

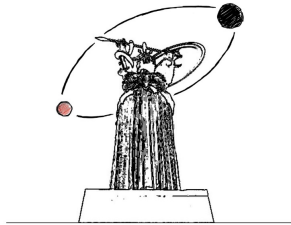


September 16-20 2024



Sapienza University of Rome
<https://agenda.infn.it/e/GWtheory>

1st TEONGRAV international workshop on the
Theory of Gravitational Waves



A tribute to Stefania Marassi

a joyful journey in between exploding stars,
compact objects and gravitational waves

Valeria Ferrari and Raffaella Schneider

Sapienza Università di Roma



ROME February 2019

Stefania Master thesis

Università degli Studi di Roma "La Sapienza"



Facoltà di Scienze Matematiche Fisiche e Naturali

Corso di laurea in Fisica

Anno Accademico 2002-2003

Tesi di Laurea

Equazioni di struttura stellare per stelle di neutroni rotanti

Candidata

Stefania Marassi

Numero di matricola: 11083078

Relatore

Prof.ssa Valeria Ferrari

Title: The equations of stellar structure for rotating neutron star

She took as a reference the fastest spinning pulsar observed at that time, PSR 1937 21 rotating at 641 Hz

She showed that the perturbative approach at third order in the rotation rate describes all stellar properties to an accuracy better than 2 % even for the maximum mass models

The fastest spinning pulsar observed until today is PSR J1748-2446ad which rotates at 716 Hz

Stefania PhD thesis



Università degli Studi di Roma "La Sapienza"

Dottorato di Ricerca in Astronomia - XX Ciclo

STRUCTURE AND OSCILLATIONS OF NEUTRON STARS

Thesis submitted for the degree of

Doctor Philosophiae

PhD in Astronomy - XX cycle- October 2007

Coordinator

Prof. Paolo de Bernardis

Advisor

Prof.ssa Valeria Ferrari

Candidate

Dr. Stefania Marassi

Anno Accademico 2006-2007

YEARS 2003-2007

O. Benhar, V. Ferrari, L. Gualtieri and S. Marassi, “Perturbative approach to the structure of rapidly rotating neutron stars”, Phys. Rev. D 72, 044028, 2005

V. Ferrari, L. Gualtieri, S. Marassi “A new approach to the study of quasi-normal modes of rotating stars”, Phys. Rev. D Vol.76, No.10, 104033, 2007

O. Benhar, V. Ferrari, L. Gualtieri, S. Marassi “Quark matter imprint on Gravitational Waves from oscillating stars”, Gen. Rel and Grav. 39, n. 9, 1323-1330, 2007.

From 2005 to 2013 Valeria chaired the Virgo-EGO Scientific forum (VESF), funded by EGO (the European Gravitational Observatory).

EGO awarded 22 fellowships

Fellow	1) Sources potentially detectable by Virgo	2) Waveforms from astroph. sources	3) Coincidences with other astrophys. instruments	4) Data analysis methodologies	5) Virgo data taking and data analysis	6) R&D for future upgrade of Virgo
A. Passamonti	x	x				
P. Montero	x	x				
F. Loeffler	x	x				
C. Aguilera	x					
A. Corsi			x	x	x	
S. Marassi	x	x				
V. Re				x	x	
O.Rabaste				x	x	
K.G.Arun				x	x	
S.Husa	x	x				
D.Rosinska	x	x		x		
S.DallOsso	x		x	x		
G. Debreczeni	x	x				
E. Gaertig	x		x			
J.Penner	x		x			
R. Sturani	x			x	x	
J. Downing	x	x				
F. Galeazzi	x	x				
A. Colla				x	x	
M. Branchesi				x	x	
P. Iosif	x	x				
A. Maselli	x	x	x			

