

CURRICULUM VITAE

Alessandro Lupi

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Research Interests:

- *Black Holes*
 - Massive black hole formation mechanisms
 - Black hole growth across cosmic times
 - Massive black hole binary formation and evolution
 - Tidal disruption events
- *Galaxies*
 - Galaxy formation and evolution
 - Cosmic dawn and reionization
- *Interstellar medium and star formation*
 - Star formation in filaments and proto-stellar cores
 - Chemistry of the interstellar medium, and line emission

Education: Ph.D. in Astronomy and Astrophysics,
University of Insubria 2015
Thesis: *Black holes in galactic nuclei: seed formation from stellar mass black holes and massive black hole pairing in galaxy mergers*

MS (cum laude) in Astrophysics and Space Physics,
University of Milano Bicocca 2012
Thesis: *Black hole formation in the Universe at high redshift*

Bachelor (cum Laude) in Physics,
University of Milano Bicocca 2010
Thesis: *Techniques for dark matter detection through bubble formation*

Employments:

Post-doctoral Fellow at Institut d'Astrophysique de Paris 2015- 2018
Post-doctoral Fellow at Scuola Normale Superiore 2018- 2020
Research Fellow at Università degli Studi di Milano-Bicocca 2020- now

Teaching:

Teaching assistant for the course of Electromagnetism II and Special Relativity at University of Insubria (Undergraduate level) 2013-2014

Teaching assistant for the course of Electromagnetism I at University of Insubria (Undergraduate level) 2014-2015

Lecture series on computational astrophysics (for Master and Ph.D. students) at Universidad de Concepción (Chile) 05/2018

Supervision of undergraduate students:

Maria Cristina Fortuna, University of Milano Bicocca 2013

Matteo Zoccolan, University of Milano Bicocca 2015

Supervision of master students:

Hugo Pfister, Institut d'Astrophysique de Paris 2016

Elia Cenci, University of Milano Bicocca 2019-2020

Luca Sala, University of Milano Bicocca 2019-2020

Simón Ferrada-Chamorro, Universidad de Concepción 2019-2020

Luis Gonzalez, Universidad de Concepción 2021-now

Nicol Gutiérrez, Universidad de Concepción 2020-now

Supervision/mentoring of Ph.D. students:

Patricio Avila, Universidad de Concepción 2020-now

Professional activities:

Reviewer for "Monthly Notices of the Royal Astronomical Society" (MNRAS)

Reviewer for "Astrophysical Journal" (ApJ)

Reviewer for "Publications of the Astronomical Society of Japan" (PASJ)

Memberships:

AGORA collaboration for galaxy simulations 2014-now

Istituto Nazionale di Astrofisica (INAF) 2019-now

Computer skills:

N-body/Hydro codes: GADGET2/3/4, RAMSES, ENZO, GIZMO, LEMONGRAB

Operating Systems: Linux, Unix, Windows, Mac OSX

Programming: Fortran77, Fortran90, C, C++/#, Objective C, HTML, Visual Basic 6/.NET, ASP, PHP, Python, Julia

Specific software: TIPSY, SPLASH, PYMSES, YT, MATLAB, PYNBODY

ACADEMIC REFERENCES

Monica Colpi

Department of Physics G.Occhialini
University of Milano Bicocca Milan, 20126, Italy
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Massimo Dotti

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Paris, 75014, France
E-mail: martav@iap.fr

Joseph Silk

Institut d'Astrophysique de Paris
Paris, 75014, France
E-mail: silk@iap.fr

SCHOOLS, MEETINGS & CONFERENCES

Invited talks:

Guillermo Haro workshop 2015: Forming and fueling supermassive black hole seeds

Location: Tonantzintla, Puebla (Mexico), date: 6-24 July 2015

Dense stellar environments as a probe of astrophysics and general relativity: what we can learn from the first GW detection?

