Fulvia Pucci

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Summary

Researcher for Plasma Sciences

Currently NASA Postdoctoral Fellow (NPP) at the Jet Propulsion Laboratory working on magnetohydrodynamics (MHD) simulations to study protoplanetary disks evolution and wind launching. Running global simulations in connection with chemistry and radiation codes for infrared molecular emission comparison with data from ground based telescopes as well as JWST. The modeling includes a study of plasma instabilities, in particular the tearing instability for the onset of fast magnetic reconnection, the magnetorotational instability and turbulence and how they affect the disk thermochemistry and spectral emission. I am also visiting Mercator Fellow University of Ruhr Bochum, Germany, collaborating on multi-fluid and particle-in-cell (PIC) simulations, comparing results with laboratory plasma data and from Space missions such as the MMS mission, and in fusion devices (e.g. the MRX and FLARE experiments) for particle energization, which can be use to estimate the role of the magnetic field heating in space and astrophysical plasmas.

Higher Education

PhD in Astronomy, Astrophysics and Space Science — Rome, Italy 2013 – 2016
Joint PhD course Universitá della Sapienza and Universitá di Roma Tor Vergata, research in Solar Physics and Plasma Physics. Thesis title: " Explosive Energy Release on the Sun: from Theoretical Models to Flare Forecasting " Defense: December 19^{th} 2016, Director Prof. Francesco Berrilli, Co-Supervisors: Prof. Luca Biferale and Prof. Marco Velli

Laurea Magistrale in Fisica e Astrofisica — Florence, Italy 2011 – 2013
Master's course in Physics and Astrophysics, University of Florence, Thesis title, (resulting in scientific publication and winner of Premio Ferraro, see below) : " Energy focusing and dissipation in natural plasmas: the transition to fast magnetic reconnection." Date July 23^{rd} 2013, Director Prof. Marco Velli, score: 110/110 cum laude

Laurea Triennale in Fisica e Astronomia — Florence, Italy 2006 – 2011
Bachelor's degree in Physics and Astronomy, University of Florence, Bachelor Thesis Title: " Qualification of the LISA Pathfinder Sensor" Date: March 3rd 2011, Director Prof. Ruggero Stanga

Work Experience

NPP Postdoctoral Fellow — JPL, Pasadena, CA
Postdoctoral Researcher — *09/15/2020-present*

Research in plasma Physics, with application to Astrophysics, in particular star and planet formation.

Research Associate — LASP, UC Boulder
Research Scientist II — *09/09/2019-09/14/2019*
Research in plasma Physics, with application to Space Plasmas, in particular for the MMS mission.

Fellow NINS-Princeton Collaboration — Toki, Japan - Princeton, NJ, US
Postdoctoral Researcher — *04/01/2017 to 09/09/2019*
Research in plasma Physics, with application to Laboratory and Astrophysical Plasmas.

UCLA Visiting Graduate Researcher — Los Angeles, California
VGR — *09/07/2015 to 01/01/2016*
Research in plasma Physics and Heliophysics.

UCLA Visiting Graduate Researcher — Los Angeles, California
VGR — *07/01/2014 to 07/31/2014*
Research in plasma Physics and Heliophysics.

JPL Year-Round Internship Program 2013 — Pasadena, USA
Year-Round Internship — *10 weeks: 08/08/2013 - 08/31/2013 ; 11/02/2013 - 12/23/2013*
Research in Solar Physics and Plasma Astrophysics at Jet Propulsion Laboratory.

Teaching Experience

PPPL 2021 Course
Princeton Plasma Physics Laboratory (PPPL)
Lecturer for the Introduction to Fusion Energy and Plasma Physics Course — *17 June 2021*
"Magnetic reconnection".

University of Tor Vergata, Rome
Member of the exam committee — *February 2015*
Exam committee "Computational Physics".

University of Tor Vergata, Rome
Invited Lecture — *28 January 2015*
Lecture on Magnetic Reconnection within the course "Phisics of Plasmas" chair Prof. G. Consolini

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Honours and Awards

Premio Vincenzo Ferraro
IV edition — *2014*
For the best Italian laurea magistrale thesis in plasma physics: "Energy focusing and dissipation in natural plasmas: the transition to fast magnetic reconnection."

