Supernovae

Contents

1 Topics

- Follow-up of Supernovae (Photometric and Spectroscopic Evolution, Rates)
- Supernova and Gamma-ray Burst connection
- Galactic and Extragalactic Novae
- Supernovae-Ia and Gamma-ray Bursts as rulers for cosmological parameters
- Follow-up of kilonovae (Photometric and Spectroscopic Evolution, Rates)
- Developing new instrumentation for the study of the Transient Universe

1.1 ICRANet participants

- Carlo Luciano Bianco
- Filippo Frontera
- Luca Izzo
- Massimo Della Valle
- Lorenzo Amati

1.2 Past collaborators

- John Danziger (INAF-Trieste)
- Roberto Gilmozzi (ESO, Garching, Munchen)

- Mario Livio (STScI, Baltimore)
- Piero Madau (Santa Cruz, California University)
- Nino Panagia (STScI, Baltimore)
- Saul Perlmutter (Lawrence Berkeley National Laboratory, University of California)
- Sumner Starrfield (Arizona State University)
- Evan Scannapieco (Arizona State University)
- Guido Chincarini (Bicocca University, Milano) and the SWIFT team
- Bruno Leibundgut (ESO)

1.3 Ongoing collaborations

- Lorenzo Amati (INAF-Bologna)
- Filippo Frontera (Ferrara University)
- Roberto Gilmozzi (ESO, Garching, Munchen)
- Filippo Mannucci (INAF-Arcetri, Firenze)
- Dani Maoz (Tel-Aviv University)
- Francesca Matteucci (Trieste University, Trieste)
- Ken Nomoto (University of Tokyo)
- Nino Panagia (STScI, Baltimore)
- Andrea Pastorello (Queen's University, Belfast)
- Robert Williams (STScI, Baltimore)
- Martin Henze (Max-Planck)
- Giampiero Tagliaferri (INAF-Milano)

- Sergio Campana (INAF-Milano)
- Maurice van Putten (Sejong University-Korea)
- Enrico Cappellaro (INAF-Padova)
- Massimo Turatto (INAF-Padova)
- Stephen Smartt (Queen's University, Belfast)
- Brian Schmidt (ANU, Canberra)

1.4 Sabatical Visits, 2005-2010

- European Southern Observatory, Munchen (2005)
- STScI, Baltimore, (2005)
- KAVLI Institute, Santa Barbara (2006, 2007)
- Tokyo University (2006)
- Dark Cosmology Center, Niels Bohr Institute, Copenhagen (2007)
- Aspen Center for Physics (2007)
- Queen's University, Belfast (2007)
- European Southern Observatory, Munchen (2008-2009)

1.5 Students

- Vahagn Harutyunyan (ICRAnet PhD, Italy)
- Fabio Ragosta (Federico II, PhD, Italy)

2 Brief description

My research field concern the study of several classes of transient phenomena such as: supernovae, gamma-ray bursts, kilonovae and classical novae .

Gamma-ray bursts and their Afterglows. My interest in this area started in 2000 when I became member of the SWIFT follow-up team. Most efforts were (and still are) devoted to the study of i) the connection between Supernovae and GRBs; ii) characterisation of the properties of the host galaxies of GRB-SNe. About fifty refereed papers on GRB subject have been published in the last 15 years, mostly based on data collect with ESO telescopes **1, 10, 12**

Supernovae. Photometric and the spectroscopic study of all types of SNe (Ia, Ib/c, II-linear, II-plateau) near maximum light and at late stages and their theoretical modelling. The observations at maximum provide us with the necessary data for using SNe (Ia and II) as standard candles. The observations at later stages allow one to discriminate among different energy sources (i.e. radioactive decay, magnetar, light-echo), to model the mechanisms of the explosion, and to shed light on the nature of the progenitor. Most observations are carried out with ESO telescope in the framework of PESSTO collaboration **4, 5, 6, 9**

Supernovae at intermediate-high z. The study of Supernovae at intermediate redshifts has been carried out with VST telescope in the framework of the SUDARE collaboration. The evolution of the core collapse SN rate with redshift contains unique information on the star formation history of the universe, the IMF of stars and the nature of the progenitors. See items **11** for our most recent papers on the SN rate issue.

Novae. Systematic study of classical novae and related objects is carried out on galactic and extragalactic (Local Group) sources **8**.

Cosmological Parameters with GRBs. SN-Ia observations in the 90's suggest that the Universe accelerates its expansion. On the other hands the cosmological interpretation of the excess of SN fading (about 20%) rely on the

lack of evolutionary effects on progenitors of type Ia SNe. This situation calls for an independent measurement of the cosmological parameters besides the one obtained via SNe-Ia. We show that GRBs can be used to measure Ω_M and we find ~ 0.3 (see Amati et al. 2008; and Amati & Della Valle 2013). This result has been confirmed through the use of an independent methodology. The robustness of the method has been tested in **2**.

Follow-up of kilonovae. A considerable number of efforts have been in searching and following up the optical counterparts of high energy phenomenons like the merging of compact objects. This search was successful and lead to the complete characterisation (photometric and spectroscopic) of GW170817, the first kilonova discovered and observed in the framework of multimessenger astronomy **3, 7**.

3 Publications 2017

refereed publications

1. *The MUSE view of the host galaxy of GRB 100316D*, Izzo, L. et al. 2017, MNRAS, 472, 4480

2.*False outliers of the Ep,i - Eiso correlation?*, Martone et al. 2017, A&A, 608, 52

3.*A kilonova as the electromagnetic counterpart to a gravitational-wave source*, Smartt, S. et al. 2017, Nature, 551, 75

4. *Type II Supernova Spectral Diversity. I. Observations, Sample Characterization, and Spectral Line Evolution*, Gutierrez, C. Et al. 2017, ApJ, 850, 89

5. *A Hydrogen-rich supernovae beyond the neutrino-driven core-collapse paradigm*, Terreran, L., et al. 2017, NatAs, 1, 713

6. *LSQ14efd: observations of the cooling of a shock break-out event in a type Ic Supernova*, Barbarino et al. 2017, MNRAS, 471, 2463

7. *Multi-messenger Observations of a Binary Neutron Star Merger* , Abbott, B., et al. 2017, ApJ, 848, L12

8. *CXO J004318.8+412016, a steady supersoft X-ray source in M 31*, Orio, M., et al. 2017, MNRAS, 470, 2212

9. *Complexity in the light curves and spectra of slow-evolving superluminous supernovae*, Inserra, C., et al. 2017, MNRAS, 468, 4642

10. *Optical photometry and spectroscopy of the low-luminosity, broad-lined Ic supernova iPTF15dld*, Pian, E. . et al. 2017, MNRAS, 466, 1848

11.*Supernova rates from the SUDARE VST-Omegacam search II. Rates in a galaxy sample*, Botticella et al. 2017, A&A, 598, 50

12. *On extreme transient events from rotating black holes and their gravitational wave emission*, Van Patten , M. And Della Valle, M. 2017, MNRAS 464, 3219