Location: Benasque (Spain), date: 5-18 June 2016

YAGN 2017

Location: Teruel (Spain), date: 23-25 October 2017

YAGN 2018

Location: Budapest (Hungary), date: 29-31 October 2018

YAGN 2020

Location: Copenhagen (Denmark)/Online meeting, date: 28-30 October 2020

SMBH conference - Formation, growth and evolution

Location: Pucon (Chile)/Online meeting, date: 7-11 December 2020

Contributed talks:

PhD school Lucchin: Exoplanets and The dark side of the Universe

Location: Asiago (Italy), date: 24-28 June 2013

The Unquiet Universe

Location: Cefalù (Italy), date: 2-7 June 2014

AGN11 - Where Black Holes and Galaxies Meet

Location: Trieste (Italy), date: 23-26 September 2014

Santa Cruz Galaxy workshop 2015

Location: Santa Cruz, California (USA), date: 17-21 August 2015

European Week of Astronomy and Space Science (EWASS2017)

Location: Prague (Czech Republic), date: 26-30 June 2017

Current and future perspectives of chemical modelling in astrophysics

Location: Hamburg (Germany), date: 17-19 July 2017

The role of gas in galaxy dynamics

Location: La Valette (Malte), date: 2-6 October 2017

Massive black holes in evolving galaxies: from quasars to quiescence

Location: Paris (France), date: 25-29 June 2018

LISA Astrophysics working group meeting

Location: Paris (France), date: 12-14 December 2018

Zoom-In and Out: From the Interstellar Medium to the Large Scale Structure of the Universe

Location: Stockholm (Sweden), date: 3-28 June 2019

Views on the interstellar medium in galaxies in the ALMA era

Location: Bologna (Italy), date: 2-6 September 2019

Sexten workshop: The interstellar medium of high-redshift galaxies

Location: Sexten (Italy), date: 13-17 January 2020

Posters:

Cosmic dawn of galaxy formation: linking theory and observations with new-generation spectral models

Location: Paris (France), date: 20-24 June 2016

European Week of Astronomy and Space Science (EWASS2017)

Location: Prague (Czech Republic), date: 26-30 June 2017

INVITED SEMINARS

Durham University, Durham (UK), March 2016

University of Maryland (USA), October 2016

University of Milano Bicocca (Italy), July 2017

Institute of Computational Science, University of Zurich (Switzerland), November 2017

MPE Garching (Germany), December 2018

University of Concepción (Chile), May 2018

University of Chile (Chile), May 2018

EPFL (Switzerland), October 2018

Osservatorio Astronomico di Brera (Italy), January 2019

KICC Cambridge (UK), April 2019

Albert Einstein Institute (Germany), May 2019

University of Concepción (Chile), July 2020

GRANTS

- CO-I of the **PRIN-INAF** “Star formation and evolution in galactic nuclei” (PI M. Mapelli, INAF-OAPd), awarded **32k EUR for 2 years (2015-2016)** 2014
- Visiting fellowship funded by the Balzan foundation in the program “Centre for Cosmological Studies”, to visit Johns Hopkins University, awarded **~3000 GBP for October 2016** 2016

- CO-I of the **PRIN INAF** “Sub-parsec resolution simulations of globular clusters in a cosmological model” (PI F. Calura, INAF-OAS), awarded **~66k EUR for 2 years (2021-2022)** 2020

