J. Michael **Burgess**

· Astrophysicist

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"Sometimes all we have left are pictures and fear"

Education

Ph.D. in Physics   *University of Alabama in Huntsville, USA*

Discerning the Physical Properties of Gamma-Ray Bursts via Time-Resolved Analysis with Physical Spectral
Models   *2011 - 2013*
Advisor: Dr. Robert D. Preece

Master in Physics   *University of Alabama in Huntsville, USA*

                                                                                      2008 - 2011

Advisor: Dr. Robert D. Preece

Bachelor of Science   *University of Alabama in Huntsville, USA*

Dual degree in Math and Physics   *2003 - 2008*

Skills

Programming Langauges	C/C++, FORTRAN, Python, Cython, R, Stan, JAGS, IDL, LaTeX, emacs
Statistics/Analysis	Full Bayesian inference, maximum likelihood, XSPEC, 3ML (developer)
Development	git, travis, coverage, python frameworks, docker, conda
Instruments	Fermi-GBM, Fermi-LAT, Swift-BAT, Swift-XRT, INTEGRAL-SPI, GROND, POLAR
Languages	English

Experience

Max-Planck-Institut für extraterrestrische Physik   *Garching, Germany*

Humboldt Research Fellow   *2017 - Now*

I am currently a member of Dr. Jochen Greiner's research group studying GRB emission physics via data from optical to high-energy gamma-ray instruments

KTH Royal Institute of Technology   *Stockholm, Sweden*

Oskar Klein Research Fellow   *2014 - 2017*

As a member of the GRB group at KTH under the direction of Felix Ryde, I investigated several aspects of GRB physics and analysis as well as assisting graduate students in their thesis studies. Developed physical models for GRB spectra and Bayesian software to fit Fermi data to models. Investigated spectral evolution in GRBs and assessed validity of classic spectral correlations related to cosmology and physical model inference. Designed novel scheme to fit Type Ia SNe cosmology data.

University of Alabama in Huntsville   *Huntsville, AL, USA*

Fermi GBM Team   *2009 - 2013*

Developed the ability to fit physical spectral models to GRB data. Participated in daily satellite operations and data monitoring. Participated in GCN collaboration to quickly distribute information about GRB triggers. Developed many multinational collaborations on various research projects.

Honors & Awards

2017	**Alexander von Humboldt Fellowship (ca 100,000 EU)**,	*Munich, Germany*
2015	**Royal Swedish Academy of Sciences Research Scholarship (ca 20,000 SEK)**,	*Stockholm, Sweden*
2014	**Oscar-Klein Postdoctoral Fellowship**,	*Stockholm, Sweden*
2012	**AAS Chamblis Award**, American Astronomical Society Meeting	*Austin, TX, USA*
2010	**Alabama Space Grant Consortium Graduate Fellowship (ca 40,000 USD /yr)**,	*UAHuntsville, USA*
2008	**Curry Astrophysics Graduate Fellowship (ca 9,000 USD /yr)**,	*UAHuntsville, USA*
2007	**Vanderbilt Prize for Undergraduate Research in Physics and Astronomy (ca 500 USD)**,	*Vanderbilt University, USA*
2007	**Alabama Space Grant Consortium Undergraduate Fellowship (ca 9000 USD / yr)**,	*UAHuntsville, USA*
2006	**NASA Institute of Advanced Concepts Research Fellowship (9000 USD)**,	*UAHuntsville, USA*
2003	**University of Alabama in Huntsville Academic Excellence Scholarship**,	*UAHuntsville, USA*

Presentations

Sixteenth Marcel Grossmann Meeting — *Rome, Italy*
Spectroscopy of GRBs: Where are we now? (**Invited**) — *July 2021*

COSI team journal club — *Berkley, California*
The Multi-Mission Maximum Likelihood Framework (**Invited**) — *Feburary 2021*