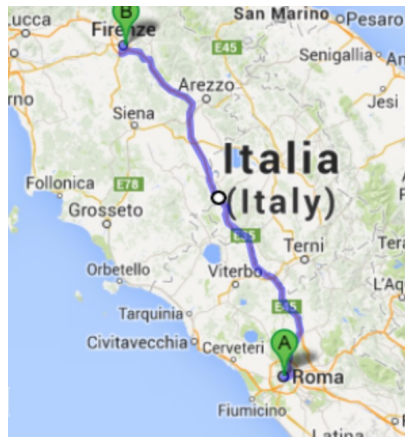


Osservatorio di Arcetri



Osservatorio di Roma

2013 - 2016



2008 - 2010



Sapienza, Dipartimento di Fisica

from 2017

Studies on stochastic background of different populations of gravitational wave sources

S. Marassi, R. Schneider, V. Ferrari, “Gravitational wave backgrounds and the cosmic transition from Population III to Population II stars”, *Mon. Not. R. Astron. Soc.* **398**, 293-302, 2009

R. Schneider, S. Marassi, V. Ferrari, “Stochastic backgrounds of gravitational waves from extragalactic sources” *Classical and Quantum Gravity*, **27** 194007-194014, 2010

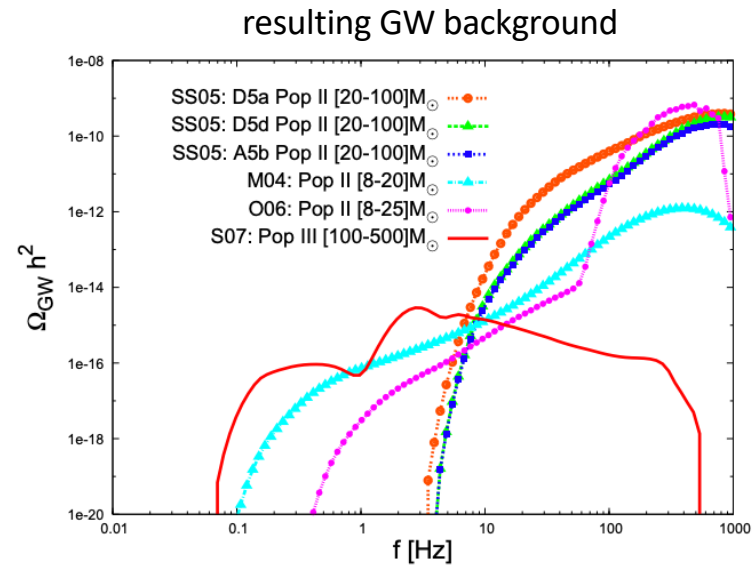
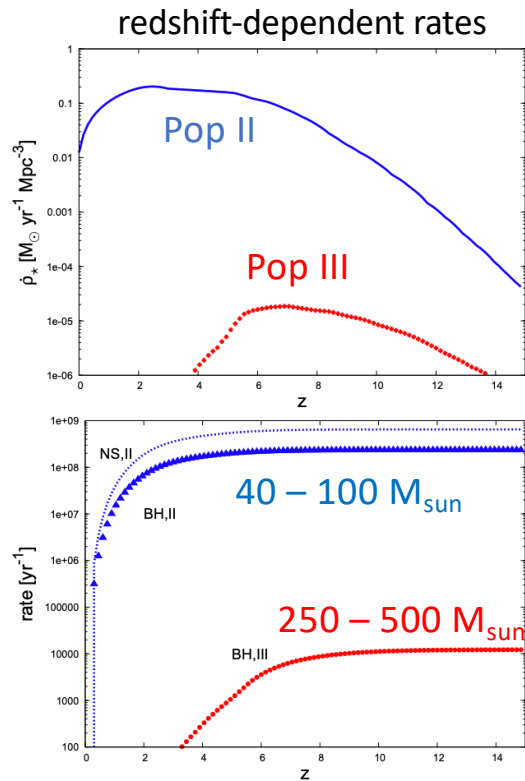
S. Marassi, R. Schneider, G. Corvino, V. Ferrari, Simon Portergies Zwart, “Imprint of the merger and ring-down on the gravitational wave background from black hole binaries coalescence”, *Phys. Rev. D* **84**, 124037, 2011

