Matt Nicholl

2019-06-04

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Interests

Astrophysics of transient sources, superluminous supernovae, gravitational wave follow-up, tidal disruption events, fast radio bursts, time-domain surveys, optical and near-infrared observations, spectral analysis, light curve modelling, galaxies hosting transients

Appointments

2018– Royal Astronomical Society Research Fellow
University of Edinburgh

2015–2018 Postdoctoral Research Fellow
Harvard-Smithsonian Center for Astrophysics
PI: Edo Berger

Education

2012–2015 PhD, Astrophysics
Queen's University Belfast
Thesis Title: Observations and modelling of superluminous supernovae
Supervisor: Stephen Smartt

2008–2012 MPhys (First Class), Physics
Oxford University

Research highlights

- Led superluminous supernova (SLSN) follow-up in major teams (Pan-STARRS, PESSTO), including first-author Nature paper in first year of PhD studies
- Thesis included the first statistical study of SLSNe, which has informed subsequent analyses by many other groups
- Discovered the first cleanly resolved double-peaked light curve of a SLSN. This is now a major topic of interest in multiple surveys
- Led papers on 4 of the 6 lowest-redshift SLSNe ever discovered, including the most extensive set of observations for any SLSN (SN 2015bn)
- Calculated for the first time the volumetric rate of Fast Radio Bursts and showed how their host galaxy properties may connect them to other transients
- Collaborated with a close team to develop the Modular Open Source Fitter for Transients (MOSFiT)—a publicly-available theoretical and statistical tool for modelling any astrophysical light curve. I led the first MOSFiT paper: the largest-ever parameter space exploration for SLSNe
- Led spectroscopic study of GW170817: an elusive 'kilonova' and the first source ever detected in both gravitational waves and light
- Collected and analyzed the latest-ever observations of a superluminous supernova relative to explosion using the Hubble Space Telescope

Awards and Grants

2018	Royal Astronomical Society Research Fellowship · 3 years salary and research budget · Only 1-2 Fellowships awarded per year
2018	NASA Chandra Observer grant, Cycle 20
2017	Hubble Space Telescope General Observer grants (2), Cycle 25
2016	Hubble Space Telescope General Observer grant, Cycle 24
2016	Michael Penston Prize of the Royal Astronomical Society · "Best UK thesis in astronomy or astrophysics"
2014	SET for Britain finalist · Presented my work at the Houses of Parliament

Recent invited talks

Oct 2019	University of Southampton colloquium
Aug 2019	Hot-wiring the Transient Universe, Northwestern University
Apr 2018	EWASS Symposium on GRB-SN connection, Liverpool
Mar 2018	University of Rochester colloquium
Oct 2017	Oscar Klein Centre colloquium, Stockholm University

May 2017	Max Planck Institute for Extraterrestrial Physics seminar
Apr 2017	Harvard-Smithsonian CfA colloquium
Feb 2017	Royal Astronomical Society ordinary meeting

Telescope time as principal investigator

HST	9 orbits over 4 programs, Cycle 24-26
Chandra	60ks over 2 programs, Cycle 20
SOAR	Target of opportunity program for gravitational wave follow-up, up to 3 nights equivalent in semester 2018B, up to 6 nights equivalent in semester 2019A
Gemini	Total 8 hours over several successful proposals, 2016-2018
VLA	4 hours, 2017

Observing experience

Magellan	Optical imaging and spectroscopy using LDSS3c and IMACs · NIR imaging using FourStar and spectroscopy using FIRE · High-resolution spectroscopy using MagE
MMT	Remote observing, optical spectroscopy with Blue Channel
NTT	Optical and NIR imaging and spectroscopy using EFOSC2 and SOFI
WHT	Optical spectroscopy with ISIS
VLT	Target of Opportunity triggers and data reduction for X-Shooter and FORS2
HST	Phase II and data reduction experience with ACS, WFC3 and STIS
Gemini	Extensive data reduction experience with Gemini pipeline

