

Fabrizio Fiore Curriculum Vitae

Personal data and education

Born: December 1 1959, Roma, Italy

Nationality: Italian

Work Address: INAF - Osservatorio Astronomico di Roma, via Frascati 33, I00040 Monteporzio-Catone (Rm) Italy Tel: +39 06 94286433; Fax: +39 06 9447243; e-mail: fiore@oa-roma.inaf.it

Dec. 1985: Italian Degree of Laurea in Physics obtained at the University of Roma La Sapienza with maximum marks (110/110).

Thesis title: "Study of the temporal variations in the X-ray emission from the Seyfert galaxy NGC 4151" Advisor: Prof. G. C. Perola

Nov. 1988 - Oct. 1991: Ph.D. in Astronomy at the University of Roma La Sapienza.

Thesis title: "Temporal and spectral variations in the X-ray emission from Active Galactic Nuclei" Advisor: Prof. G. C. Perola

Professional Experience

- Nov. 1989 - Nov. 1990: Research fellowship at the Cosmic Radiation Laboratory of RIKEN, Wako, Saitama, Japan.
- Jan. 1992 - Nov. 2000: Astrophysicist at the Smithsonian Astrophysical Observatory
- Jan. 1994 - Sept. 2001: Researcher at the Osservatorio Astronomico di Roma.
- Jul. 1995 - Dec. 2000: Senior Scientist at the BeppoSAX Science Data Center.
- Oct. 2001 - present: Associate Astronomer at INAF - Osservatorio Astronomico di Roma.

Institutional activities and responsibilities

- Director of INAF - Osservatorio Astronomico di Roma since Jan 2012
- Member of the ESA Astrophysical Working Group December 2010 – December 2013
- Member of the ESA Future Technology Advisory Committee since April 2011
- In 2005 I was elected in the INAF Scientific Council, a body with the main duty of preparing the Italian Long Term Plan for Astrophysics I acted as a secretary for this body and I acted as editor of the Long Term Plan, in addition to drafting several parts on AGN and GRB science: <http://www.inaf.it/struttura-organizzativa/cs/plt/inaf-long-term-plan>
- I was part of the team that prepared the study: *Feasibility study on High Energy Astrophysics: fields of interest and perspectives for the national community*, coordinated by E. Costa, G.C. Perola, and G. Puglierin, and commissioned by the Italian Space Agency (ASI) in the fall 2003 <http://www.oa-roma.astro.it/~fiore/ASIAAE/>.
- I was part of the board "Strategie" of the 2007-2009 ASI contract *Studio di Astrofisica delle alte energie* (<http://projects.iasf-roma.inaf.it/aae/AAE.htm>)
- I lectured the ASI council on behalf of the Italian High Energy Astrophysics community, in the workshop "Lo spazio incontra la scienza" organized by ASI in December 2009
- I acted as editor for the reports of the Osservatorio Astronomico di Roma prepared for the years: 1996, 1997, 1998 and 2007.
- I was part of the "Consiglio Direttivo" of the OAR in 1995-1996

Technological projects

- ➔ I was member of the ESA/XEUS/IXO Science Working Group since 2004 and I am now member of the ATHENA Science Team. I am also part of the Athena Ground Segment Working Group.
- ➔ On 2003 I started to work at the project of a new imaging mission in the hard 10-100 keV band, HEXIT-SAT. The driving idea was to try to perform a revolution in this energy band, similar to that achieved by the *Einstein* satellite at the end of the 70' below 3 keV. These ideas soon joined the Simbol-X project, and I become Simbol-X deputy lead scientist. I was

then in charge of science coordination of the New Hard X-ray Mission (NHXM), a project to revitalize the HEXIT-SAT and Simbol-X mission concepts. I am today a member of the NASA/NuSTAR Science Working Group.