S. Marassi, R. Ciolfi, R. Schneider, L. Stella & V. Ferrari “Stochastic background of gravitational waves emitted by magnetars” *MNRAS*, **411** 2549-2557, 2011

A. Maselli, S. Marassi, V. Ferrari, K.D. Kokkotas, R. Schneider “Constraining Modified Theories of Gravity with Gravitational-Wave Stochastic Backgrounds”, *Phys. Rev. Lett.* **117** (9), 091102, 2016

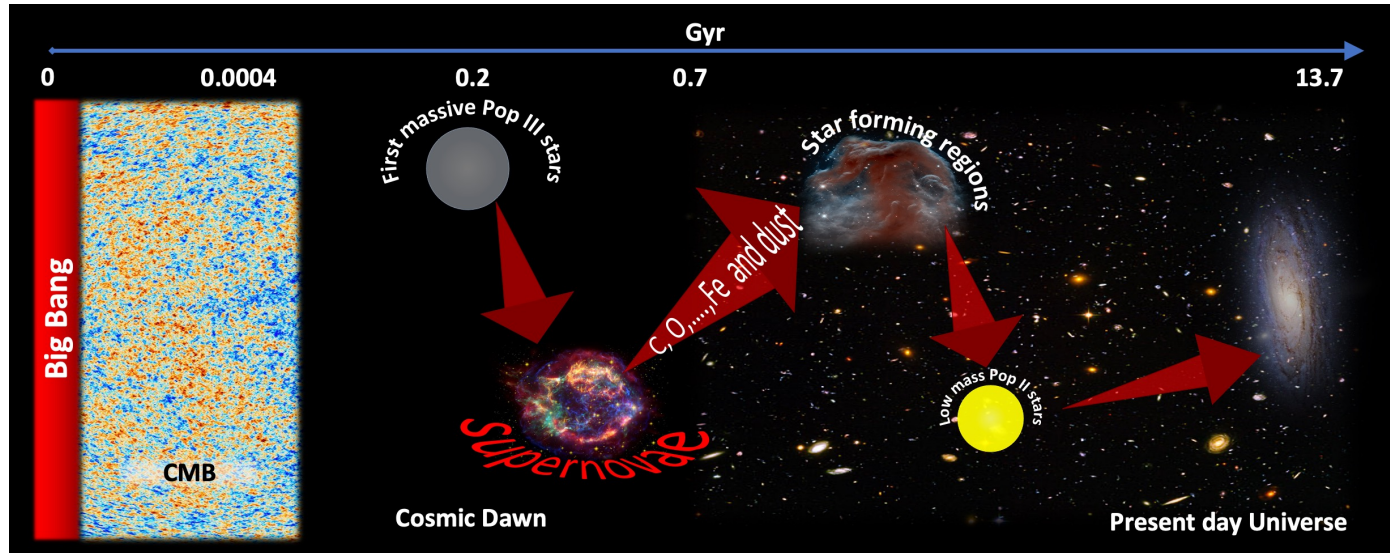
YEARS 2009 – 2016

Gravitational wave backgrounds and the cosmic transition from Population III to Population II stars
 Marassi, RS, Ferrari, MNRAS, 398, 293, 2009



Pop III \rightarrow Pop II transition driven by metal enrichment @ $Z_{\text{cr}} = 10^{-4} Z_{\text{sun}}$

What is the driving physical process for the Pop III – Pop II transition? How can we constrain it observationally?



Marassi, Valiante, de Bressan 2013

The origin of the most iron-poor stars

Marassi, S.; Chiaki, G.; Schneider, R.; Limongi, M.; Omukai, K.; Nozawa, T.; Chieffi, A.; Yoshida, N., 2014, ApJ, 794, 100

Supernova dust formation and the grain growth in the early universe: the critical metallicity for low-mass star formation