Scientific responsibilities held

2019–	Phase 3 Data Reduction manager for Advanced PESSTO survey
2019	Local Organising Committee: Quasars in Crisis conference
2016–	Proposal review panels: Gemini, HST, Liverpool Telescope and others
2014–	Referee for ApJ, MNRAS and Nature Astronomy
2013–2015	Managed target of opportunity triggers for VLT program in PESSTO

Students mentored

2019	Fergus Davidson, University of Edinburgh undergraduate, via the Institute for Astronomy Summer Student scheme
2018–	Phil Short, University of Edinburgh PhD student (principal supervisor: Prof A. Lawrence)
2017–2018	Zoe Padilla and Nick Gottschlich Hawthorne, students at Cambridge Rindge and Latin High School. I supervised a year-long research project through the CfA Student Mentoring Program
2016–2017	Spencer Scott, Harvard undergraduate. I supervised a research project for Spencer resulting in a published ApJL paper with Spencer as first author
2015–2018	Peter Blanchard, Harvard PhD student (principal supervisor: Prof E. Berger)

Other teaching

2018–2019	Introductory Astrophysics, University of Edinburgh. Supervised problem-solving workshops and graded coursework through the Turnitin system
2012–2015	Computer lab demonstrator, Queen's University Belfast
2014	Supervised work-placement projects for high school students at QUB

Public outreach and media

- Keynote speaker at the 2019 Northern Ireland Physics teachers annual conference
- Contributed to public excitement and understanding of the first joint electromagnetic–gravitational wave source through launch of a new website kilonova.org, social media, and press interviews
- Paper on a very nearby superluminous supernova received significant media attention, the highlight being a radio interview with the Canadian Broadcasting Corporation for their weekly science show (broadcast 2017-08-12)
- Always willing to provide comment to the media on new discoveries in astrophysics (e.g. see here)
- Receipt of the Michael Penston prize from the RAS in 2016 gave me the chance to talk to local media about my research
- Qualified as a STEM (Science, Technology, Engineering and Maths) Ambassador, for encouraging children to pursue scientific careers. In this capacity I have helped at several events, including:

  — BBC Stargazing Live events in Jan 2012 (Oxford), 2013, 2014 and 2015 (QUB). Involved helping visitors to use telescopes and talking to them about my own research

  — STFC "Seeing The Universe In All Its Light" Exhibition, May 2014. Taught local children about imaging systems in ground- and space-based astronomy
- Press release for Nature paper led to interviews with journalists for international and local news
- Interviewed about my work live on BBC Radio Foyle, Oct 2013

Personal references

- Prof. Andy Lawrence · University of Edinburgh · Line manager
- Prof. Edo Berger · Harvard University · Postdoc Advisor
- Prof. Stephen Smartt · Queen’s University Belfast · PhD supervisor
- Prof. Brian Metzger · Columbia University · Collaborator
- Prof. Avishay Gal-Yam · Weizmann Institute of Science · Collaborator
- Prof. Philipp Podsiadlowski · Oxford University · MPhys supervisor
- Prof. Stefano Benetti · Osservatorio Astronomico di Padova · Collaborator

Publications

Summary:

- Total / **as first author**: 72 / **16**
- Citations: 4711 / **892**
- h-index: 36 / **12**

Full listing (titles link to abstracts on ADS):

First author

[1] The tidal disruption event AT2017eqx: spectroscopic evolution from hydrogen rich to poor suggests an atmosphere and outflow
Nicholl, M., Blanchard, P. K., Berger, E., *et al.*, 2019, Monthly Notices of the Royal Astronomical Society, submitted

[2] Nebular-phase spectra of superluminous supernovae: physical insights from observational and statistical properties
Nicholl, M., Berger, E., Blanchard, P. K., *et al.*, 2018, The Astrophysical Journal, 871, 102

[3] One Thousand Days of SN2015bn: HST Imaging Shows a Light Curve Flattening Consistent with Magnetar Predictions
Nicholl, M., Blanchard, P. K., Berger, E., *et al.*, 2018, The Astrophysical Journal Letters, 866, L24

[4] SuperBol: A User-friendly Python Routine for Bolometric Light Curves
Nicholl, M., 2018, Research Notes of the American Astronomical Society, 2, 230

