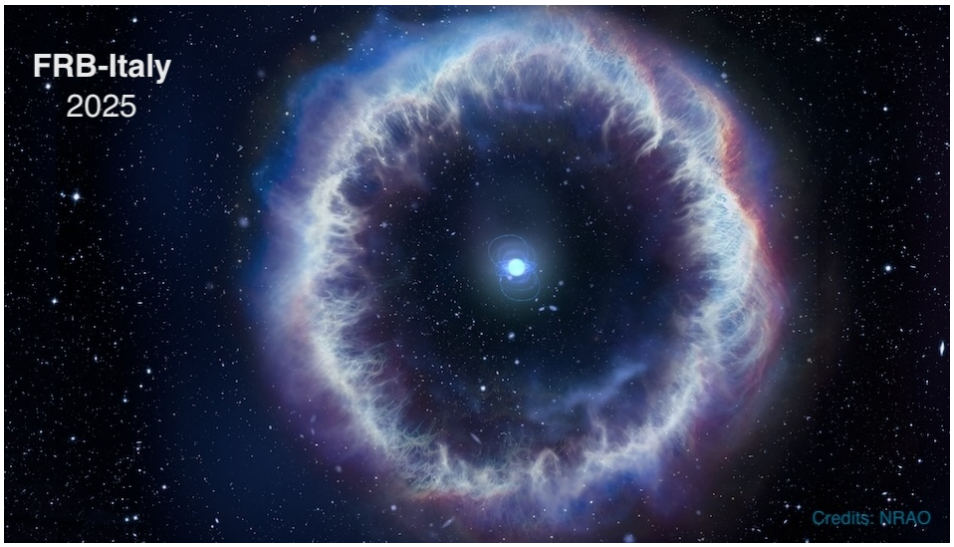
FRB-Italy 2025

Wednesday 7 May 2025 - Friday 9 May 2025

Area Territoriale di Ricerca di Bologna



Book of Abstracts

Contents

FRB-Italy / **1**

Il Database delle galassie ospiti

Corresponding Author: luciano.nicastro@inaf.it

Illustrerò la struttura e l'utilizzo del database che raccoglie i dati delle galassie che ospitano FRB.

FRB-Italy / **2**

Searching for four-leaf clovers in the Radio Transiet Sky

Author: Matteo Trudu[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: matteo.trudu@inaf.it

The discovery of fast radio bursts (FRBs) was a serendipitous process, much like the detection of the first pulsar by S. J. Bell. Since the first FRB was identified in 2007, both hardware and software technologies for detecting these enigmatic transients have advanced dramatically, enabling the discovery of increasingly exotic events. In this talk, I will review the current state of FRB searches, covering both algorithmic and instrumental developments, and discuss future prospects for refining our search strategies.

Strumenti HW & SW, presente e futuro / **3**

The Northern Cross Fast Radio Burst project: status update and future perspectives

Author: Gianni Bernardi[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: gianni.bernardi@inaf.it

The Northern Cross is a T-shaped radio interferometer located at the Medicina station, near Bologna, operating at 408 MHz. It has been undergoing a significant refurbishment/restoration over the last few years, allowing observations of fast radio bursts (FRBs, a project named "Northern Cross FRB project"). In this talk I will review the status of the project (past and current observing campaigns and their results) and describe the current readiness of the project and the future telescope upgrades, particularly in the light of the Next Generation Croce del Nord programme.

FRB-Italy / **4**

FRB-Italy: Innovative Approaches to Outreach and Education

Author: Rachele Toniolo[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: rachele.toniolo@inaf.it

INAF has always been involved in the development of activities for astronomy outreach and education. The purpose is to exploit innovative teaching approaches to foster the development of scientific and critical thinking, which are fundamental skills in our society.
"Hunting for FRBs"is one of the activities developed so far that represents these aspects. This educational workshop aims to introduce high school students to the research world. Participants have to look for FRBs on a noisy data set, experiencing a process similar to the one that stands behind scientific research.
The activity is based on the student-centered approach, an educational method that focuses on the specific interests and learning styles of students. It encourages active participation, collaboration, and free experimentation, the basis for the development of scientific thinking.
In my talk, I will present in more detail the activity and its educational potential in the framework of FRB research.