- At the 2001 workshop 'Scientific drivers for ESO future VLT/VLTI instrumentation' I suggested that '*a spectrograph which would join a resolution of ~10,000 to the highest possible sensitivity over a broad wavelength range seems the best instrument for GRB absorption studies*' (Scientific drivers for ESO future VLT/VLTI instrumentation, ESO Astrophysics Symposia, p. 30). An instrument with these characteristics, X-shooter, is today available at ESO/VLT and I am member of the Italian X-shooter team.
- In 1999-2000 I was the first to suggest, in an ApJ letter and several talks, the possibility to use GRBs as lighthouses to X-ray the IGM. This suggestion is at the base of several mission concepts like Pharos, ESTREMO, EDGE, XENIA.
- From 1994 to 2000 I collaborated with the BeppoSAX Science Data Centre as senior scientist responsible for the scientific software development, data quality check, data archiving and coordination of instrument cross-calibration. These activities were also important for one of the main results obtained by BeppoSAX, the discovery of GRB afterglows and their precise localizations.

Scientific Leadership Profile

I coauthored more than 300 papers on leading international academic Journals since 1986, which produced more than 13400 citations (H index of 63). I am present in the list of top Italian scientists: http://www.topitalianscientists.org/Top_italian_scientists_VIA-Academy.aspx

My publication record includes contributions to extragalactic astrophysics on several different topics such as the physics and evolution of Active Galactic Nuclei (AGN), Gamma Ray Bursts (GRB), clusters of galaxies, the interstellar matter (ISM) and the intergalactic medium (IGM). Some of the key results obtained in the above areas went beyond the state of the art at that time. They include:

- ◆ The use of X-ray spectral variability of Seyfert galaxies as a tool to study the primary X-ray emission and the distribution and physical state of circum-nuclear absorbing and reflecting matter.
- ◆ The study of warm, ionized absorbers in AGN and the discovery of ionized absorption in several radio quiet and radio loud quasars.
- ◆ The discovery of photoelectric absorption in several luminous high-redshift quasars in the framework of a collaboration with M. Elvis, J. Bechtold and B. Wilkes.
- ◆ With A. Comastri and F. La Franca we invented the first hard (5-10 keV) X-ray survey (the BeppoSAX High Energy Large Area Survey, HELLAS) and performed the first identifications of the faint hard X-ray sources. We discovered a large population of highly obscured AGN at $z > 0.5$, predicted by models for the Cosmic X-ray background (CXB).
- ◆ We then promptly extended this work to the new Chandra and XMM-Newton data. We concluded in just 3 years the first XMM-Newton serendipitous survey with nearly complete optical identifications, the HELLAS2XMM survey. This work was extremely successful and produced several exciting discoveries: a) the identification a population of X-ray bright but optically dull galaxies (XBONGs); b) the discovery of a strong correlation between the X-ray to optical flux ratio and the luminosity for X-ray selected obscured AGN; c) the spectroscopic identification of the first large sample (2 dozens) of type 2 AGN with high luminosity (the since then elusive type 2 QSOs); d) the confirmation of 'downsizing' in the AGN evolution, including obscured objects; e) the discovery of strong correlations between the fraction of obscured AGN and the their luminosity and redshifts. The HELLAS and HELLAS2XMM projects produced >300 and >750 citations respectively, so far (a number higher than that of similar projects like the Chandra Multi-wavelength project, Champ, the Serendipitous Extragalactic X-ray Source Identification program, SEXSI, the XMM-Newton bright serendipitous survey, XMM-BSS). My HELLAS2XMM 2003 paper is the second paper for number of citations among all papers using data from the Telescopio Nazionale Galileo (Oliva, arXiv:0812.2185).
- ◆ To extend the HELLAS2XMM work we started to work at three large international projects aimed at the study of the X-ray selected AGN clustering and evolution. a) I was the PI of the

first XMM (AO2) large program (400ks) on the ELAIS-S1 field; b) together with A. Comastri we participated as leading actors to the XMM and Chandra successful proposals on the COSMOS field (1.4Msec and 1.8 Msec respectively) and the Chandra Deep Field South (3Msec XMM time).