[5] The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/VIRGO GW170817. III. Optical and UV Spectra of a Blue Kilonova From Fast Polar Ejecta
Nicholl, M., Berger, E., Kasen, D. *et al.*, 2017, The Astrophysical Journal Letters, 848, L18

[6] The magnetar model for Type I superluminous supernovae I: Bayesian analysis of the full multi-colour light curve sample with MOSFiT
Nicholl, M., Guillochon, J., Berger, E., 2017, The Astrophysical Journal, 850, 55

[7] The Superluminous Supernova SN 2017egm in the Nearby Galaxy NGC 3191: A Metal-rich Environment Can Support a Typical SLSN Evolution
Nicholl, M., Berger, E., Margutti, R., *et al.*, 2017, The Astrophysical Journal Letters, 845, L8

[8] Empirical constraints on the origin of fast radio bursts: volumetric rates and host galaxy demographics as a test of millisecond magnetar connection
Nicholl, M., Williams, P. K. G., Berger, E., *et al.*, 2017, The Astrophysical Journal, 843, 84

[9] An Ultraviolet Excess in the Superluminous Supernova Gaia16apd Reveals a Powerful Central Engine
Nicholl, M., Berger, E., Margutti, R., *et al.*, 2017, The Astrophysical Journal Letters, 835, L8

[10] Superluminous supernova 2015bn in the nebular phase: evidence for the engine-powered explosion of a stripped massive star
Nicholl, M., Berger, E., Margutti, R., *et al.*, 2016, The Astrophysical Journal Letters, 828, L18

[11] SN 2015BN: A Detailed Multi-wavelength View of a Nearby Superluminous Supernova
Nicholl, M., Berger, E., Smartt, S. J., *et al*., 2016, The Astrophysical Journal, 826, 39

[12] Seeing double: the frequency and detectability of double-peaked superluminous supernova light curves
Nicholl, M. & Smartt, S. J., 2016, Monthly Notices of the Royal Astronomical Society Letters, 457, 79

[13] On the diversity of superluminous supernovae: ejected mass as the dominant factor
Nicholl, M., Smartt, S. J., Jerkstrand, A., *et al*., 2015, Monthly Notices of the Royal Astronomical Society, 452, 3869

[14] LSQ14bdq: A Type Ic Super-luminous Supernova with a Double-peaked Light Curve
Nicholl, M., Smartt, S. J., Jerkstrand, A., *et al*., 2015, The Astrophysical Journal Letters, 807, 18

[15] Superluminous supernovae from PESSTO
Nicholl, M., Smartt, S. J., Jerkstrand, A., *et al*., 2014, Monthly Notices of the Royal Astronomical Society, 444, 2096

[16] Slowly fading super-luminous supernovae that are not pair-instability explosions
Nicholl, M., Smartt, S. J., Jerkstrand, A., *et al*., 2013, Nature, 502, 346

Joint-first/ Second author

[17] Follow-up of the Neutron Star Bearing Gravitational Wave Candidate Events S190425z and S190426c with MMT and SOAR *
Hosseinzadeh, G., Cowperthwaite, P. S., Gomez, S., Villar, V. A., **Nicholl, M.**, Margutti, R., *et al*., 2019, The Astrophysical Journal, accepted
* *The first six authors contributed equally to this work*

[18] Bright Type IIP Supernovae in Low-metallicity Galaxies
Scott, S., **Nicholl, M.**, Blanchard, P. K., *et al*., 2018, The Astrophysical Journal Letters, 870, L16

[19] A Hydrogen-Poor Superluminous Supernova with Enhanced Iron-Group Absorption: A New Link Between SLSNe and Broad-Lined Type Ic SNe
Blanchard, P. K., **Nicholl, M.**, Berger, E., *et al*., 2018, The Astrophysical Journal, 872, 90

[20] Superluminous Supernovae in LSST: Rates, Detection Metrics, and Light Curve Modeling
Villar, V. A., **Nicholl, M.**, Berger, E., *et al*., 2018, The Astrophysical Journal, 869, 166

[21] MOSFiT: Modular Open-Source Fitter for Transients
Guillochon, J., **Nicholl, M.**, Villar, V. A., *et al*., 2018, The Astrophysical Journal Supplement Series, 236, 6

