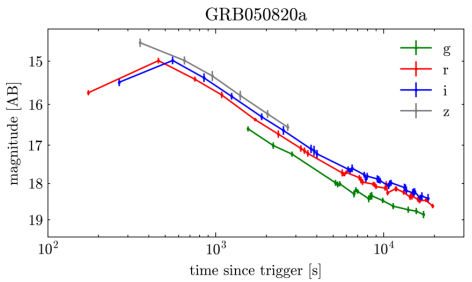
INVESTIGATING THE DIVERSITY OF RELATIVISTIC JETS

(And the automated Palomar 60-inch GRB follow-up survey)



PhD:

- Investigating the GRB population:
  - Lorentz factors
  - opening angles
  - true rates
  - … etc.

P60 survey (2004-2017):

- Hundreds of alerts
- Response time < 3 min - unbiased
- Data up to 2010:
  - 30 events followed early
  - 75% detection rate

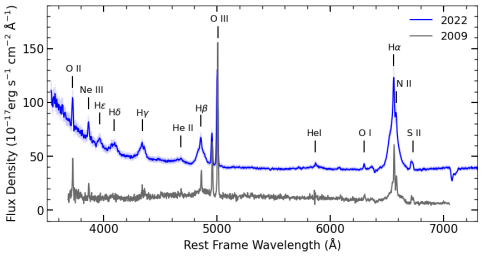
Aleksandra Bochenek
PhD student at ARI, LJMU
(they/them)

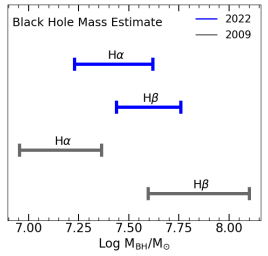
1

2

13 Year Changing-look Event in AGN: The Case of ZTF18abuamgo

Joel Carpenter
J.Carpenter@soton.ac.uk
Dr Sandra Raimundo





Features

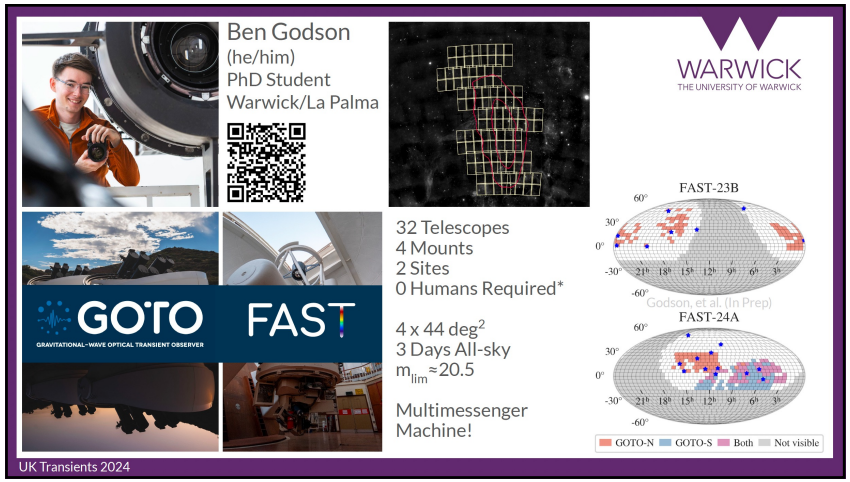
- Emergence of broad Balmer emission
- Brightened accretion disc
- ~ $4\times10^7 M_\odot$ black hole

Next Steps…

- Broad Line Region physics
- Accretion disc luminosity
- 2023 & 2024 observations

University of Southampton

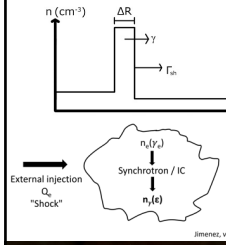
3

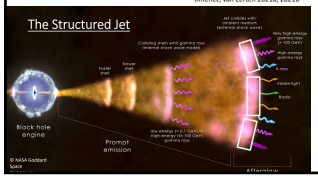


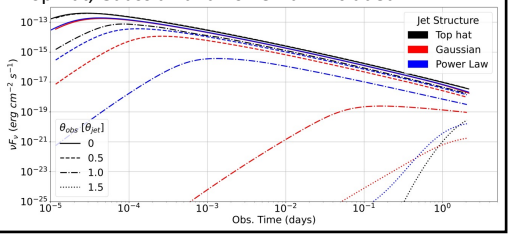
4

TeV emission from structured jets using a kinetic approach

- Shock evolution represented by shell model (van Eerten 2013; also Piran 99; Pe'er 2012; Nava 2013…)
- Population evolved using the kinetic code *Katu (Jimenez, van Eerten 2021a, 2021b)*
  - Synchrotron/SSC included (with Klein-Nishina)
- Flux calculated from equal-arrival time surface (EATS)
- Structure from multiple isotropic zones, $E_{iso} \propto \theta$
  - Top-hat, Gaussian and Power-law included