- ◆ By using Spitzer, Chandra and HST data of the CDFS and COSMOS fields I discovered a population of galaxies with mid-infrared AGN luminosities but faint, host galaxy dominated, optical emission. We found that these galaxies have faint but extremely hard X-ray colors, strongly suggesting that most are hosting AGN so obscured to be faint and hard in X-rays. This population is of the right size to reconcile the active and relic super-massive black hole mass functions, in agreement with AGN synthesis models of the CXB.
- ◆ By using the first HST/WFC3 data and the extra-deep Chandra exposure in the ERS area I extended the study of the AGN luminosity functions to redshift ~ 6 . We evaluated the AGN fraction (or AGN duty cycle) from the local Universe to $z \sim 6$ finding a strong evolution, consistent with AGN triggering scenarios based on galaxy interactions.
- ◆ With N. Menci we interpreted the evolution of the fraction of obscured AGN and the AGN contribution to the CXB in the framework of a galaxy evolution model including a physical description for the AGN feedback.
- ◆ I participated to the discovery of the X-ray afterglows of GRBs. My work helped to reduce systematic errors on MECS source localizations, which was the key to the identification of GRB optical counterparts.
- ◆ I was the first to suggest to use GRBs as bright beacons to illuminate and study in absorption the host galaxy ISM and the IGM along the GRB line of sight. I was the first to obtain high-resolution spectra of GRB afterglows [GRB020813 and GRB021004], opening a brand new scientific line of research. Finally, we pushed the study of dust in GRB host galaxies to the highest redshifts [$z=6.3$, GRB050904].
- ◆ With R. Maiolino and C. Feruglio we pioneered mm interferometry to study AGN driven, massive molecular outflows. The derived outflow rates turned out to be strong enough to quench the star-formation in these galaxies, strongly supporting AGN feedback scenarios.

Top 30 publications of the last ten years

These are not necessarily my papers with the highest number of citation but the papers that I consider more influential in their fields.

1. Feruglio, C., Fiore, F., Maiolino, R., Piconcelli, E., Aussel, H., Elbaz, D., Le Floch, E., Sturm, E., Davies, R., Cicone, C. 2013, *NGC 6240: extended CO structures and their association with shocked gas*, *Astronomy & Astrophysics*, 549, 51
2. Lamastra, A., Menci, N., Fiore, F., Santini, P., Bongiorno, A., Piconcelli, E. 2013, *Probing AGN triggering mechanisms through the starburstiness of the host galaxies*, *Astronomy & Astrophysics*, 559, 56
3. Cicone, C., Feruglio, C., Maiolino, R., Fiore, F., Piconcelli, E., Menci, N., Aussel, H.; Sturm, E. 2012 *The physics and the structure of the quasar-driven outflow in Mrk231*, *Astronomy & Astrophysics*, 543, 99
4. Fiore, F., Puccetti, S., Mathur, S. 2012, *Demography of High-Redshift AGN*, *Advances in Astronomy*, vol. 2012
5. Fiore, F. et al. 2012, *Faint high-redshift AGN in the Chandra deep field south: the evolution of the AGN luminosity function and black hole demography*, *Astronomy & Astrophysics*, 537, 16
6. Giallongo, E., Menci, N., Fiore, F., Castellano, M., Fontana, A., Grazian, A., Pentericci, L. 2012, *Active Galactic Nuclei as Main Contributors to the Ultraviolet Ionizing Emissivity at High Redshifts: Predictions from a Λ -CDM Model with Linked AGN/Galaxy Evolution*, *ApJ*, 755, 124
7. Feruglio, C., Maiolino, R., Piconcelli, E., Menci, N., Lamastra A., Fiore, F. 2010, *Quasar feedback revealed by giant molecular outflows*, *Astronomy & Astrophysics* 518, L155
8. Lamastra, A., Menci, N., Fiore, F., di Porto, C.; Amendola, L. *Constraining dynamical dark energy models through the abundance of high-redshift supermassive black holes*, *MNRAS*, 420, 2429