[22] Systematic Investigation of the Fallback Accretion-powered Model for Hydrogen-poor Superluminous Supernovae
Moriya, T., **Nicholl, M.**, Guillochon, J., *et al*., 2018, The Astrophysical Journal, 867, 113

[23] The Type I Superluminous Supernova PS16aqv: Lightcurve Complexity and Deep Limits on Radioactive Ejecta in a Fast Event
Blanchard, P. K., **Nicholl, M.**, Berger, E., *et al*., 2018, The Astrophysical Journal, 865, 9

[24] PS16dtm: A Tidal Disruption Event in a Narrow-line Seyfert 1 Galaxy
Blanchard, P. K., **Nicholl, M.**, Berger, E., *et al*., 2017, The Astrophysical Journal, 843, 106

[25] Complexity in the light curves and spectra of slow-evolving superluminous supernovae
Inserra, C., **Nicholl, M.**, Chen, T.-W., *et al*., 2017, Monthly Notices of the Royal Astonomical Society, 468, 4642

[26] The evolution of superluminous supernova LSQ14mo and its interacting host galaxy system
Chen, T.-W., **Nicholl, M.**, Smartt, S. J., *et al*., 2017, Astronomy & Astrophysics, 602, A9

[27] The supernova CSS121015:004244+132827: a clue for understanding super-luminous supernovae
Benetti, S., **Nicholl, M.**, Cappellaro, E., *et al*., 2014, Monthly Notices of the Royal Astronomical Society, 441, 289

Other

[28] SN 2016iet: The Pulsational or Pair Instability Explosion of a Low Metallicity Massive CO Core Embedded in a Dense Hydrogen-Poor Circumstellar Medium
Gomez, S., Berger, E., **Nicholl, M.**, *et al*., 2019, The Astrophysical Journal, submitted

[29] A Radio Source Coincident with the Superluminous Supernova PTF10hgi: Evidence for a Central Engine and an Analogue of the Repeating FRB121102?
Eftekhari, E., Berger, E., Margalit, B., *et al*., 2019, The Astrophysical Journal Letters, 876, 10

[30] Lasair: The Transient Alert Broker for LSST:UK
Smith, K. W., Williams, R., Young, D. R, *et al*., 2018, Research Notes of the American Astronomical Society, 3, 26

[31] Evidence for rapid disk formation and reprocessing in the X-ray bright tidal disruption event AT 2018fyk
Wevers, T., Pasham, D. R., van Velzen, S., *et al*., 2019, MNRAS, submitted

[32] A Search for Optical Emission from Binary-Black-Hole Merger GW170814 with the Dark Energy Camera
Doctor, Z., Kessler, R., Herner, K., *et al*., 2019, The Astrophysical Journal Letters, 873, 24

[33] Where is the Engine Hiding Its Missing Energy? Constraints from a Deep X-Ray Non-detection of the Superluminous SN 2015bn
Bhirombhakdi, K., Chornock, R., Margutti, R., **Nicholl, M.***et al*., 2018, The Astrophysical Journal Letters, 868, 32

[34] An embedded X-ray source shines through the aspherical AT2018cow: revealing the inner workings of the most luminous fast-evolving optical transients
Margutti, R., Metzger, B. D., Chornock, R., *et al*., 2018, The Astrophysical Journal, 868, 32

[35] Unveiling the engines of fast radio bursts, superluminous supernovae, and gamma-ray bursts
Margalit, B., Metzger, B. D., Berger., E, **Nicholl, M.**, *et al*., 2018, Monthly Notices of the Royal Astonomical Society, 481, 2407

[36] Serendipitous Discovery of a 14 year old Supernova at 16 Mpc
Guillochon, J., Stockler de Moraes, J., **Nicholl, M.**, *et al*., 2018, Research Notes of the American Astronomical Society, 2, 165

[37] Spitzer Space Telescope Infrared Observations of the Binary Neutron Star Merger GW170817
Villar, V. A., Cowperthwaite, P. S., Berger, E., *et al*., 2018, The Astrophysical Journal Letters, 826, 11