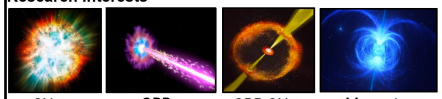


5

Amit Kumar
Postdoctoral Fellow

University of Warwick
Working Groups: **GOTO**, PESSTO, GSP.

Research Interests



❑ Discovering and classifying SNe and GRBs to understand their:
→ Powering Mechanisms
→ Progenitors
→ Environments
→ Ejecta Morphology

❑ Characterisation of telescopes' back-end Instruments and site calibrations.

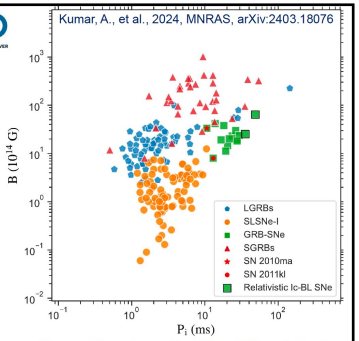


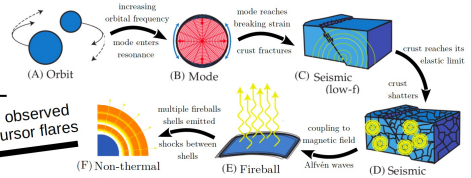
Figure: Magnetars with different Pi and B values can govern various types of transients.

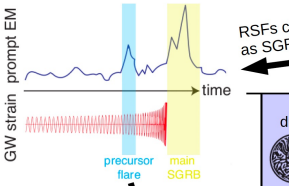
Currently Looking for a new role! Reach me at:
amit.kumar.3@warwick.ac.uk
amitkundu515@gmail.com

Publications

6

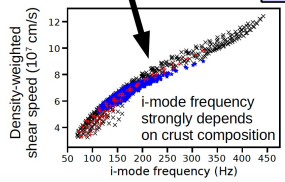
Resonant shattering flares: asteroseismic probes of the neutron star crust