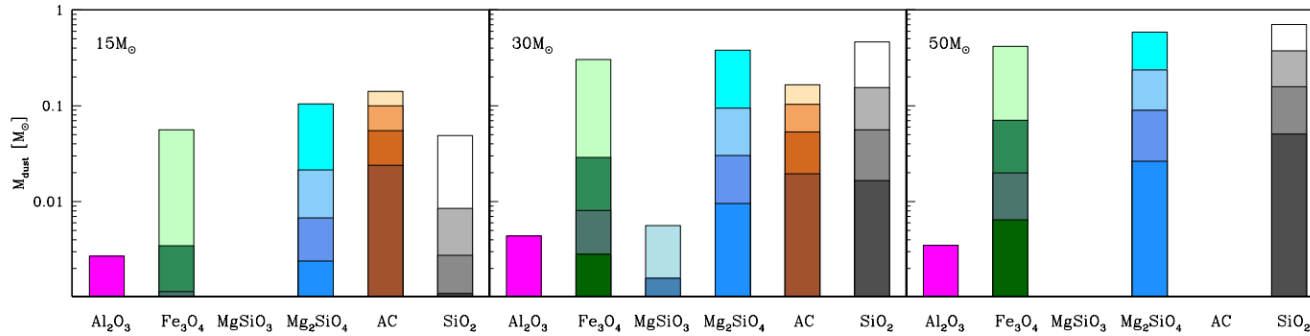
Chiaki, G.; **Marassi, S.**; Nozawa, T.; Yoshida, N.; Schneider, R.; Omukai, K.; Limongi, M.; Chieffi, A. 2015, MNRAS, 446, 2659

Seeding the second star - II. CEMP star formation enriched from faint supernovae

Chiaki, G.; Wise, J. H.; **Marassi, S.**; Schneider, R.; Limongi, M.; Chieffi, A. 2020, MNRAS, 497, 3149

YEARS 2014 – 2020

How does dust formation in SN ejecta depend on the progenitor stars and explosion properties?



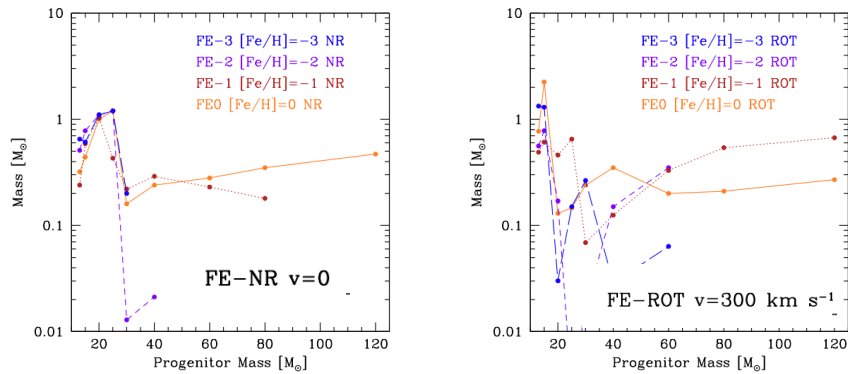
The metal and dust yields of the first massive stars

Marassi, S.; Schneider, R.; Limongi, M.; Chieffi, A.; Bocchio, M.; Bianchi, S. 2015, MNRAS, 454, 4250

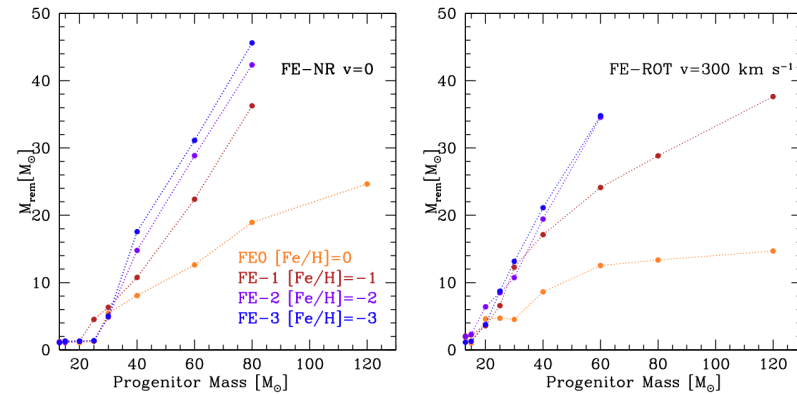
Supernova dust yields: the role of metallicity, rotation, and fallback