FRB-Italy / **5**

FRB-Italy: Strategies for Effective Science Communication

Author: Maura Sandri[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: maura.sandri@inaf.it

The first Italian workshop on FRBs aims to bring together the national scientific community interested in these enigmatic phenomena, fostering collaborations and new research projects. An essential aspect of the initiative's success is effective communication, which helps engage both the scientific community and the broader public. This contribution will explore targeted communication strategies, including the creation of a dedicated website, the dissemination of press releases, and the strategic use of social media, with the goal of amplifying the workshop's impact and making research findings more accessible to a wider audience.

FRB per studi in astrofisica e cosmologia / **6**

The contribution of Insight-HXMT to constraining the possible X/gamma emission of extragalactic FRB sources

Author: Cristiano Guidorzi[1]

[1] *University of Ferrara*

Corresponding Author: guidorzi@fe.infn.it

The first Chinese X-ray mission, Insight Hard X-ray Modulation Telescope (Insight-HXMT), carries on board three collimator-based instruments, which altogether cover the range 1-250 keV. In addition, the High-Energy (HE) instrument works as an open-sky monitor in the 0.2-3 MeV. In this talk I report two main contributions of Insight-HXMT: a) thanks to the unique combination of large effective area and sub-ms resolution of HE, we constrained the possible simultaneous emission of 39 well localised FRBs, excluding associations with typical gamma-ray bursts; b) also in the context of coordinated multiwavelength campaigns, we constrained possible high-energy activity of periodic repeater FRB20180916B throughout the different phases of radio activity, excluding the possible occurrence of energetic magnetar giant flares.

Link con le magnetar / **7**

solicited talk a due voci con Marta, FRB-magnetar link

Author: Alice Borghese[1]

[1] *ESA/ESAC*

Corresponding Author: alice.borghese@gmail.com

TBD

FRB per studi in astrofisica e cosmologia / **8**

Exploring the connection between FRBs and neutron star mergers

Author: Eleonora Troja[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: eleonora.troja@uniroma2.it

Neutron star (NS) mergers, detected via gravitational wave (GW) signals by LIGO and Virgo, create extreme magnetized environments, providing optimal conditions for coherent radio emission observable as a fast radio burst (FRB). The temporal and spatial coincidences between GW events and FRBs offer a unique opportunity to directly identify FRB progenitors, test models of magnetar formation, and probe the behavior of ultra-dense matter. In particular, some NS mergers produce an intermediate-lived hypermassive neutron star (HMNS), which may power delayed FRB emission before collapsing into a black hole. However, confirming these associations remains challenging due to detection sensitivities, sky localization constraints, and uncertainties in the time delay between the merger and the FRB. In this talk, I will discuss possible connections between GW events, FRBs, and NS mergers, as well as the observational constraints that can help test this link.

Origine e fenomenologia / **9**

Pinpointing

Author: Marcello Giroletti[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: marcello.giroletti@inaf.it

One key aspect required to understand the origin of FRBs is to know the type of environment they are emitted in. Thus, not only the host galaxy of an FRB is of importance, but also the precise location within that host need to be determined to solve the FRB-puzzle. Such accurate measurements are only possible with Very Long Baseline Interferometry. I will review the cases of FRBs localised with milliarcsecond precision, describing the technique, the main results and their implications, and the future prospects.

FRB per studi in astrofisica e cosmologia / **10**

Constraints on Fast Radio Burst emission in the aftermath of Gamma-Ray Bursts

Author: Barbara Patricelli[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: barbara.patricelli@inaf.it

The physical origin of Fast Radio Bursts (FRBs) is still unknown. Many models consider magnetars as possible FRB sources, supported by the observational association of FRBs with the galactic magnetar SGR 1935+2154. Magnetars are also thought to be the source of the power of a fraction of Gamma Ray Bursts (GRBs), opening the possibility that the two extreme phenomena have a common progenitor.
In this work we present a new, systematic search for GRB-FRB association, using the most updated catalog of FRBs observed with the Canadian Hydrogen Intensity Mapping Experiment (CHIME) instrument, and the sample of all GRBs detected by Swift so far. We also show, using a synthetic population of FRBs associated to Swift GRBs, how likely it is to have a joint detection with current and future radio facilities.
With our analysis we only recovered two, low significant, possible GRB-FRB associations already reported in literature; however the absence of any unambiguous association so far between Swift GRBs and FRBs cannot exclude that the two populations are connected, given the characteristics of current GRB and FRB detectors. In the next decade, with new generations of GRB and FRB detectors there will be a higher probability to detect joint GRB-FRB events, if any.