[38] A Decline in the X-ray through Radio Emission from GW170817 Continues to Support an Off-Axis Structured Jet
Alexander, K. D., Margutti, R., Blanchard, P. K., *et al.*, 2018, The Astrophysical Journal Letters, 863, 18

[39] Jets in Hydrogen-poor Super-luminous Supernovae: Constraints from a Comprehensive Analysis of Radio Observations
Coppejans, D. L., Margutti, R., Guidorzi, C., *et al.*, 2018, The Astrophysical Journal, 856, 56

[40] The Binary Neutron Star event LIGO/VIRGO GW170817 160 days after merger: synchrotron emission across the electromagnetic spectrum
Margutti, R., Alexander, K. D., Xie, X., *et al.*, 2018, The Astrophysical Journal Letters, 856, 18

[41] A Precise Distance to the Host Galaxy of the Binary Neutron Star Merger GW170817 Using Surface Brightness Fluctuations
Cantiello, M., Jensen, J. B., Blakeslee, J. P., *et al.*, 2018, The Astrophysical Journal Letters, 854, L31

[42] How Many Kilonovae Can Be Found in Past, Present, and Future Survey Datasets?
Scolnic, D., Kessler, R., Brout, D., *et al.*, 2018, The Astrophysical Journal Letters, 852, L2

[43] Results from a systematic survey of X-ray emission from Hydrogen-poor Superluminous Supernovae
Margutti, R., Chornock, R., Metzger, B. D., *et al.*, 2018, The Astrophysical Journal, 864, 45

[44] Superluminous supernova progenitors have a half-solar metallicity threshold
Chen, T.-W., Smartt, S. J., Yates, R. M., **Nicholl, M.**, *et al.*, 2017, Monthly Notices of the Royal Astronomical Society, 470, 3566

[45] Long-duration superluminous supernovae at late times
Jerkstrand, A., Smartt, S. J., Inserra, C., **Nicholl, M.**, *et al.*, 2017, The Astrophysical Journal, 835, 13

[46] The GRB-SLSN Connection: mis-aligned magnetars, weak jet emergence, and observational signatures
Margalit, B., Metzger, B. D., Thompson, T. A., **Nicholl, M.**, Sukhbold, T., 2018, Monthly Notices of the Royal Astonomical Society, 475, 2659

[47] The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/Virgo GW170817. I. Dark Energy Camera Discovery of the Optical Counterpart
Soares-Santos, M., Holz, D. E., Annis, J., *et al.*, 2017, The Astrophysical Journal Letters, 848, L16

[48] The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/VIRGO GW170817. II. UV, Optical, and Near-IR Light Curves and Comparison to Kilonova Models
Cowperthwaite, P. S., Berger, E., Villar, V. A., Metzger, B. D., **Nicholl, M.**, *et al.*, 2017, The Astrophysical Journal Letters, 848, L17

[49] The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/VIRGO GW170817. IV. Detection of Near-infrared Signatures of r-process Nucleosynthesis with Gemini-South
Chornock, R., Berger, E., Kasen, D., Cowperthwaite, P. S., **Nicholl, M.**, *et al.*, 2017, The Astrophysical Journal Letters, 848, L19

[50] The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/VIRGO GW170817.

V. Rising X-ray Emission from an Off-Axis Jet
Margutti, R., Berger, E., Fong, W., *et al.*, 2017, The Astrophysical Journal Letters, 848, L20

[51] The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/VIRGO GW170817. VI. Radio Constraints on a Relativistic Jet and Predictions for Late-Time Emission from the Kilonova Ejecta
Alexander, K. D., Berger, E., Fong, W., *et al.*, 2017, The Astrophysical Journal Letters, 848, L21

[52] The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/VIRGO GW170817. VII. Properties of the Host Galaxy and Constraints on the Merger Timescale
Blanchard, P. K., Berger, E., Fong, W., **Nicholl, M.**, *et al.*, 2017, The Astrophysical Journal Letters, 848, L22

[53] The Electromagnetic Counterpart of the Binary Neutron Star Merger LIGO/VIRGO GW170817. VIII. A Comparison to Cosmological Short-duration Gamma-ray Bursts
Fong, W., Berger, E., Blanchard, P. K., *et al.*, 2017, The Astrophysical Journal Letters, 848, L23