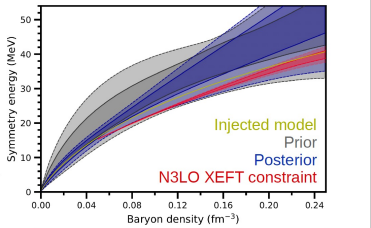


RSFs could be observed as SGRB precursor flares

Duncan Neill
dn431@bath.ac.uk
UNIVERSITY OF BATH

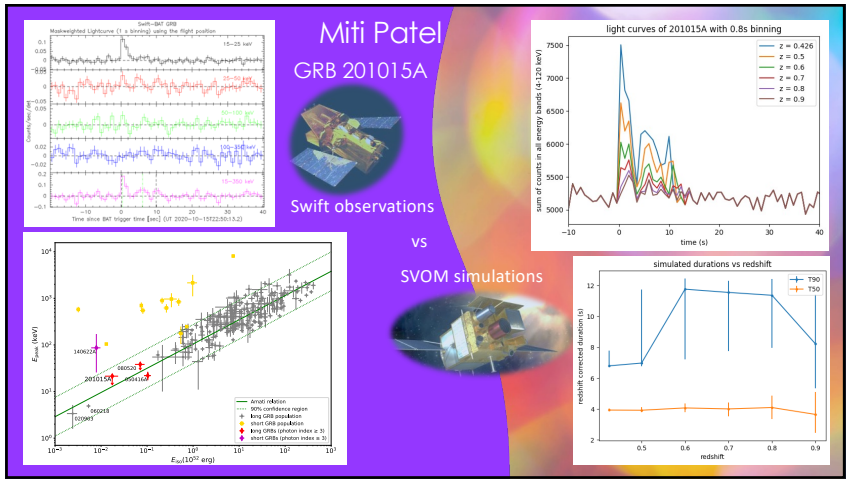


Crust composition is sensitive to nuclear physics

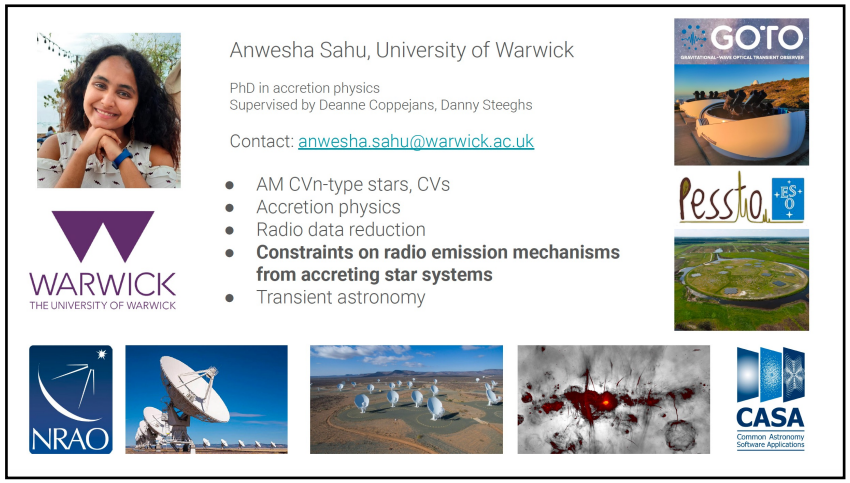


Coincident RSF and GW detections can inform us of NS crust composition and its underlying nuclear physics!

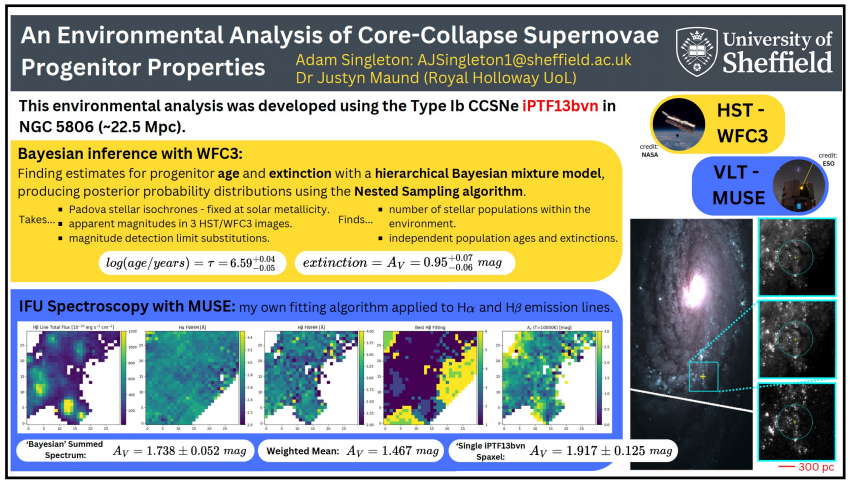
7



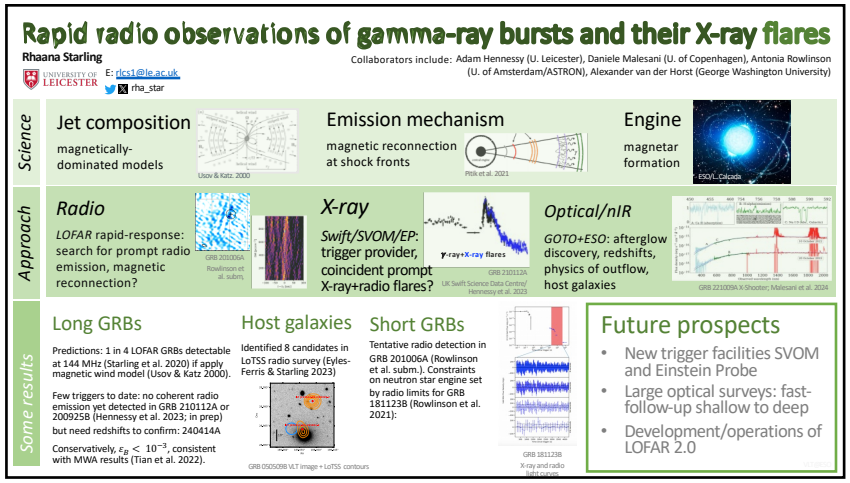
8


Anwesha Sahu, University of Warwick
PhD in accretion physics
Supervised by Deanne Coppejans, Danny Steeghs
Contact: anwesha.sahu@warwick.ac.uk
AM CVn-type stars, CVs
Accretion physics
Radio data reduction
Constraints on radio emission mechanisms from accreting star systems
Transient astronomy
WARWICK
THE UNIVERSITY OF WARWICK
GOTO
Pesstio
NRAO
CASA
Common Astronomy Software Applications

