays.

All these new results have been actively discussed, and though no final conclusions have been reached, we are looking forward to an exciting era in which scientists will try to understand the consequences of all these three observational results on the theory of gamma-ray production in GRBs.

This conference was financially supported to a major extent by a grant of the Deutsche Forschungsgemeinschaft (GR 1350/15-1) which allowed us to keep the conference fee at a low level despite the exclusive venue. Further financial support was provided by the Deutsches Zentrum für Luft- und Raumfahrt (DLR), the Cluster of Excellence 'Origin and Structure of the Universe', and the Jena Optronik GmbH. We are extremely grateful for all this support.

This conference would not have been possible without the dedication of a number of people, both locally as well as external. The members of the Scientific Organizing Committee[1] have been charged with particularly heavy work load wrt. talk selection, poster prize selection and refereeing of all contributions for this electronic proceedings volume. The members of the Local Organizing Committee[2] have been vital in preparing all the little details during the preparation of this conference, as well as arranging all the social events. We also would like to mention the extraordinary help of the administration of our co-organizing institute, the Max-Planck Institute for Physics, most notably Anneliese Fleischer, and Sybille Rodriguez-Schneider. And last, but not least, we acknowledge with particular gratitude the limitless help by our secretary, Walburga Frankenhuizen. It is a pleasure to express our thanks to all the above mentioned colleagues, for the enthusiasm and dedication to make this conference a memorable event for all attendees. Finally, we also thank all the participants for their fruitful contributions and questions, leading to lively discussions not only after basically every talk, but also in the hallways and around the poster presentations.

References

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[2] M. Ahlers, *GRBs at Neutrino Telescopes*, in proceedings of *Gamma-Ray Bursts 2012 Conference*, PoS(GRB2012)127.

[3] P. Baerwald, *Neutrinos from GRBs, and the connection to gamma-ray observations*, in proceedings of *Gamma-Ray Bursts 2012 Conference*, PoS(GRB2012)128.

[4] S. Guiriec, *The Fermi Era: Towards a better understanding of the GRB prompt emission*, in proceedings of *Gamma-Ray Bursts 2012 Conference*, PoS(GRB2012)006.

[5] A. Homeier, *Recent IceCube Results from Searches for Transient Neutrino Sources*, in proceedings of *Gamma-Ray Bursts 2012 Conference*, PoS(GRB2012)135.

[1] Andrei Beloborodov (Columbia), Roger Blandford (Stanford), Frederic Daigne (IAP), Chris Fryer (LANL), Johan Fynbo (DARK), Neil Gehrels (NASA/GSFC), Jochen Greiner (MPE; co-chair), Francis Halzen (Wisconsin), Dieter Hartmann (Clemson), Nobu Kawai (TiTec), Chryssa Kouveliotou (NASA/MSFC), Julie McEnery (NASA/GSFC), Szabolcs Marka (Columbia), Nicola Omodei (Stanford), Bill Paciesas (USRA), Valentin Pal'shin (Ioffe), Rob Preece (UAH), Arne Rau (MPE; co-chair), Sandra Savaglio (MPE), Robert Wagner (MPP).

[2] Davide Burlon, Jonathan Elliott, Robert Filgas, Suzanne Foley, Walburga Frankenhuizen, David Gruber, Andreas v. Kienlin (chair), Sinead McGlynn, Felipe Olivares E., Patricia Schady, Vladimir Sudilovsky.

[6] D. Lazzati, *Theory of the Gamma-ray Burst Prompt Emission*, in proceedings of *Gamma-Ray Bursts 2012 Conference*, PoS(GRB2012)010.

[7] S. McGlynn, *Photospheric Emission in Fermi Gamma Ray Bursts*, in proceedings of *Gamma-Ray Bursts 2012 Conference*, PoS(GRB2012)012.

[8] F. Ryde, *The Photosphere in Gamma-Ray Bursts: Lessons Learned from Fermi*, in proceedings of *Gamma-Ray Bursts 2012 Conference*, PoS(GRB2012)011.

[9] D. Yonetoku, *Study of emission mechanism of Gamma-Ray Bursts by the gamma-ray polarization with IKAROS-GAP*, in proceedings of *Gamma-Ray Bursts 2012 Conference*, PoS(GRB2012)019.

Figure 1: Conference participants on the staircase of the Künstlerhaus, the GRB2012-Munich venue.