[54] The Complete Ultraviolet, Optical, and Near-Infrared Light Curves of the Kilonova Associated with the Binary Neutron Star Merger GW170817: Homogenized Data Set, Analytic Models, and Physical Implications
Villar, V. A., Guillochon, J., Berger, E., *et al.*, 2017, The Astrophysical Journal Letters, 851, L21

[55] Improved Constraints on H0 from a combined analysis of gravitational-wave and electromagnetic emission from GW170817
Guidorzi, C., Margutti, R., Brout, D., *et al.*, 2017, The Astrophysical Journal Letters, 851, L36

[56] Multi-messenger Observations of a Binary Neutron Star Merger
Abbott, B. P., Abbott, R., Abbott, T. D., *et al.*, 2017, The Astrophysical Journal Letters, 848, L12

[57] A gravitational-wave standard siren measurement of the Hubble constant
Abbott, B. P., Abbott, R., Abbott, T. D., *et al.*, 2017, Nature, 551, 85

[58] Hydrogen-rich supernovae beyond the neutrino-driven core-collapse paradigm
Terreran, G., Pumo, M. L., Chen, T.-W., *et al.*, 2017, Nature Astronomy, 1, 713

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Margutti, R., Metzger, B. D., Chornock, R., *et al.*, 2017, The Astrophysical Journal, 836, 25

[60] The Superluminous Transient ASASSN-15lh as a Tidal Disruption Event from a Kerr Black Hole
Leloudas, G., Fraser, M., Stone, N. C., *et al.*, 2016, Nature Astronomy, 1, 2

[61] On the nature of Hydrogen-rich Superluminous Supernovae
Inserra, C., Smartt, S. J., Gall, E. E. E., *et al.*, 2018, Monthly Notices of the Royal Astronomical Society, 475, 1046

[62] Localization and Broadband Follow-up of the Gravitational-wave Transient GW150914
Abbott, B. P., Abbott, R., Abbott, T. D., *et al.*, x2016, The Astrophysical Journal, 826, 13

[63] Supplement: Localization and Broadband Follow-up of the Gravitational-wave Transient GW150914
Abbott, B. P., Abbott, R., Abbott, T. D., *et al.*, 2016, The Astrophysical Journal Supplement Series, 225, 8

[64] Pan-STARRS and PESSTO search for an optical counterpart to the LIGO gravitational wave source GW150914

Smartt, S. J., Chambers, K. C., Smith, K. W., *et al*., 2016, Monthly Notices of the Royal Astronomical Society, 462, 4094

[65] SN 2012aa - a transient between Type Ibc core-collapse and superluminous supernovae
Roy, R., Sollerman, J., Silverman, J. M., *et al*., 2016, Astronomy & Astrophysics, 596, 67

[66] LSQ13fn: A type II-Plateau supernova with a possibly low metallicity progenitor that breaks the standardised candle relation
Polshaw, J., Kotak, R., Dessart, L., *et al*., 2016, Astronomy & Astrophysics, 588, 1

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Elias-Rosa, N., Pastorello, A., **Nicholl, M.**, *et al*., 2015, Monthly Notices of the Royal Astronomical Society, 451, 3151

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Chen, T.-W., Smartt, S. J., Jerkstrand, A., **Nicholl, M.**, *et al*., 2015, Monthly Notices of the Royal Astronomical Society, 452,1567

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Inserra, C., Sim, S. A., Wyrzykowski, L., *et al*., 2015, The Astrophysical Journal Letters, 799, 2

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Smartt, S. J., Valenti, S., Fraser, M., *et al*., 2015, Astronomy and Astrophysics, 579, 40

[71] The superluminous supernova PS1-11ap: bridging the gap between low and high redshift
McCrum, M., Smartt, S. J., Kotak, R., *et al*., 2014, Monthly Notices of the Royal Astronomical Society, 437, 656

[72] Super-luminous Type Ic Supernovae: Catching a Magnetar by the Tail
Inserra, C., Smartt, S. J., Jerkstrand, A., *et al*., 2013, The Astrophysical Journal, 770, 128