Origine e fenomenologia / 11

Search for optical counterpart of FRBs with SiFAP2@TNG

Author: Filippo Ambrosino[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: filippo.ambrosino@inaf.it

High-time-resolution detectors are playing a crucial role in advancing our understanding of fast transient events enabling precise measurements of their properties. SiFAP2, a state-of-the-art high-speed optical photometer permanently mounted at the 3.6m INAF Telescopio Nazionale Galileo (TNG) paved the way for significant breakthroughs in optical observations, especially on neutron stars. This instrument is deeply involved in a multiwavelength campaign on repeating Fast Radio Bursts to search for their optical counterpart. In this talk, I will present the SiFAP2 photometer as well as the first results obtained. In particular, I will focus on transient events we called Fast Optical Bursts and their possible association to FRBs. Finally, I will also present the enhanced version of SiFAP2 – named eSiFAP –which is currently under development to perform simultaneous optical and nIR fast photometry, and to be installed at TNG in the next future.

Origine e fenomenologia / 12

Looking for a multi-wavelength counterpart for FRBs

Corresponding Author: maura.pilia@inaf.it

TBD

Origine e fenomenologia / **13**

Search for transient radio emission from Galactic magnetars

Author: Andrea Geminardi[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: andrea.geminardi@inaf.it

he radio emission from magnetars is poorly understood and characterized observationally, in particular for what concerns single pulses and sporadic events.
The interest in it was boosted by the recent detection of an extremely bright ms radio signal from the Galactic magnetar SGR 1935+2154, which occurred almost simultaneously with a typical magnetar short burst of X-rays.
As of now, this event remains the only Galactic radio pulse reminiscent of fast radio bursts (FRBs) and the only one with a sound association with a known progenitor.
We performed a long-term campaign of seven Galactic magnetars using the Northern Cross transient radio telescope searching for short timescales and dispersed radio pulses obtaining no detections in ~480 hours of observation.
Furthermore, under some assumptions on the magnetars properties and energetic behavior, we found that our upper limits point towards the fact that the entire population of FRBs observed cannot be explained by bursts emitted by magnetars.

Link con le magnetar / **14**

Magnetars from Binary Neutron Stars merger

Author: Maria Giuliana Stratta[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: giulia.stratta@inaf.it

TBD

FRB per studi in astrofisica e cosmologia / **15**

Cosmology with FRBs

Author: Matteo Cinus[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: matteo.cinus@inaf.it

TBD

Origine e fenomenologia / **16**

FRB emission models: a review

Author: Simone Dall'Osso[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: simone.dallosso@inaf.it

TBD

17

The quest for PRS and their link with nebulae

Author: Gabriele Bruni[1]

[1] *INAF - Istituto di Astrofisica e Planetologia Spaziali*

Corresponding Author: gabriele.bruni@inaf.it

Deep investigation of the environment where the bursts occur is the most promising way to shed light on these mysterious phenomena. Observations of a handful of events indicated different progenitor channels, yielding to distinct location, local environment and host galaxy properties. The recent discovery of a persistent radio source associated with FRB 20201124A and 20240114A supports the nebular model for the continuum emission, circumscribing the progenitors to magnetars (favoured) or hyperaccreting X-ray binaries. In the near future, the advent of new dedicated radio facilities will deliver dozens of arcsec-level localized FRBs per year, improving the statistics on host galaxies and continuum counterparts. The talk aim at reviewing current developments and future prospects of PRS characterisation.