TUM ORIGINS special seminar — *Munich, Germany*
Seminar on Hierarchical Bayesian Models (**Invited**) — *Januaray 2021*

Gamma-ray Bursts in the Gravitational Wave Era 2019 — *Yokohama, Japan*
Synchrotron (**Invited**) — *Oct. 2019*

Ioffe Workshop on GRBs and other transient sources: 25 Years of Konus-Wind Experiment (KW25) — *St. Petersberg, Russia*
Synchrotron (**Invited**) — *Sept. 2019*
Prompt Emission Session Chair

Nanjing GRB Conference — *Nanjing, China*
Synchrotron (**Invited**) — *March. 2019*
Involved in prompt emission panel discussion

PyGamma — *Heidlberg, Germany*
The Multi-Mission Maximum Likelihood Framework (Invited) — *March. 2019*

XX Integral Conference — *Geneva, Switzerland*
Synchrotron — *Janurary 2019*

POLAR Workshop — *Geneva, Switzerland*
Polarization — *December 2018*

Deciphering the Violent Universe — *Cancun, Mexico*
GRB Spectral Width — *Janurary 2017*

Fermi Symposium — *Garmish, Germany*
Awakening the BALROG — *October 2017*

GRB Symposium 2016 — *Huntsville, AL, USA*
On the Fermi GBM event 0.4s GW-150914 — *XX 2016*

Imperial College London Statistics Seminar — *London, United Kingdom*
Exploring Gamma-ray Burst via the Bayesian Paradigm (**Invited**) — *XX 2016*

TEXAS Symposium
Geneva, Switzerland

An External Shock Origin of GRB 141028A
XX 2015

Fourteenth Marcel Grossmann Meeting
Rome, Italy

Taking the Band Function Too Far
July 2015

5th Fermi Symposium
Nagoya, Japan

To synchrotron or Not to Synchrotron
Oct. 2014

GRB 2013 Symposium
Huntsville, AL, USA

Relating the Thermal and Non-thermal Components of Fermi GRBs
XXX. 2013

GRB 2012
Malaga, Spain

Exploring Fermi GRBs via Physical SEDs
Nov. 2012

3rd Fermi Symposium
Rome, Italy

Constraints of the Synchrotron Shock Model
Nov. 2011

GRB 2010
Annapolis, MD< USA

Constraints of the Synchrotron Shock Model (**Invited**)
Nov. 2010

Advising

Florian Seitz
MPE, Garching, Germany

Assistant Bachelor Supervisor
2021-present

- Fitting of physical models in time and energy to GRB afterglow light curves

Kivanc Gulderen
MPE, Garching, Germany

Assistant Bachelor Supervisor
2021-present

- Application of Nazgul location algorithm to entire set of IPN GRBs

Eduard Dolhescu
MPE, Garching, Germany

Assistant Bachelor Supervisor
2020-2021

- Further development of the Nazgul location software
- Testing of Nazgul on real data

Markus Trost
MPE, Garching, Germany

Assistant Master Supervisor
2020-2021

- Developing population synthesis of GRB infrared afterglows

Niklas von Minckwitz
MPE, Garching, Germany

Assistant Bachelor Supervisor
2019-2020

- Calibrating the effect of localization errors on GRB spectra

Moritz Singhartinger
MPE, Garching, Germany

Assistant Bachelor Supervisor
2019-2020

- Development of new methods for GRB triangulation

Bjoern Blitzinger
MPE, Garching, Germany

Assistant Master and Ph. D Supervisor
2018-present

- Modeling of the Fermi-GBM background with a focus on fitting the Earth's albedo flux and the cosmic γ-ray background spectra
- Developing a new analysis for INTEGRAL SPI data

Francesco Berlato
MPE, Garching, Germany

Assistant Ph. D Supervisor
2017-2020

- Using BALROG to locate GRBs with Fermi-GBM and understanding the inherent systematics of the instrument.
- Fitting physical photospheric models to GRB spectra