Marassi, S.; Schneider, R.; Limongi, M.; Chieffi, A.; Graziani, L.; Bianchi, S

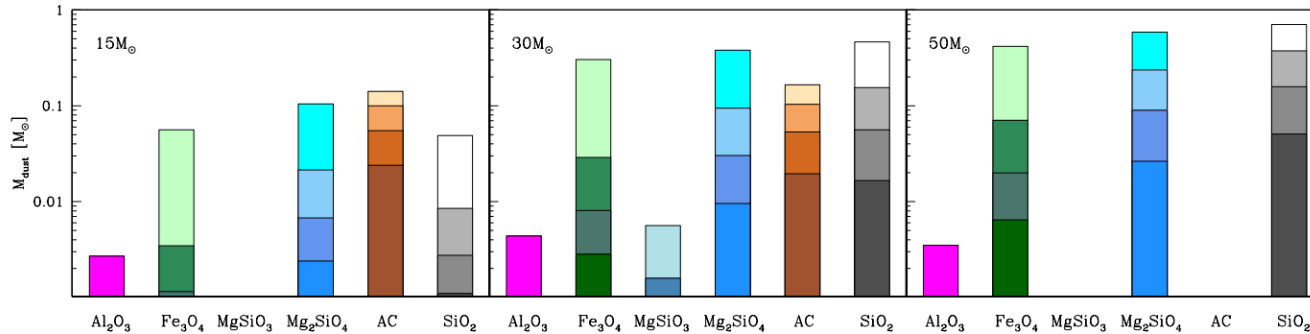
dust mass produced



remnant BH mass formed



How does dust formation in SN ejecta depend on the progenitor stars and explosion properties?



The metal and dust yields of the first massive stars

Marassi, S.; Schneider, R.; Limongi, M.; Chieffi, A.; Bocchio, M.; Bianchi, S. 2015, MNRAS, 454, 4250

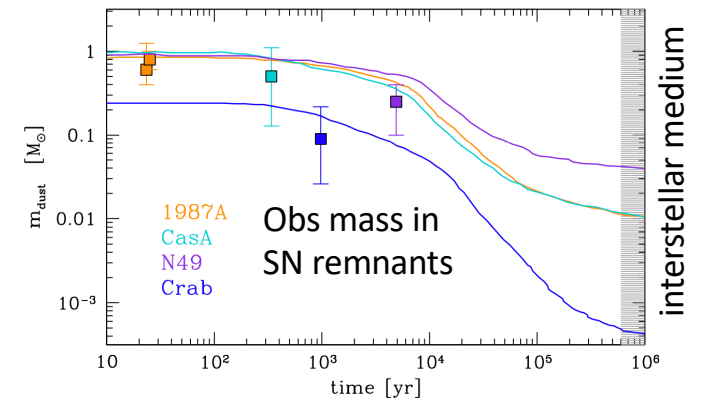
Supernova dust yields: the role of metallicity, rotation, and fallback

Marassi, S.; Schneider, R.; Limongi, M.; Chieffi, A.; Graziani, L.; Bianchi, S 2019, MNRAS, 484, 2587

Dust grains from the heart of supernovae

Bocchio, M.; **Marassi, S.;** Schneider, R.; Bianchi, S.; Limongi, M.; Chieffi, A. 2016, A&A, 587, 157