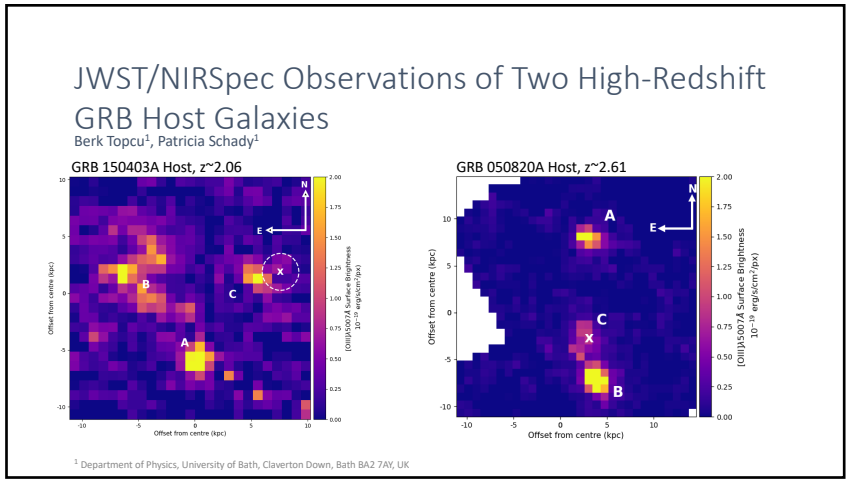
9


An Environmental Analysis of Core-Collapse Supernovae Progenitor Properties
Adam Singleton: AJSingleton1@sheffield.ac.uk
Dr Justyn Maund (Royal Holloway UoL)
University of Sheffield
This environmental analysis was developed using the Type Ib CCSNe iPTF13bvn in NGC 5806 (~22.5 Mpc).
HST - WFC3
VLT - MUSE
Bayesian inference with WFC3:
Finding estimates for progenitor age and extinction with a hierarchical Bayesian mixture model, producing posterior probability distributions using the Nested Sampling algorithm.
Takes...
Padova stellar isochrones - fixed at solar metallicity.
apparent magnitudes in 3 HST/WFC3 images.
magnitude detection limit substitutions.
Finds...
number of stellar populations within the environment.
independent population ages and extinctions.
$log(age/years) = \tau = 6.59^{-0.04}_{-0.05}$
$extinction = A_V = 0.95^{-0.07}_{-0.06}\ mag$
IFU Spectroscopy with MUSE: my own fitting algorithm applied to Hα and Hβ emission lines.
'Bayesian' Summed Spectrum: $A_V = 1.738 \pm 0.052\ mag$
Weighted Mean: $A_V = 1.467\ mag$
'Single iPTF13bvn Spaxel: $A_V = 1.917 \pm 0.125\ mag$
300 pc

10


Rapid radio observations of gamma-ray bursts and their X-ray flares
Rhaana Starling
E: rlcs1@le.ac.uk
rha_star
Collaborators include: Adam Hennessy (U. Leicester), Daniele Malesani (U. of Copenhagen), Antonia Rowlinson (U. of Amsterdam/ASTRON), Alexander van der Horst (George Washington University)
Science
Jet composition
magnetically-dominated models
Emission mechanism
magnetic reconnection at shock fronts
Engine
magnetar formation
Approach
Radio
LOFAR rapid-response: search for prompt radio emission, magnetic reconnection?
X-ray
Swift/SVOM/EP: trigger provider, coincident prompt X-ray+radio flares?
Optical/nIR
GOTO+ESO: afterglow discovery, redshifts, physics of outflow, host galaxies
Some results
Long GRBs
Predictions: 1 in 4 LOFAR GRBs detectable at 144 MHz (Starling et al. 2020) if apply magnetic wind model (Usov & Katz 2000).
Few triggers to date: no coherent radio emission yet detected in GRB 210112A or 200925B (Hennessy et al. 2023; in prep) but need redshifts to confirm: 240414A
Conservatively, $\varepsilon_B < 10^{-3}$, consistent with MWA results (Tian et al. 2022).
Host galaxies
Identified 8 candidates in LoTSS radio survey (Eyles-Ferris & Starling 2023)
Short GRBs
Tentative radio detection in GRB 201006A (Rowlinson et al. subm.). Constraints on neutron star engine set by radio limits for GRB 181123B (Rowlinson et al. 2021):
Future prospects
New trigger facilities SVOM and Einstein Probe
Large optical surveys: fast-follow-up shallow to deep
Development/operations of LOFAR 2.0

