

# FEDERICO FRASCHETTI

## Present Address

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## • PROFILE

Theoretical astrophysicist with wide interests in space physics, high energy astrophysics and laboratory astrophysics: non-relativistic and relativistic shocks, particle acceleration, particle transport in magnetic turbulence, origin of cosmic-rays, relativistic hydrodynamics.

## • APPOINTMENTS

- 2020-present** Senior Research Scientist/Guest Lecturer, Dept. Planetary Sciences, U. of Arizona, Tucson, USA.
- 2018-21** Visiting Scientist at the Harvard/Smithsonian Center for Astrophysics.
- 2012-present** Faculty Affiliate Member, Theoretical Astrophysics Program, U. of Arizona, Tucson, USA.

## • RESEARCH EXPERIENCE

- 2012-2019** Associated Staff Scientist/Guest Lecturer, Dept.s Planetary Sciences/Astronomy, Univ. of Arizona, Tucson, USA.
- 2009-12** Research Associate, Dept.s Planetary Sciences/Physics, Univ. of Arizona, Tucson, USA.
- 2008-09** Post Doc Fellow/Invited Researcher at LUTh, Observatory Paris-Meudon, Paris.
- 2007-17** Qualification for Assistant Professor (“Maître de conférences”) in CNU sections 29, Particle Physics, (“Constituants élémentaires”) and 34, Astrophysics (“Astronomie, astrophysique”).
- 2006-08** Post Doc Fellow at CEA Saclay, DSM/IRFU/Service d’Astrophysique.
- 2005** Post Doc Fellow at *Brera Astronomical Observatory* (Merate) within *Swift* mission for GRB and ICRA at Physics Department of University of Rome *La Sapienza*.

## • EDUCATION

- 2004** PhD with full marks in High Energy Astrophysics: “On the afterglow of Gamma-Ray Bursts within the EMBH model” advisors: Prof. R. Ruffini (University of Rome *La Sapienza*) and Dr. L. Vanzo (University of Trento).
- 2001** “Laurea” in Physics (B.S. and M.S.) with *110/110 cum laude* at University of Rome *La Sapienza*; supervision of Prof. R. Ruffini.

## • GRANTS, FELLOWSHIPS

- 2020-24** PI on NASA Living With the Star *Tracking mechanisms efficiently accelerating charged particles at shocks at multiple heliospheric distances out to 1.5 AU*
- 2020-23** Co-I on Heliophysics System Observatory Connect *Energetics of Solar Eruptions from the Chromosphere to the Inner Heliosphere* (PI: K. Reeves, Center for Astrophysics | Harvard & Smithsonian).
- 2019** Co-I on Chandra Theory proposal *The ionization of M dwarf exoplanet atmospheres by flare energetic particles* (PI: J. Drake, Center for Astrophysics — Harvard & Smithsonian).

- 2018-19** PI on NSF-EAGER proposal *Novel approach to acceleration and escape of charged particles at interplanetary and astrophysical shock waves*
- 2018-21** PI on NASA Supporting Research proposal *Anisotropy and particle injection at localized enhancements of supra-thermal particles at oblique collisionless shocks at 1 AU.*
- 2018** Fellowship at the Collaborative Research Center 676 (Sonderforschungsbereich 676) at Hamburg University/DESY (Germany, 3 months, declined).
- 2017 & 18** American Astronomical Society International Travel Grant.
- 2015 & 16 & 17** PI on Travel Grant, Theoretical Astrophysics Program, University of Arizona.
- 2015-16** Co-I on Veritas proposal *Observations of the hot spot in W44 SNR* (PI: V. Bugaev, U St. Louis, WA)
- 2016** Co-I on Chandra Theory proposal *The contribution to protoplanetary disk ionization from T-Tauri flare energetic particles* (PI: J. Drake, Harvard/Smithsonian Center for Astrophysics).
- 2015** PI of the Crowdfunding campaign *Help Solve the Mystery of Cosmic Rays* at [www.fiatphysica.com](http://www.fiatphysica.com).
- 2015-18** Co-I on NASA Supporting Research proposal *Analysis of Spacecraft Observations and Numerical Modeling of Solar-Energetic Particles Associated with Strong Interplanetary Shock Waves* (PI: J. Giacalone, U. of Arizona).
- 2015-16** Co-I on *Particle acceleration in laser-produced shocks by lower-hybrid wave turbulence*, LASER-LAB-EUROPE proposal (PI: G. Gregori, U. of Oxford, UK).
- 2013-16** PI on NASA Supporting Research proposal *Time-dependent perpendicular transport of charged energetic particles in three-dimensional anisotropic magnetic turbulences.*
- 2014** Co-I on “Studies of high energy gamma-ray emissions from Tycho with Fermi and VERITAS”, VERITAS proposal (PI: N. Park, U. of Chicago).
- 2012-14** PI of working team “First principles physics for charged particle transport in strong space and astrophysical magnetic turbulence”, ISSI (Switzerland);  
URL: <http://www.lpl.arizona.edu/~ffrasche/ISSI.html>.

- **AWARDS**

- 2016** APAC Award, University of Arizona.
- 2005** “Pietro Tacchini” prize for PhD thesis in astrophysics by SAIIt (Società Astronomica Italiana).
- 1998, '99, 2001** Awards by Department of Physics, University of Rome *La Sapienza*.

- **SERVICES**

- Peer-reviewer (~ 5 -10 papers/year): Physical Review Letters, Physical Review E, Nature, Nature Physics, Nature Communications, ApJ, ApJL, MNRAS, A&A, Solar Physics, Phil. Trans. A of Royal Society, J. Atmospheric and Solar-Terrestrial Physics, VERITAS papers committee.
- NSF/NASA panelist and mail-in reviewer (2010-present): peer-reviewer of NSF/NASA proposals.
- 2014-2018 Organiser of biweekly heliophysics-space physics group meetings at University of Arizona, Dept. of Planetary Sciences and NOAO.