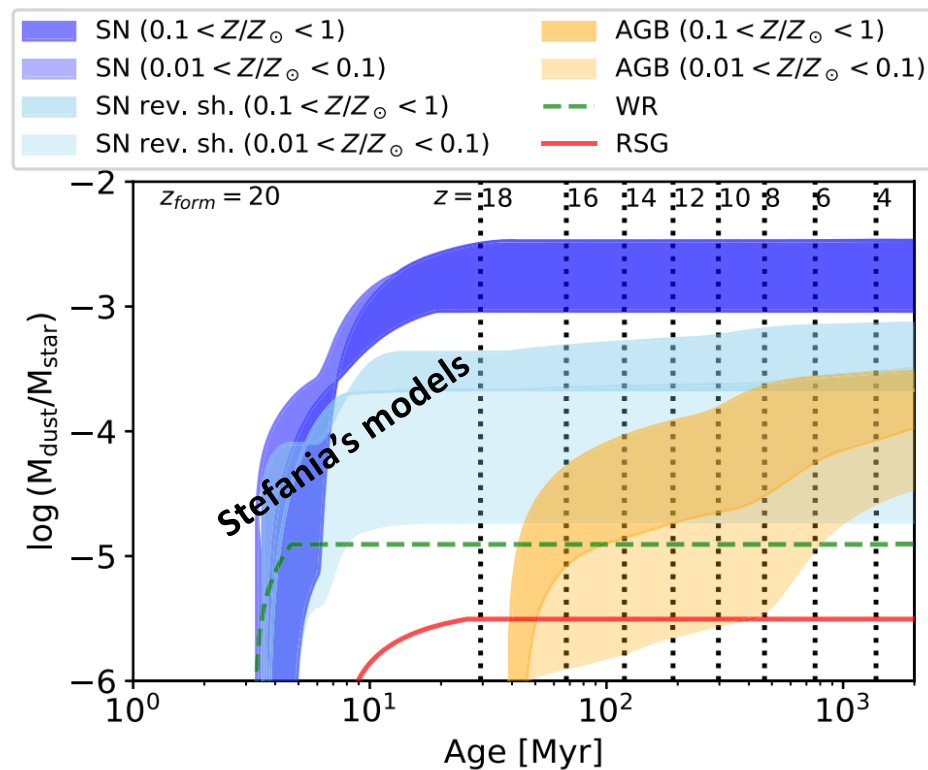
time evolution of newly formed SN dust



The formation and cosmic evolution of dust in the early Universe: I. Dust sources

Raffaella Schneider¹  · Roberto Maiolino^{2,3} 

Received: 8 August 2023 / Accepted: 1 February 2024
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The authors dedicate this review to the memory of Stefania Marassi, a brilliant and enthusiastic scientist, who has given important contributions to the understanding of dust formation and survival in supernovae. She will be greatly missed.

GW150914 was detected

Stefania's birthday present!

NEWS RELEASE

For Immediate Release

February 11, 2016

GRAVITATIONAL WAVES DETECTED 100 YEARS AFTER EINSTEIN'S PREDICTION

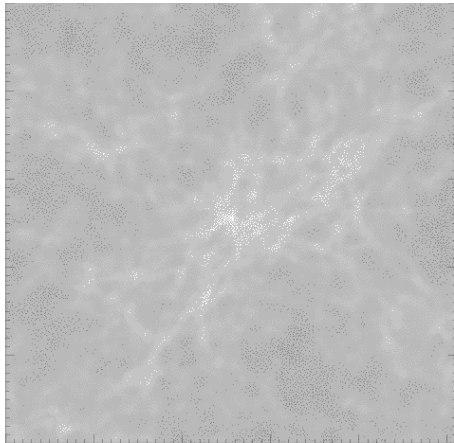
LIGO Opens New Window on the Universe with Observation of Gravitational Waves from Colliding Black Holes