Training

ISSS Summer School — L'Aquila, Italy

Ground and space-based instruments for future research in Solar-Terrestrial physics *6/6/2016-6/10/2016*

Focused on computational and experimental techniques that will be applied in the next generation of ground- and space-based instruments for solar-terrestrial physics related research. In particular: forecasting of Solar Activity, Space Weather, and the conditions in the Earth's magnetosphere and ionosphere.

SOLARNET Summer School at MSSL — UCL, Guildford, UK

4th SOLARNET Summer School and Workshop *04/13/2016-04/22/2016*

Focused on MHD waves and instabilities, kinetic processes in MHD, 3D reconnection, particle acceleration and transport.

Parallel Computing course CINECA — Bologna, Italy

Parallel Computing with MPI and OpenMP *12/09/2014-12/11/2014*

Focused on the basic functionalities of two parallel programming tools: the MPI (Message Passing Interface) library for distributed architectures and OpenMP system for shared memory and multicore architectures.

C course CINECA — Rome, Italy

Scientific and Technical Computing in C *11/06/2014-11/07/2014*

Focused on key features of C language, with emphasis to modern programming style for scientific and technical applications particularly suitable to HPC environments.

Solar Orbiter Summer School — L'Aquila, Italy

Towards a Deeper Understanding of the Sun and the Heliosphere with Solar Orbiter *09/22/2014-09/25/2014*

The purpose of the school is to provide an overview of the science themes of the Solar Orbiter mission and to prepare students for analyzing the mission's future observations, to study the fundamental links between the the magnetized solar atmosphere and the dynamics of the solar wind, which, ultimately, is the source of space weather.

Heliophysics Summer School — Boulder, CO

Comparative Heliophysics *07/09/2014-07/16/2014*

Focused on the foundations of heliophysics while exploring connections to adjacent disciplines from the perspective of our local cosmos: stars like the Sun, planets like those in the solar system, and formation histories not too dissimilar from those that are relevant to understanding the formation, evolution, and present state of our immediate space environment.

Workshop and Meeting organization

First Joint Solar-Orbiter Solar Probe Plus Workshop, 2015 Responsible for the meeting organization.

Scientific Responsible for the Princeton-Japan collaboration meeting, 2019
Responsible for the Reconnection and Planetary accretion Scientific organization.

SOC European Conference on Magnetic Reconnection in Plasmas Scientific organizing committe member 23-26 May 2023 Marseille (France).

Additional Information

Language skills: Italian: mother tongue. **English**: fluent. **German**: Basic knowledge. Capable of understanding and participating in simple discussions.

Driver's license: Italy B, California C

Classical and modern dance studies: Schools Delta della Luna(Firenze)2003-2009, Nijinsky(Firenze) 2009-2010 Music: piano,1994-2002

Volley Ball: Played on the Rinascita Volley Firenze team 1994-2002

Fulvia Pucci: List of Publications

1. **F. Pucci**, U. Gorti, N. Turner, R. Nakatani *Global Resistive MHD Simulations of Protoplanetary Disks: the Role of Chemistry in Wind Launching and Accretion.*
(in prep)

2. A. Singh, T. Yokoyama, **F. Pucci**, K. Shibata *Origin and Development of Spicules in the Quiet Sun.*
(to be submitted)

3. K. M. Schoeffler, B. Eichmann, M.E. Innocenti, **F. Pucci** *PIC simulations of the tearing instability for relativistic pair plasmas.*
(submitted)

4. **F. Pucci**, K. A. P. Singh, U. Gorti, M. Velli, N. Turner, D. Varshney, M.E. Innocenti *Applications of Fast Magnetic Reconnection Models to the Atmospheres of the Sun and Protoplanetary Disks.*
(Accepted for publication in ApJ)
arXivLink