Simon Steinmaßl
MPE, Garching, Germany

Assistant Master Supervisor
2018-2019

- Bayesian modeling of x-ray binary data obtained by GROND

Marco Grau   *MPE, Garching, Germany*
ASSISTANT BACHELOR SUPERVISOR   *2019*
- Fitting physical afterglow models to multiwavelength data

Ana Bacelj   *MPE, Garching, Germany*
ASSISTANT MASTER SUPERVISOR   *2017*
- Fitting hierarchical Bayesian correlation models to Fermi-GBM data

Felix Kunzweiler   *MPE, Garching, Germany*
ASSISTANT BACHELOR AND MASTER SUPERVISOR   *2018-2020*
- Construction of an object-oriented frame work for fitting and modeling the Fermi-GBM background
- development of a pipeline and website for Fermi-GRB localizations and alerts
- development of a transient search pipe-line in GRB data

Liang Li   *KTH Royal Institute of Technology,*
                                                                                Stockholm, Sweden
ASSISTANT PH. D SUPERVISOR   *2014-2016*
- Spectral analysis and correlations in GRB spectra

Shabnam Iyyani   *KTH Royal Institute of Technology,*
                                                                                Stockholm, Sweden
ASSISTANT PH. D SUPERVISOR   *2014*
- Synchrotron and photospheric modeling of Fermi-GBM observed GRBs.

Teaching

Lecturer and Co-Organizer   *Max Planck Institute for*
                                                                   extraterrestrial Physics, Garching,
                                                                                          Germany
SPECTRAL FITTING METHODS WORKSHOP   *2019*
- Lecture (link)

Lecturer and Co-Organizer   *Max Planck Institute for*
                                                                   extraterrestrial Physics, Garching,
                                                                                          Germany
MPE CODE MONKEYS   *2019*
- Hosted a weekly meetup with MPE students to discuss computer software issues and give advice

Lecturer and Co-Organizer   *Max Planck Institute for*
                                                                   extraterrestrial Physics, Garching,
                                                                                          Germany
MCMC WORKSHOP   *2019*
- Created a spontaneous meetup with MPE students to learn how to code an MCMC

Assistant Lecturer   *Technical University of Munich,*
                                                                                Garching, Germany
APPLIED MULTI-MESSENGER ASTRONOMY 2 (STATISTICAL AND MACHINE LEARNING METHODS IN PARTICLE AND ASTROPHYSICS)
(PH2282)   *2019*
- Lecture 1 (link)
- Lecture 2 (link)
- Lecture 3 (link)

Organizer   *Max Planck Institute for*
                                                                   extraterrestrial Physics, Garching,
                                                                                          Germany
STEW: STUDIES OF TRANSIENTS AND EXTREME WINDS   *2018-2019*
- Weekly meetup with students and postdocs to discuss progress in our research groups and help students learn to present their work

Invited Lecturer on GRB Analsysis   *University of Delaware, Lewes,*
                                                                                          Deleware
FERMI SUMMER SCHOOL   *2015*
- Invited to instruct graduate students on proper Fermi GRB Analysis (link)

Assistant Lecturer   *KTH Royal Institute of Technology,*
                                                                 Stockholm, Sweden

Astroparticle Physics (SH2204)   *2016*

Assistant Lecturer   *KTH Royal Institute of Technology,*
                                                                 Stockholm, Sweden

Astroparticle Physics (SH2204)   *2014*

Assistant Lecturer   *KTH Royal Institute of Technology,*
                                                                 Stockholm, Sweden

Astrophysics (SH2402)   *2014*

Assistant Lecturer   *University of Alabama in Huntsville,*
                                                                   Huntsville, AL

Quantum Mechanics (Bachelor level)   *2013*

Assistant Lecturer   *University of Alabama in Huntsville,*
                                                                   Huntsville, AL