9. Lamastra, A. et al. 2010, *The building up of the black hole-stellar mass relation*, The Astrophysical Journal, 617, 348
10. Fiore, F. et al. 2009, *Chasing highly obscured QSOs in the COSMOS field*, The Astrophysical Journal, 693, 447.
11. Brusa, M., Fiore, F. et al. 2009, *Black hole growth and starburst activity at $z = 0.6-4$ in the Chandra Deep Field South. Host galaxies properties of obscured AGN*, Astronomy & Astrophysics, 507, 1277
12. Fiore, F. et al. 2009, *Simbol-X Core Science in a Context*, Proceedings of the 2nd International Simbol-X Symposium. AIP Conference Proceedings, Vol. 1126, pp. 9-14.
13. D'Elia, V., F. Fiore, et al. 2009, *The Prompt, High-Resolution Spectroscopic View of the "Naked-Eye" GRB080319B*, The Astrophysical Journal, 694, 332
14. Elvis, M. et al. 2009, *The Chandra COSMOS Survey. I. Overview and Point Source Catalog*, The Astrophysical Journal Supplement, 184, 158
15. Fiore, F., et al. 2008, *Unveiling Obscured Accretion in the Chandra Deep Field-South* The Astrophysical Journal 672, 94.
16. Menci, N., Fiore, F., Cavaliere, A., Puccetti, S. 2008, *The Blast Wave Model for AGN Feedback: Effects on AGN Obscuration*, 686, 219
17. Fiore, F. et al. 2008 *Science with Simbol-X MemSAIt*, vol.79 N. 1, p. 38, arXiv:0801.0409
18. Fiore, F. et al. 2007 *Selection effects shaping the gamma ray burst redshift distributions* Astronomy & Astrophysics, 470, 515.
19. Stratta, G., Maiolino, R., Fiore, F., D'Elia, V. 2007 *Dust Properties at $z = 6.3$ in the Host Galaxy of GRB 050904*, The Astrophysical Journal 661, L9
20. Hasinger, G. et al. 2007, *XMM-Newton Wide-Field Survey in the COSMOS Field. I. Survey Description*, The Astrophysical Journal Supplement, 172, 29
21. Fiore, F., et al. 2005, *A Flash in the Dark: UVES/VLT High-Resolution Spectroscopy of Gamma-Ray Burst Afterglows*, The Astrophysical Journal 624, 853.
22. La Franca, F. Fiore, F. et al. 2005 *The HELLAS2XMM Survey. VII. The Hard X-Ray Luminosity Function of AGNs up to $z = 4$: More Absorbed AGNs at Low Luminosities and High Redshifts*, The Astrophysical Journal, 635, 864
23. Tagliaferri, G. et al. 2005, *GRB 050904 at redshift 6.3: observations of the oldest cosmic explosion after the Big Bang*, Astronomy & Astrophysics, 443 L1
24. Stratta, G., Fiore, F. et al., 2004 *Absorption in Gamma-Ray Burst Afterglows*, The Astrophysical Journal 608, 846
25. Fiore, F., Perola, G.C., Pareschi, G. Citterio, O. Anselmi, A. Comastri, A. 2004, *HEXIT-SAT: a mission concept for X-ray grazing incidence telescopes from 0.5 to 70 keV* Proceedings of SPIE Vol. 5488, UV to Gamma Ray SpaceTelescope Systems, astro-ph/0407647
26. Menci, N., Fiore, F., Perola, G.~C., Cavaliere, A. 2004 *X-Ray Evolution of Active Galactic Nuclei and Hierarchical Galaxy Formation*, The Astrophysical Journal, 606, 58
27. Fiore, F. et al. 2003, *The HELLAS2XMM survey. IV. Optical identifications and the evolution of the accretion luminosity in the Universe*, Astronomy & Astrophysics, 409, 79.
28. Elvis, M., Fiore, F. 2003, *A High Resolution Intergalactic Explorer for the Soft X-ray/FUV* Paper presented at the August 2002 SPIE meeting "Astronomical Telescopes and Instrumentation", Kona, Hawaii, astro-ph/0303444
29. Savaglio, S., Fall, S.M., Fiore, F. 2003 *Heavy-Element Abundances and Dust Depletions in the Host Galaxies of Three Gamma-Ray Bursts*, The Astrophysical Journal 585 638
30. Nicastro, F. et al. 2003, *The far-ultraviolet signature of the 'missing' baryons in the Local Group of galaxies*, Nature, 421, 719

Educational, teaching, and training activities

- 2000-2008: Cycles of lessons on AGN and X-ray instrumentations for the Ph.D. programs in Physics and Astronomy of the Universities of Roma La Sapienza, Roma Tor Vergata e Roma Tre.
- 2007-2008: Lecturer of High Energy Astrophysics for under-graduated students at the University of Roma Tre

- 2009-2014: Lecturer of High Energy Astrophysics for under-graduated students at the University of Roma La Sapienza

During my post doc at CfA I introduced Smita Mathur to AGN physics and absorption topics. While my astrophysical interests gradually shifted toward the high-z Universe, Smita started her career under my supervision on ionized absorbers, and became soon expert in UV and X-ray absorption in AGN.