5. S. Hoilijoki, F. Pucci, R. E. Ergun, S. J. Schwartz, F. D. Wilder, S. Eriksson, A. Chasapis, N. Ahmadi, J. M. Webster, J. L. Burch, R. B. Torbert, R. J. Strangeway, B. L. Giles, *Origin of Electron-Scale Magnetic Fluctuations Close to an Electron Diffusion Region.*
JGR, 126, 5,2021

6. **F. Pucci**, K. Tomida, J. Stone, S. Takasao, H. Ji, S. Okamura, *Transition Region from Turbulent to Dead Zone in Protoplanetary Disks: Local Shearing Box Simulations.*
ApJ, 907, 1,2021

7. **F. Pucci**, M. Velli, C. Shi, K. A. P. Singh, A. Tenerani, F. Alladio, F. Ambrosino, P. Buratti, W. Fox, J. Jara-Almonte, H. Ji, M. Yamada J. Yoo, S. Okamura, R. Ergun, S. Hoilijoki, S. Schwartz
Onset of fast magnetic reconnection and particle energization in laboratory and space plasmas.
JPP,86(6), 535860601,2020

8. **F. Pucci**, A. Singh, M. Velli, A. Tenerani
Tearing modes in partially ionized astrophysical plasma.
ApJL, 903,1,2020

9. C. Shi, M. Velli, **F. Pucci**, A. Tenerani, M. Innocenti
Oblique tearing mode instability: guide field and Hall effect.
ApJ, 902,2,2020

10. R.E. Ergun, N. Ahmadi, L. Kromyda, S.J. Schwartz, A. Chasapis, S. Hoilijoki, F.D. Wilder, P.A. Cassak, J.E. Stawarz, K.A. Goodrich, D.L. Turner, F. Pucci, A. Pouquet, W.H. Matthaeus, J.F. Drake, M. Hesse, M.A. Shay, R.B. Torbert, J.L. Burch
Particle acceleration in strong turbulence in the Earth's magnetotail.
ApJ, 898,2,153,2020

11. R.E. Ergun, N. Ahmadi, L. Kromyda, S.J. Schwartz, A. Chasapis, S. Hoilijoki, F.D. Wilder, J.E. Stawarz, K.A. Goodrich, D.L. Turner, I.J. Cohen, S.T. Bingham, J.C. Holmes, R. Nakamura, F. Pucci, R.B. Torbert, J.L. Burch, P-A Lindqvist, R.J. Strangeway, O. Le Contel, B.L. Giles
Observations of particle acceleration in magnetic reconnection-driven turbulence.
ApJ, 898,2,154,2020

12. A. Singh, **F. Pucci**, A. Tenerani, K. Shibata, A. Hillier, M. Velli
Dynamic evolution of current sheets, ideal tearing, plasmoid formation and generalized fractal reconnection scaling relations.
2019ApJ...881...52S

13. M. Sitnov, J. Birn, B. Ferdousi, E. Gordeev, Y. Khotyaintsev, V. Merkin, T. Motoba, A. Otto, E. Panov, P. Pritchett, **F. Pucci**, J. Raeder, A. Runov, V. Sergeev, M. Velli, X. Zhou
Explosive Magnetotail Activity.
Space Sci Rev, 215:31, 2019

14. **F. Pucci**, S.Usami, H. Ji, X. Guo, R. Horiuchi, S. Okamura, W. Fox, J. Jara-Almonte, M. Yamada, J. Yoo
Energy transfer and electron energization in collisionless magnetic reconnection for different guide-field intensities.
Phys. Plasmas 25, 122111, 2018

15. W. Fox, F. D. Wilder, S. Eriksson, J. Jara-Almonte, **F. Pucci**, J. Yoo, A. V. Stechow, H. Ji, M. Yamada, R. E. Ergun, M. Øieroset, T. D. Phan
Energy conversion and parallel electric fields in reconnection diffusion regions by comparing scaled laboratory and space experiments.
GRL,45, 12,677-12, 684, 2018

16. **F. Pucci**, M. Velli, A. Tenerani, D. Del Sarto
Onset of fast "Ideal" tearing in thin current sheets: Dependence on the equilibrium current profile
PoP, 25, 032113, 2018