General Relativity (Bachelor level)   *2012*

Organizations

POLAR-2
Project Scientst   *2018 - Now*

International Association of Astrostatistics
Board Member   *2018 - 2021*

Cosmostats Initiative (COIN)
Member   *2017 - Now*

Press

What powers the most powerful explosions in the Universe? (link)
MPE Press Release   *2019*

Nature Astronomy Outreach Article
Saving Synchrotron in Gamma-ray Bursts (link)   *2019*

SciTechDaily Interview
What powers the most powerful explosions in the Universe? (link)   *2019*

AstroNews Interview (German)
What powers the most powerful explosions in the Universe? (link)   *2019*

SciGow Interview
What powers the most powerful explosions in the Universe?(link)   *2019*

Oskar Klein Center Interview
Interview (link)   *2014*

UAH Interview

Don't worry about getting fried by gamma ray burst (link)   *2013*

Phys.org Interview

Don't worry about getting fried by gamma ray burst (link)   *2013*

Software

https://threeml.readthedocs.io

3ML
Lead developer

The Multi-Mission Maximum Likelihood framework (3ML) provides a common high-level interface and model definition, which allows for an easy, coherent and intuitive modeling of sources using all the available data, no matter their origin. At the same time, thanks to its architecture based on plug-ins, 3ML uses under the hood the official software of each instrument, the only one certified and maintained by the collaboration which built the instrument itself. This guarantees that 3ML is always using the best possible methodology to deal with the data of each instrument.

https://astromodels.readthedocs.io

ASTROMODELS
Lead developer

Astromodels is a very flexible framework to define models for likelihood or Bayesian analysis of astrophysical data.

https://popsynth.readthedocs.io
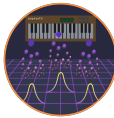
POPSYNTH
Sole developer

popsynth is a generic population modeling framework designed to generate synthetic populations of astrophysical sources either for experimental design or calibration of statistical models.

https://github.com/grburgess/pynchrotron

PYNCHROTRON
Sole developer

pynchrotron is a numerical code that uses the Chang-Cooper method to solve the Fokker-Plank equation for the injection of electrons and their subsequent cooling via synchrotron emission. A 3ML model is provided to allow for spectral fitting to GRB/AGN data.

https://cosmogrb.readthedocs.io

COSMOGRB
Sole developer

cosmogrb is a package built upon popsynth to simulate GRBs from luminosity functions and various other distributions. Each GRB can be passed through an instrument's response resulting in data when can be later analyzed (preferably with 3ML. Thus, one can generate catalogs of data from theoretical assumptions an test what these assumptions lead to in terms of observation.

https://gbmgeometry.readthedocs.io

GBMGEOMETRY
Lead developer

gbmgeometry provides spacecraft geometry tools for the Fermi-GBM satellite. 3D plotting and animation tools are provided to allow for understanding the incident angle of GRB emission.

https://gbm-drm-gen.readthedocs.io

GBM_DRM_GEN
Lead developer

The backbone of the BALROG is the which is a full rewrite of the original GBM response generator. BALROG must generate an instrument response for each proposed position on the sky.

https://github.com/grburgess/pyipn

PYIPN
Lead developer

PyIPN is a tool for simulating GRB light curves observed by gamma-ray detectors dispersed throughout the Universe (theorectically, but mostly in the Sol system).

https://github.com/grburgess/nazgul

NAZGUL
Lead developer

A modern approach to triangulating GRBs via time-delay measurements of multiple instruments. The method utilizes random Fourier features and full-Bayesian hierarchical model to properly locate GRBs with the appropriate statistical likelihood.

pychangcooper.readthedocs.io

PYCHANGCOOPER
Sole developer

A simple python solve for generic Fokker-Planck equations

MORGOTH

Lead developer

morgoth is the MPE lead GBM localization, spectral analysis, and cataloging pipeline that provides real-time localizations of GRBs to the follow-up community.

GBMKITTY

Sole developer

An experimental package to automatically create spectral analysis catalogs for the Fermi-GBM data.