WASHINGTON, DC/Cascina, Italy

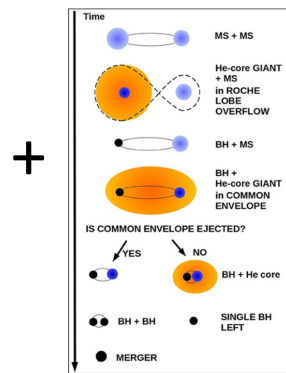
GW150914 was detected

Stefania's birthday present

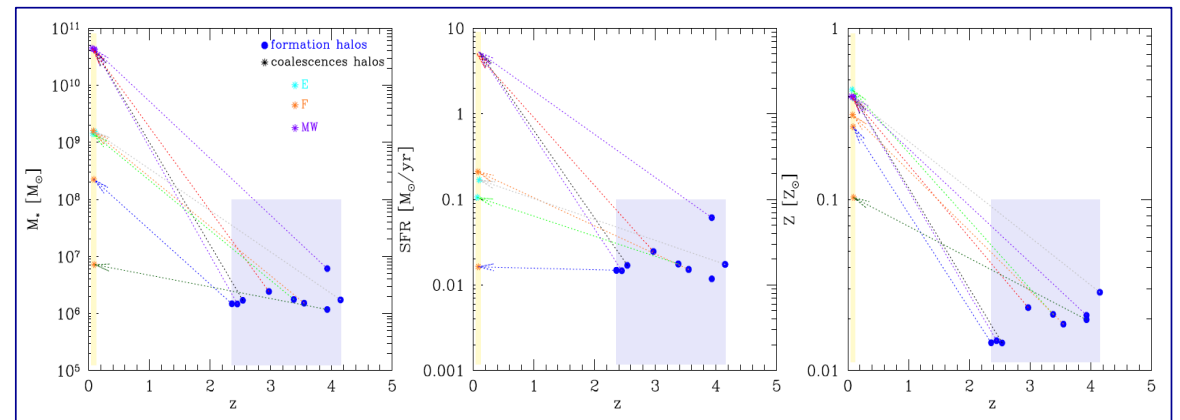
galaxy evolution model



binary population synthesis



identify formation and coalescence sites of GW150914-like events



Evolution of dwarf galaxies hosting GW150914-like events

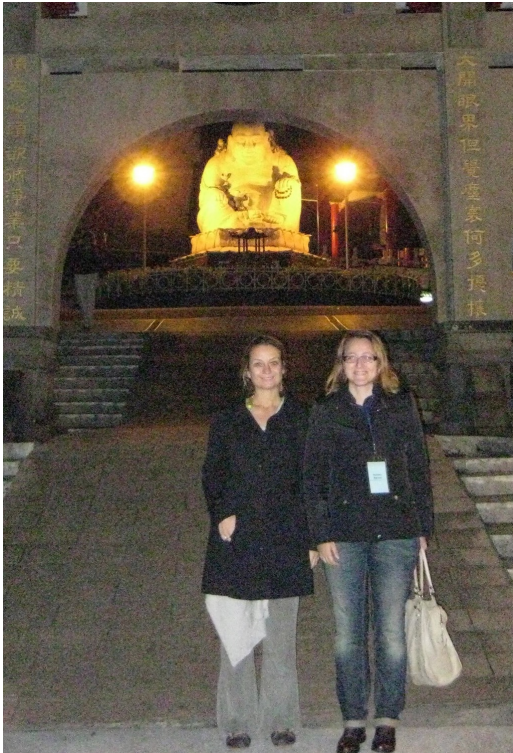
Marassi, S.; Graziani, L.; Ginolfi, M.; Schneider, R.; Mapelli, M.; Spera, M.; Alparone, M., 2019, MNRAS, 484, 3219

The formation and coalescence sites of the first gravitational wave events

Schneider, R.; Graziani, L.; **Marassi, S.**; Spera, M.; Mapelli, M.; Alparone, M.; de Bannassuti, M. 2017, MNRAS, 471, L105

Cosmic archaeology with massive stellar black hole binaries

Graziani, L.; Schneider, R.; **Marassi, S.**; Del Pozzo, W.; Mapelli, M.; Giacobbo, N. 2020, MNRAS, 485, L81



this was Stefania

She was a brilliant and talented scientist

She was a wonderful human being,
a generous and supportive friend,
and a very joyful person.

We miss her
and we are very grateful to have had the
immense fortune of sharing these wonderful
years of research with her



Award in the name of Stefania Marassi



<https://gofund.me/7a97c2f2>

we would like to remember Stefania's great passion for science and her desire to help and support others in achieving their goals. We have decided to launch a fundraising campaign to finance an award in her name, intended for young women scholars in the field of astrophysics and gravity theory. The amount of the award, which will depend on the funds raised, will be transferred to the Department of Physics at the University of Rome La Sapienza