17. **F. Pucci**, M. Velli, A. Tenerani
Fast Magnetic Reconnection: "Ideal" Tearing and the Hall Effect

ApJ, 845, 25, 2017

18. S. Landi, E. Papini, L. Del Zanna , A. Tenerani, **F. Pucci**
Activation MHD reconnection on "ideal" timescales
PPCF, 59, 1, 2017

19. A. Tenerani, M. Velli, **F. Pucci**, S. Landi, F. A. Rappazzo
"Ideally" unstable current sheets and the triggering of fast magnetic reconnection
JPP, 82, 5, 31, 2016

20. D. Del Sarto, **F. Pucci**, A. Tenerani, M. Velli
"Ideal" tearing and the transition to fast reconnection in the weakly collisional MHD and EMHD regimes
JGR,121, 1857, 2016

21. L. Giovannelli, F. Berrilli, D. Del Moro, S. Scardigli, G. Consolini, M. Stangalini, F. Giannattasio, A. Caroli, **F. Pucci**, V. Penza
N-body model of magnetic flux tubes reconnecting in the solar atmosphere
JPhCS, 689, 1, 2016

22. L. Del Zanna, S. Landi, E. Papini, **F. Pucci**, M. Velli
The ideal tearing mode: theory and resistive MHD simulations
JPCS, 719, 1, 2016

23. A. Tenerani, M. Velli, F. A. Rappazzo, **F. Pucci**
Magnetic reconnection: recursive current sheet collapse triggered by "ideal" tearing
ApJL, 813, L32, 2015.

24. S. Landi, L. Del Zanna, E. Papini, **F. Pucci**, M. Velli
Resistive Magnetohydrodynamics Simulations of the Ideal Tearing Mode
ApJ, 806, 131, 2015

25. M. Velli, **F. Pucci**, F. Rappazzo, A.Tenerani
Models of coronal heating, turbulence and fast reconnection
Phil. Trans.R. Soc. , A 373, 20140262, 2015

26. A. Tenerani, A. F. Rappazzo, M. Velli, **F. Pucci**
The Tearing Mode Instability of Thin Current Sheets: the Transition to Fast Reconnection in the Presence of Viscosity.

ApJ, 801(2), 145, 2015

27. **F. Pucci** and M. Velli
Reconnection of quasi-singular current sheets: the "ideal" tearing mode
ApJL, 780(2), L19, 2014

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Presentation and Conferences

NASA Postdoctoral Virtual Symposium — Jet Propulsion Laboratory
Invited Talk — *15 November 2023*
"Protoplanetary disk atmospheres" fast magnetic energy dissipation and its role in chemistry and observations from the James Webb Space Telescope JWST"

Magnetohydrodynamical flows in young circumstellar disks 2023 meeting — Ringberg, Germany
Invited Talk at the conference — *3 October 2023*
"Protoplanetary disk atmospheres? fast magnetic energy dissipation and its role in chemistry and line emission"

Plasma Physics seminar — Politecnico di Torino
Seminar — *4 November 2022*
"Fast magnetic reconnection in partially ionized plasmas, from injection to the dissipation scales"

Plasma Seminar Series — Pisa Physics Department
Virtual Seminar — *31 October 2022*
"Fast magnetic reconnection and particle energization in collisionless plasmas"

Inside 2022 — Ringberg Castle
The Inner Regions of Protoplanetary Disks workshop — *18-21 September 2022*
Poster:"Non-Ideal MHD simulations of the inner region of PPDs: local heating and wind launching"

SFB collaboration — Ruhr University, Bochum
SBF kickoff meeting — *27 May-4 June 2022*
Oral:"Reconnection in partially ionized plasmas with application to astrophysics and space plasmas"

MR 2022 — Monterey, CA
MAGNETIC RECONNECTION WORKSHOP 2022 — *16-20 May 2022*
Oral:"Reconnection in Protoplanetary disks."