ACCEPTED COMPUTATIONAL PROPOSALS

- **PI** of the proposal “Massive Black Hole Binary Formation in gas rich nuclei” at CINECA, **50k CPU hours** awarded for SPH/AMR simulations on the EURORA cluster 2013
- **PI** of the proposal “Massive Black Hole growth and feedback in galaxy mergers” at CINECA, **150k CPU hours** awarded for AMR simulations on the PLX2 cluster 2014
- **PI** of the proposal “Fast growth of stellar mass black holes via phases of super-critical accretion” at CINECA, **200k CPU hours** awarded for AMR simulations on the GALILEO cluster 2015
- CO-I of the PRACE proposal “Instabilities of galaxy disks in highly scalable cosmological simulations” (PI M. Dotti, University of Milano Bicocca), **100k CPU hours** awarded to test the scalability up to thousands of cpus of the code Changa, as a preparatory step to very large box cosmological simulations 2016
- CO-I of the proposals “The cosmic evolution of massive black holes” at GENCI, **11.7M CPU hours** awarded for numerical simulations on the OCCIGEN 2017
- **19.64M CPU hours** awarded for numerical simulations on the OCCIGEN and IRENE machines 2018
- **11.3M CPU hours** awarded for numerical simulations on the OCCIGEN, IRENE, and Jean Zay machines 2019
- **PI** of the proposal “The impact of AGN feedback onto the ISM of high-redshift galaxies” at CINECA, **2M CPU hours** awarded for numerical simulations on the GALILEO2 machine 2019
- CO-I of the proposal “The cosmic evolution of massive black holes” at GENCI, **7M CPU hours** awarded for numerical simulations on the OCCIGEN and IRENE machines 2020

ORGANISATION OF CONFERENCES

- Member of the Steering Committee of the workshop “Young Astronomers on Galactic Nuclei” (YAGN) for young astronomers working on MBHs, held at the Institut d’Astrophysique de Paris. November 17-18, 2016
- Member of the local organising committee for the conference “Massive black holes in evolving galaxies: from quasars to quiescence” held at the Institut d’Astrophysique de Paris June 25-29, 2018
- Member of the local and scientific organising committees for the conference “The interstellar medium of high-redshift galaxies” held at the Sexten Center for Astrophysics January 13-17, 2020

PUBLICATION LIST

Accepted publications:

1. *Constraining the high redshift formation of black hole seeds in nuclear star clusters with gas inflows*, **A. Lupi**, M. Colpi, B. Devecchi, G. Galanti and M. Volonteri, 2014, MNRAS, 442, 3616
2. *Massive black hole and gas dynamics in galaxy nuclei mergers. I. Numerical implementation*, **A. Lupi**, F. Haardt and M. Dotti, 2015, MNRAS, 446, 1765-1774
3. *Massive black hole and gas dynamics in galaxy nuclei mergers. II. Black hole pairing and binary formation*, **A. Lupi**, F. Haardt, M. Dotti and M. Colpi, 2015, MNRAS, 453, 3437-3446
4. *Growing massive black holes through supercritical accretion of stellar-mass seeds*, **A. Lupi**, F. Haardt, M. Dotti, D. Fiacconi, L. Mayer and P. Madau, 2016, MNRAS, 456, 2993-3003
5. *Hydrodynamical simulations of the tidal stripping of binary stars by massive black holes*, D. Mainetti, **A. Lupi**, S. Campana and M. Colpi, 2016, MNRAS, 457, 2516-2529
6. *Clumpy high-z galaxies as a testbed for feedback-regulated galaxy formation*, L. Mayer, V. Tamburello, **A. Lupi**, B. Keller, J. Wadsley and P. Madau, 2016, ApJL, 830, L13
7. *The AGORA High-Resolution Galaxy Simulations Comparison Project. II: Isolated Disk Test*, J. Kim, O. Agertz, R. Teyssier, M. J. Butler, D. Ceverino, J.H. Choi, R. Feldmann, B. W. Keller, **A. Lupi**, and the other AGORA collaboration members, 2016, ApJ, 833, 2
8. *The fine line between total and partial tidal disruption events*, D. Mainetti, **A. Lupi**, S. Campana and M. Colpi, 2017, A&A, 600, A124
9. *Young and turbulent: the wild early life of today's most massive galaxies*, D. Fiacconi, L. Mayer, P. Madau, **A. Lupi**, M. Dotti and F. Haardt, 2017, MNRAS, 467, 4080-4100
10. *Simplified galaxy formation with mesh-less hydrodynamics*, **A. Lupi**, M. Volonteri and J. Silk, 2017, MNRAS, 470, 1673-1686
11. *The birth of a supermassive black hole binary*, H. Pfister, **A. Lupi**, P. R. Capelo, M. Volonteri, J. Bellovary and M. Dotti, 2017, MNRAS, 471, 3646
12. *Massive Black Holes from Dissipative Dark Matter*, G. D'Amico, P. Panci, **A. Lupi**, S. Bovino and J. Silk, 2018, MNRAS, 473, 1
13. *The natural emergence of the correlation between H2 and star formation rate surface densities in galaxy simulations*, **A. Lupi**, S. Bovino, P. R. Capelo, M. Volonteri and J. Silk, 2018, MNRAS, 474, 2884
14. *The effect of non-equilibrium metal cooling on the interstellar medium*, P. R. Capelo, S. Bovino, **A. Lupi**, D. R. G. Schleicher and T. Grassi, 2018, MNRAS, 475, 3283