- **TEACHING EXPERIENCE**

- AY 20-21** Instructor, Astronomy (399, undergrad. course), Dep. Astronomy, Univ. of Arizona, Tucson.
- AY 19-20** Instructor, Astronomy (299, undergrad. course), Dep. Astronomy, Univ. of Arizona, Tucson.
- AY 19-20** Co-Instructor, Astronomical problem solving (196, undergrad. course), Dep. Astronomy, Univ. of Arizona, Tucson.
- AY 13-14**
  - Instructor, High-Energy Astrophysics (599, graduate course), Dep. Physics/Astronomy, Univ. of Arizona, Tucson.
  - Guest Lecturer, Theoretical Astrophysics (589, graduate course), Dep.s Physics/Astronomy/ Planetary Sciences, Univ. of Arizona, Tucson.
- AY 06-07** Lab. TA, Optics-electr., Dép. Physique, Univ. de Versailles, Paris.

- AY 02-05** Co-Supervision Degree theses Astrophysics, Dep. Physics, Univ. *La Sapienza* of Rome.
- AY 99-00** Lab. TA, Optics-electr., Dep. Physics, Univ. *La Sapienza* of Rome.
- AY 98-99** Lab. TA, Mechanics-electr., Dep. Physics, Univ. *La Sapienza* of Rome.

- **CURRENT RESEARCH STUDENT OR GRADUATE STUDENT ADVISOR**

- Zehao Dong (undergraduate Astronomy, Univ. of Arizona).
- Liam David (undergraduate Physics/Astronomy, Univ. of Arizona).
- Aurelia Balkanski (undergraduate Physics, Harvard Univ).
- Darshana Mandal (undergraduate Physics, Bangalore Univ., India).
- M. Rassel (graduate student Univ. of Cincinnati, co-advised).

- **CURRENT POST-DOC MENTOR**

- Manpreet Singh (start-date January 2021)

- **FORMER RESEARCH STUDENT OR POST-GRAD STUDENT**

- Yue Zeng (undergraduate Physics/Astronomy, Univ. of Arizona, AY 2019-20).
- M. Rassel (postgrad. Harvard Univ., MA, and Univ. Colorado, Boulder, AY 2017-18);
- C. Zhou (Harvard Univ., MA, and Winsor School, Boston, MA, AY 2017-18; now NYU),

- **GUEST SCIENTIST** (1 week  $\leq$  duration  $\leq$  2 months)

- 2016/08** Center for Astrophysics, Harvard Univ. (1 month)
- 2013/06** Observatory Paris-Meudon, LUTh, Paris (France, 1 month).
- 2011/04** Observatory Paris-Meudon, LUTh, Paris (France, 1 week).
- 2011/01** University of Chicago, Dept. of Astronomy (1 week).
- 2010/08** Rutgers University, Dept. of Physics and Astronomy (1 week).
- 2010/06** Princeton University, Dept. of Astrophysical Sciences (1 week).
- 2010/04** New York University, Center for Cosmology and Particle Physics (1 week).
- 2009/09** APC, “Astroparticule et Cosmologie”, University Paris VII, Paris (France, 2 weeks).
- 2009/05-06** Ruhr Universität Bochum, Theoretical Physics Dept., Germany (2 months).
- 2007/01** University of Leicester, Dept. of Physics and Astronomy, UK (1 week).
- 2006/07** University of Leicester, Dept. of Physics and Astronomy, UK (1 week).
- 2002/06** Max-Planck-Institut fuer Astrophysik, Garching, Germany (1 week).

- **MEMBERSHIPS**

- Multimessenger Astronomy Science Advisory Group, stellar-mass BH-BH binaries, 2018–present;
- eXTP Working Group, 2017–present;
- Athena Study Science Team Working Group 3.4, *The astrophysics of supernova remnants and the interstellar medium*, 2015–present;
- Lynx, working groups *Physics of plasmas*, *Life-cycle of stars* and *Multiwavelength Synergy*, 2016–present;
- American Astronomical Society (AAS); High-Energy Astrophysics Division, 2010–present;
- Associate Member of VERITAS collaboration, 2011–present;
- International Astronomical Union (IAU; High Energy Phenomena and Fundamental Physics, Interstellar Matter and Local Universe, Sun and Heliosphere), 2011–present;
- American Geophysical Society (AGU), 2010–present.

- **SPOKEN AND WRITTEN LANGUAGES**

- Italian: mother tongue.
- English, French: fluent.
- German, Russian: basics.

- **OUTREACH**

**2012** "Origin of Cosmic-Rays" at Tucson High Magnet School, Tucson, AZ (USA).

**2016** Advisor for series *How The Universe Works* by Pioneer Productions (British television company).

**2019** "Magnetic hurricanes in other worlds", Astronomy on the TAP, Tucson, AZ (USA).

**2019** "The relentless quest for life in the universe, aka magnetic hurricanes in other worlds", Brain & Brews, Tucson, AZ (USA).

- **COMPUTER SKILLS**

Operating systems: Mac OS-X, LINUX, Microsoft Windows (NT & XP); the algebraic tensorial manipulator Maple V; IDL, DS9, Gnuplot, Mathematica; Latex; FORTRAN, C languages. XSPEC software; XRT pipeline for Swift data analysis; XMM V&V for screening of 2XMM pipeline.

- **CERTIFICATES**

**2018-21** Certificate Minors Protection Training for Responsible Adults (Harvard University).

Cambridge, USA, October 14<sup>th</sup>, 2020