11


JWST/NIRSpec Observations of Two High-Redshift GRB Host Galaxies
Berk Topcu[1], Patricia Schady[1]
GRB 150403A Host, z~2.06
GRB 050820A Host, z~2.61
Offset from centre (kpc)
[OIII]λ5007Å Surface Brightness 10⁻¹⁹ erg/s/cm²/pix
[1] Department of Physics, University of Bath, Claverton Down, Bath BA2 7AY, UK

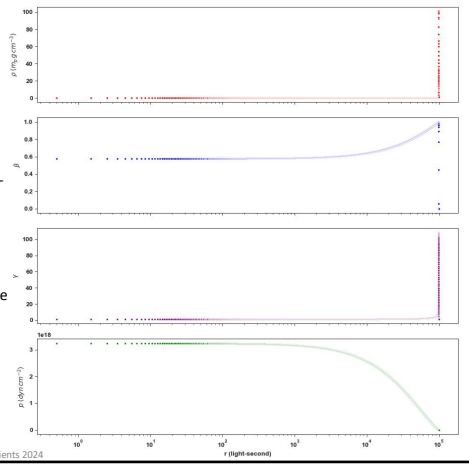
12

Numerical Analysis of Short Gamma-ray Bursts

- Model the structural evolution of sGRB jets for off-axis EM observations as counterpart to GW observations of the BNS merger
- Develop analytical solutions to the jet spreading
- Additionally model the processes that produce the prompt emission

Cairns Turnbull

Astrophysics Research Insitute, Liverpool John Moores University

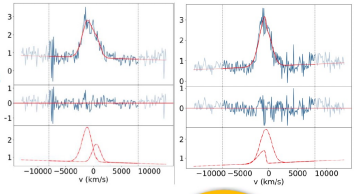


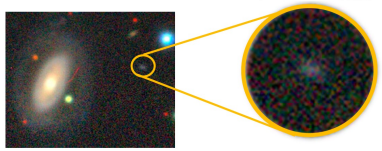
13

Ben Warwick
PhD Student, University of Warwick
Supervisors: Joe Lyman, Deanne Coppejans
ben.warwick@warwick.ac.uk

WARWICK
THE UNIVERSITY OF WARWICK

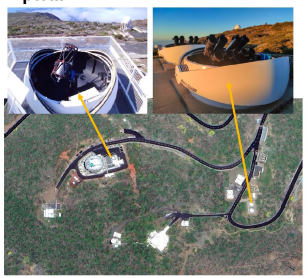
SN2023tsz (Ibn)





pt5m

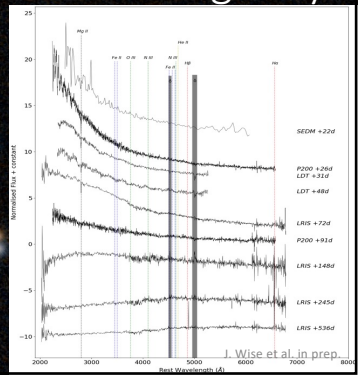
GOTO



14

AT2019cmw: A candidate Tidal Disruption Event of a high mass star in a dead galaxy

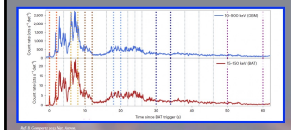
- Brightest event in ZTF Bright Transient Survey, $L > 10^{45.5} ergs^{-1}$
- High temperature at peak, spectral appearance and $t^{\sim\frac{-5}{3}}$ decline suggests a "featureless" TDE origin
- Displays cooling post-peak
- Redback "cooling envelope" modelling suggests $M_* \sim 50 M_\odot$

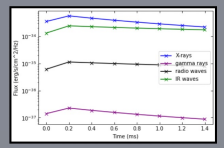


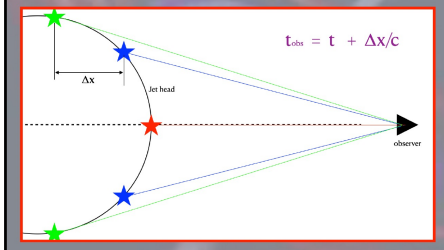
15

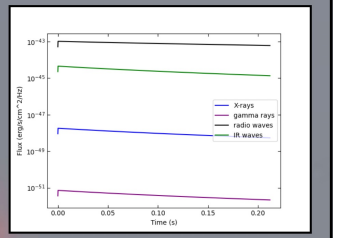
Extended Emission from Merger GRBs

Isabelle Worssam
1st year PhD
University of Birmingham









16