15. *The momentum budget of clustered supernova feedback in a 3D, magnetised medium*, E. S. Gentry, M. R. Krumholz, P. Madau, and **A. Lupi**, 2019, MNRAS, 483, 3647
16. *H2 chemistry in galaxy simulations: an improved supernova feedback model*, **A. Lupi**, 2019, MNRAS, 484, 1687
17. *Black hole formation in the context of dissipative dark matter*, M. A. Latif, **A. Lupi**, D. R. G. Schleicher, G. D'Amico, P. Panci, and S. Bovino, 2019, MNRAS, 485, 3352
18. *Super-Eddington Accretion and Feedback from the First Massive Seed Black Holes*, J. A. Regan, T. P. Downes, M. Volonteri, R. Beckmann, **A. Lupi**, M. Trebitsch, and Y. Dubois, 2019, MNRAS, 486, 3892
19. *Barred galaxies in cosmological zoom-in simulations: the importance of feedback*, T. Zana, P. R. Capelo, M. Dotti, L. Mayer, **A. Lupi**, F. Haardt, S. Bonoli, and S. Shen, 2019, MNRAS, 488, 1864
20. *High-redshift quasars and their host galaxies I: kinematical and dynamical properties and their tracers*, **A. Lupi**, M. Volonteri, R. Decarli, S. Bovino, J. Silk, and J. Bergeron, 2019, MNRAS, 488, 4004
21. *The 3D Structure of CO Depletion in High-mass Prestellar Regions*, S. Bovino, S. Ferrada-Chamorro, **A. Lupi**, G. Sabatini, A. Giannetti, and D. R. G. Schleicher, 2019, ApJ, 887, 224;
22. *Difficulties in mid-infrared selection of AGNs in dwarf galaxies*, **A. Lupi**, T. Sbarrato, and S. Carniani, 2020, MNRAS, 492, 2528
23. *The [CII]-SFR correlation in dwarf galaxies across cosmic time*, **A. Lupi** and S. Bovino, 2020, MNRAS, 492, 2818
24. *Globular Cluster Formation from Colliding Substructure*, P. Madau, **A. Lupi**, J. Diemand, A. Burkert, and D. N. C. Lin, 2020, ApJ, 890, 18
25. *Dynamical friction-driven orbital circularization in rotating discs: a semi-analytical description*, M. Bonetti, E. Bortolas, **A. Lupi**, M. Dotti, and S. I. Raimundo, 2020, MNRAS, 494, 3053
26. *A new proxy to estimate the cosmic ray ionization rate in dense cores*, S. Bovino, S. Ferrada-Chamorro, **A. Lupi**, D. R. G. Schleicher, and P. Caselli, 2020, MNRAS, 495, L7
27. *Predicting FIR lines from simulated galaxies*, **A. Lupi**, A. Pallottini, A. Ferrara, S. Bovino, S. Carniani, and L. Vallini, 2020, MNRAS, 496, 5160
28. *Shaping the structure of a GMC with radiation and winds*, D. Decataldo, **A. Lupi**, A. Ferrara, A. Pallottini, and M. Fumagalli, 2020, MNRAS, 497, 4718
29. *Missing [C II] emission from early galaxies*, S. Carniani, A. Ferrara, R. Maiolino, M. Castellano, S. Gallerani, A. Fontana, M. Kohandel, **A. Lupi**, A. Pallottini, L. Pentericci, L. Vallini, E. Vanzella, 2020, MNRAS, 499, 5136