Princeton Astroplasma Seminar — Princeton Astrophysics Department
Virtual Seminar — *26 February 2021*
"Non ideal effects in protoplanetary disks: transition from turbulent to Dead Zone in local and global stratified simulations"

JPL Journal Club — Pasadena, CA
SPJC — *19 October 2021*
Review of the paper "Surface layer accretion in transitional and conventional disks: from polycyclic aromatic hydrocarbons to Planets (Perez-Becker and Chiang, 2010)"

JPL Journal Club — Pasadena, CA
SPJC — *10 November 2020*
"Understanding the role of the chemistry and non-ideal effects in modeling realistic protoplanetary disks."

Seminar at Max Plank Institute for Plasma Physics — Germany
Seminar — *10 May 2019*
"Energy transfer and electron energization in collisionless magnetic reconnection for different guide-field intensities"

Solar and Space Plasma Seminar Series — NAOJ, Tokyo JP
Seminar — *19 April, 2019*
Oral:"Flares, CMEs and explosive events: the "ideal" tearing mode as a fast reconnection triggering mechanism in magnetized plasmas and following nonlinear evolution"

Max Planck Princeton Center — Tokyo, Japan
Workshop 2019 hosted by IRCC-AFP, NINS — *18-21 February 2019*
2 Invited Oral: 1) "Transition from turbulent to dead zone in protoplanetary disks: how do the boundaries of the active zone evolve?", 2)"Energy transfer and electron energization in collisionless magnetic reconnection for different guide-field intensities"

A++ workshop 2019 — Las Vegas University
The Athena++ workshop — *18-22 March 2019*
Invited Oral:"Evolution of MRI turbulence in protoplanetary disks: a local simulation including dead-zone boundaries"

AGU — Washington DC
American Geophysical Union meeting 2018 — *December 2018*
Poster:"Triggering fast magnetic reconnection in the presence of current sheets with a non-zero normal component."

APS — Portland, Oregon
American Physical Society meeting 2018 — *11-18 October 2018*
Poster:"Energy transfer and electron energization in collisionless magnetic reconnection for different guide-field intensities."

MR2018 — Princeton USA
US-Japan Workshop of MR2018 — *4-8 September 2018*
Oral:"Energy transfer and electron energization in collisionless magnetic reconnection for different guide-field intensities."

ASTRONUM — Panama City Beach, US
Astronum meeting — *25th-29th June 2018*
Poster: "Energy transfer and electron energization in collisionless magnetic reconnection for different guide-field intensities."

MPPC meeting 2018 — Princeton, US
Max Plank- Princeton Collaboration meeting — *23rd-26th April 2018*
Oral: "Energy transfer and electron energization in collisionless magnetic reconnection for different guide-field intensities."

AGU 2017 — New Orleans, US
American Gephysical Union — *9th-15th December 2017*
Poster: "Electron energization mechanisms in collisionless magnetic reconnection for different guide-field intensities."

ISSI team meeting — Bern, Switzerland
ISSI team by M. Sitnov — *23rd-27th October 2017*
The goal of our team is to provide a review paper on "Explosive reconnection events in the magnetotail".

MPPC meeting 2017 — Greifswald, Germany
Max Plank- Princeton Collaboration meeting — *19th-22nd September 2017*
Oral: "Magnetic reconnection at kinetic scales: from the trigger mechanism at ion scales to electron energization"

JpGU-AGU Joint Meeting 2017 — Makuhari Messe, Japan
Japan Geoscience Union — *20th-25th May 2017*
Poster: "Fast magnetic reconnection onset for different equilibrium configuration: from analytical results to 3D simulations."

Seminar Tokyo University — Tokyo, Japan
Meeting with Prof. Ono and Prof. Yokoyama — *8th May 2017*
Oral Presentation: "Triggering Fast Magnetic Reconnection in Astrophysical and Laboratory Plasmas: Critical Aspect Ratios from Fluid to Kinetic Scales."