Back in Roma during mid 90' I supervised the thesis of Laurea in Physics and the PhD thesis of Fabrizio Nicastro, both on ionized absorbers. I then suggested Fabrizio to apply our ionized absorber models to the warm intergalactic medium, to understand whether it was possible to observe in X-rays absorption lines or edges from this extremely tenuous medium. Fabrizio based his following career on this topic.

At the end of the 90' I started to work on AGN evolution and obscured AGN and since then I contributed to form on these topics several young researchers, including C. Vignali, D. Alexander, M. Brusa, A. Malizia, M. Perri, F. Cocchia, S. Puccetti, C. Feruglio, E. Piconcelli, G. Lanzuisi, A. Lamastra, C. Malacaria.

I introduced four young students, Valerio D'Elia, Silvia Piranomonte, Giulia Stratta and Paul Ward to GRB high-resolution spectroscopy and GRB absorption studies. Today Valerio and Silvia are leading scientists in the field of GRB spectroscopy.

Recently I started to work in the field of mm interferometry and I introduced to these topics a young student, C. Cicone.

Refereeing activities and membership of organizing committees of conferences

- More than 70 papers referred for the Astrophysical Journal, Letters to Astrophysical Journal, Astronomy & Astrophysics and Monthly Notices of Royal Academy of Sciences since 1992.
- Member of the Scientific Council of the Memorie della Societa' Astrofisica Italiana.
- Member of the review panel of Chandra X-ray Observatory in 2001 (AO3) and 2006 (AO8)
- Pundit of the top review panel of the Chandra X-ray Observatory in 2013 (AO15).
- Chair of the AGN review panel of the Chandra X-ray Observatory in 2010 (AO12).
- Chair of the AGN review panel of XMM-Newton on 2002 and 2003 (AO2 and AO3).
- Referee for the Time Allocation Committe of the Telescopio Nazionale Galileo (TNG) from 2000 to 2002 (AO2, AO3, AO4, AO5 and AO6) and member of the Time Allocation Committee of the TNG from 2004 to 2005 (AO11, AO12, AO13, AO14)
- I was main organizer of the conferences:
 - The active X-ray sky, results from BeppoSAX and XTE, Roma, Italy October 21-24 1997;
 - AGN and galaxy evolution, Specola Vaticana in Castel Gandolfo, Italy, October 3-6 2005;
 - Simbol-X: the hard X-ray universe in focus, Bologna, May 14-16, 2007
 - Galaxies vs. Black Holes, Castellammare del Golfo, June 24-27, 2013
- I was part of the SOC of 14 international conferences, workshops or schools since 1997.

International recognition and diffusion.

In 1998 I was awarded as part of the BeppoSAX team the Bruno Rossi Prize of the High Energy Division of the American Astromical for the discovery of the Gamma Ray Bursts afterglows in the X-ray band. I gave a lectures and seminars on AGN and GRBs in many prestigious institutions including the Harvard-Smithsonian CfA, MPE, OBSPM, CEA, Caltech, GSFC, Durham University, Tubingen University, Dartmouth college, in addition to many Italian Universities and Observatories. I was invited to give presentations and lectures to more than 20 international conferences and symposiums.

Ability to establish an interdisciplinary approach.

I have productively worked in several different scientific field of investigation, from the physics of AGN, to AGN evolution, to the AGN role in galaxy evolution and AGN feedback, to GRBs, to the ISM and IGM, to participating or leading projects for new X-ray missions. Bringing in a new field all

my previous know-how, I always tried to investigate connections between different areas, which allowed me to fully exploit all important synergies among different astrophysical topics.