30. *Constraints on the [C II] luminosity of a proto-globular cluster at $z \sim 6$ obtained with ALMA*, F. Calura, E. Vanzella, S. Carniani, R. Gilli, P. Rosati, M. Meneghetti, R. Paladino, R. Decarli, M. Brusa, **A. Lupi**, Q. D'Amato, P. Bergamini, G. B. Caminha, 2021, MNRAS, 500, 3083
31. *Black hole spin evolution in warped accretion discs*, E. Cenci, L. Sala, **A. Lupi**, P. R. Capelo, M. Dotti, 2021, MNRAS, 500, 3719
32. *Non-isotropic feedback from accreting spinning black holes*, L. Sala, E. Cenci, P. R. Capelo, **A. Lupi**, M. Dotti, 2021, 500, 4788
33. *A Virgo Environmental Survey Tracing Ionised Gas Emission (VESTIGE).IX. The effects of ram pressure stripping down to the scale of individual HII regions in the dwarf galaxy IC 3476*, A. Boselli, **A. Lupi**, B. Epinat, P. Amram, M. Fossati, J. P. Anderson, S. Boissier, M. Boquien, G. Consolandi, P. Cote, J. C. Cuillandre, L. Ferrarese, L. Galbany, G. Gavazzi, J. A. Gomez-Lopes, S. Gwyn, G. Hensler, J. Hutchings, H. Kuncarayakti, A. Longobardi, E. W. Peng, H. Plana, J. Postma, J. Roediger, Y. Roehly, C. Schimd, G. Trinchieri, B. Vollmer, 2021, A&A in press, (arXiv:2012.07377)
34. *Dynamical evolution of massive perturbers in realistic multi-component galaxy models I: implementation and validation*, M. Bonetti, E. Bortolas, **A. Lupi**, and M. Dotti, 2021, MNRAS in press (arXiv:2010.08555)
35. *Forming massive seed black holes in high-redshift quasar host progenitors*, **A. Lupi**, Z. Haiman, and M. Volonteri (MNRAS, in press)

Submitted papers:

- A new chemical clock suggests short initial stages in the path to form a Sun-like star, S. Bovino, **A. Lupi**, A. Giannetti, G. Sabatini, D. R. G. Schleicher, F. Wyrowski, and K. M. Menten, submitted to Science
- Chemical post-processing of magneto-hydrodynamical simulations: robustness and pitfalls, S. Ferrada-Chamorro, **A. Lupi**, and S. Bovino
- Dynamical evolution of massive perturbers in realistic multi-component galaxy models II: the effect of galactic bars, E. Bortolas, M. Bonetti, M. Dotti, **A. Lupi**, Pedro R. Capelo, Lucio Mayer, and A. Sesana

Papers in preparations:

- High-redshift quasars and their host galaxies II: morphological evolution, **A. Lupi**, M. Volonteri, R. Decarli, S. Bovino, and J. Silk
- High-redshift quasars and their host galaxies III: quasar environment, **A. Lupi**, M. Volonteri, R. Decarli, S. Bovino, and J. Silk
- The impact of AGN radiation onto the emission lines in LAE, **A. Lupi** and A. Ferrara

- The AGORA High-resolution Galaxy Simulations Comparison Project. III: Cosmological Zoom-in Simulation of a Milky Way-mass Halo, S. Roca-Fàbrega, J.-H. Kim et al. (including **A. Lupi**) on behalf of the AGORA Collaboration