Seminar Kyoto University — Kyoto, Japan
Informal workshop at Kyoto with Prof. Shibata — *25th April 2017*
Oral Presentation: "Flares, CMEs and explosive events: the "ideal" tearing mode and fast reconnection triggering in magnetized plasmas, from fluid to kinetic scales"

Seminar Nagoya University — Nagoya, Japan
Solar Group Seminar Nagoya — *21st April 2017*
Oral Presentation: "Flares, CMEs and explosive events: the "ideal" tearing mode and fast reconnection triggering in magnetized plasmas, from fluid to kinetic scales" and discussion with Prof. Kusano's group and other visiting professors.

MR2017 — Matsuyama, Japan
Magnetic Reconnection Meeting 2017 — *19th-22nd March 2017*
Oral Presentation: "Fast magnetic reconnection: critical aspect ratios for different types of equilibrium configurations and the transition to kinetic physics"

AGU 2016 — San Francisco, US
American Geophysical Union Fall Meeting — *12th-16th December 2016*
Poster: "3D Simulations of the Double Tearing Mode Instability "

ISSI team meeting — Bern, Switzerland
ISSI team by M. Sitnov — *17th-21st October 2016*
First team meeting on "Explosive reconnection events in the magnetotail".

Astrophysics Workshop — Rome, Italy
Joint PhD La Sapienza-Tor Vergata — *21st-23rd September 2016*
First Doctoral dissertation: "Explosive energy release on the Sun: from theoretical models to flare forecasting"

SOLARNET Workshop at MSSL — UCL, Guildford, UK
Solar eruptive events — *20th-22nd April 2016*
Title, oral presentation: "Triggers for fast reconnection: the effects of different equilibrium configurations on the "ideal" tearing mode and the transition to kinetic physics."

AGU 2015 — San Francisco, CA
Magnetic Reconnection: A Fundamental Process
Operating throughout the Universe — *14-18th December 2015*
Poster: "Ideal Tearing in the Hall Regime"

Seminar UCLA — Los Angeles, CA
Space Physics Seminar — *11th December 2015*
"Fast tearing: the transition to kinetic effects"

Seminar JPL — Pasadena, CA
Space Physics Seminar — *11th December 2015*
"Triggers for fast reconnection: the effects of different equilibrium configurations on the "ideal" tearing mode and the transition to kinetic physics"

Plasma Fest — Los Angeles, CA
Plasma Fest UCLA — *22nd September 2015*
Poster: "Fast Magnetic Reconnection: the Hall effect"

First Joint SPP-SO Workshop — Artimino, Italy
The Origins of the Heliosphere — *22nd September 2015*
Poster: "Fast Magnetic Reconnection: the Hall effect", http://www.solarprobeplus.org/2015/

Lecture on Magnetic Reconnection — Rome, Italy
Plasma Physics — *29th January 2015*
Magnetic Reconnection lecture, for course by Prof. Giuseppe Consolini, Universityà of Roma Tor Vergata.

Workshop Accademia dei Lincei — Rome, Italy
Complex Plasma Phenomena in the Laboratory and in the Universe — *19-20th January 2015*
Poster: "Fast Magnetic Reconnection: the Trigger for CMEs?"

Workshop on Plasma Astrophysics — Firenze, Italy
Arcetri 2014 — *27-30th October, 2014*
Department of Physics and Astronomy University of Florence, Title (oral presentation): "Fast tearing in current sheets: scaling for different equilbria and preliminary results on kinetic effects?".

Stage Tor Vergata — Rome, Italy
Winter Stage 2014 — *4th - 7th February 2014*
Department of Physics, University of Roma Tor Vergata, Lecturer: " Tecniche astronomiche per la Fisica Solare" ("Astronomical techniques for Heliophysics").

SoHe meeting — Catania, Italy
Meeting of the Italian Community in Solar and Heliospheric Physics — *4-6th September 2013*
Title, oral presentation: "Reconnection of Quasi-singular Current Sheets and Tearing in the Ideal Limit" (http://www.oact.inaf.it/weboac/SoHe2013/).

1st Solarnet - 3rd EAST/ATST meeting — Oslo, Norway
Synergies between ground and space based solar research — *5-8 August 2013*
Title, oral presentation: "Reconnection of Quasi-singular Current Sheets and Tearing in the Ideal Limit" (http://folk.uio.no/matsc/oslo-13/info.html).