18

ItaliaN Single-dish radio telescopes enhancement for studying Transients And GRAvitational Waves (INSTAGRAW)

Author: Andrea Melis[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: andrea.melis@inaf.it

INAF manages three single-dish radio telescopes: SRT, Medicina, Noto. The science of pulsars and Fast Radio Bursts constitutes key projects in radio astronomy. SRT already plays a key role in various projects, such as the EPTA, which uses radio pulsar data to search for gravitational waves. Currently-available instrumentation at SRT severely limits its possible scientific return. At Medicina and Noto, no specific system was ever installed that would allow them to be involved in those fields.
I would present the INAF techno grant recently funded with the aims to equip all three telescopes with a modern infrastructure that will allow them to excel in transient studies; both as a single antenna and as part of an Italian pulsar timing array.
Specifically, the goal of this techno grant is to design and build - for SRT, Medicina and Noto - a digital infrastructure based on the SKARAB FPGA-based board that is capable of dealing with a bandwidth of at least 512 MHz to be recorded and/or post-processed for every science transients related, among which the Fast Radio Bursts.

19

The host galaxies of fast radio bursts

Author: Sandra Savaglio[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: sandra.savaglio@unical.it

Although FRBs are frequent events, the precise localization has only been achieved in a limited number of cases. However, this number has doubled in the past year. In this talk, we will present key properties of a sample of galaxies hosting these events, compiled from existing publications. Over 100 FRB host galaxies have been identified so far, with redshifts measured for most of them. The redshift interval is 0.0 < z < 1.35, with median and mean values of z = 0.224 and z = 0.259, respectively. Approximately three-quarters of the hosts are star-forming, and at least 40% are spiral galaxies. The median stellar mass is M= *10^10.2 M_sun, spanning the range 8.1 < log10(M*/M_sun) < 11.4. Although the dataset continues to expand, these findings offer valuable insights into the possible progenitors of FRBs. The number of host galaxy detections is growing rapidly, and we expect new interferometric facilities to increase the number of well-localized events tenfold in the coming years.

20

A tricky statistical search for Fast Optical Bursts

Author: Carlo Campa[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: carlo.campa@inaf.it

The long unexplored fast optical sky is now accessible thanks to new large ground-based telescopes and new generation instruments. Studying it may lead to new discoveries, but it is also challenging due to optical pollution.
In this talk, I will present our preliminary results obtained from an automated search and characterisation of mysterious Fast (millisecond) Optical Bursts (FOBs) in over 300 hours of observation with the fast photometer SiFAP2 at the Telescopio Nazionale Galileo.
Using a Bayesian Blocks-based algorithm we developed, we found a surprisingly high rate of 2 FOBs per hour. Our analysis suggests that many of these bursts likely have a non-astrophysical origin. However, some bursts show marginally significant evidence to the contrary.

FRB per studi in astrofisica e cosmologia / 22

Exploring the multi-messenger nature of FRBs: insights from gamma-ray and gravitational wave searches

Author: Giacomo Principe[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: giacomo.principe@ts.infn.it

Fast Radio Bursts (FRBs) are a recently discovered class of GHz-band astrophysical transients with an unknown origin. Exploring their potential gamma-ray and gravitational wave (GW) counterparts is crucial for constraining their emission mechanisms. We present a search for GW signals from FRBs, focusing on the Galactic magnetar SGR 1935+2154, using the GEO600 detector, setting the strictest upper limits on concurrent GW emission from FRBs to date. For gamma-ray searches, we analyzed 13 years of Fermi-LAT data covering over 1000 FRBs—the largest sample ever studied. This

represents the most extensive and sensitive search for gamma-ray emission from FRBs, setting the most stringent upper limits on short- and long-timescale emission, cumulative signals, and individual photon searches. These results provide critical constraints on the multi-messenger nature of FRBs and their underlying physics.

23

Optical monitoring of FRB20220912A and comparison with background/foreground events

Author: Alessia Spolon[1]

[1] *Istituto Nazionale di Astrofisica (INAF)*

Corresponding Author: alessia.spolon@inaf.it

Repeating FRBs are ideal targets for multi-wavelength observational campaigns aiming at potential counterparts. We are monitoring FRB 20220912A, one of the most active repeaters, using the fast optical photon counters Aqueye+ and Iqueye at the Asiago Observatory. We are trying to characterize foreground/background events by analyzing archival Aqueye+ data taken on other fields. To this purpose we studied the field of PSR J1023+0038, considering the source as a low-level sky background contaminant. We find that 90% of the statistically significant events detected above the average rate in the 1 ms binned light curve are present both in the on-source and on sky detector fields. This fact suggests that these events are linked to diffuse atmospheric phenomena. We will compare these events with those found in the field of FRB 20220912A.