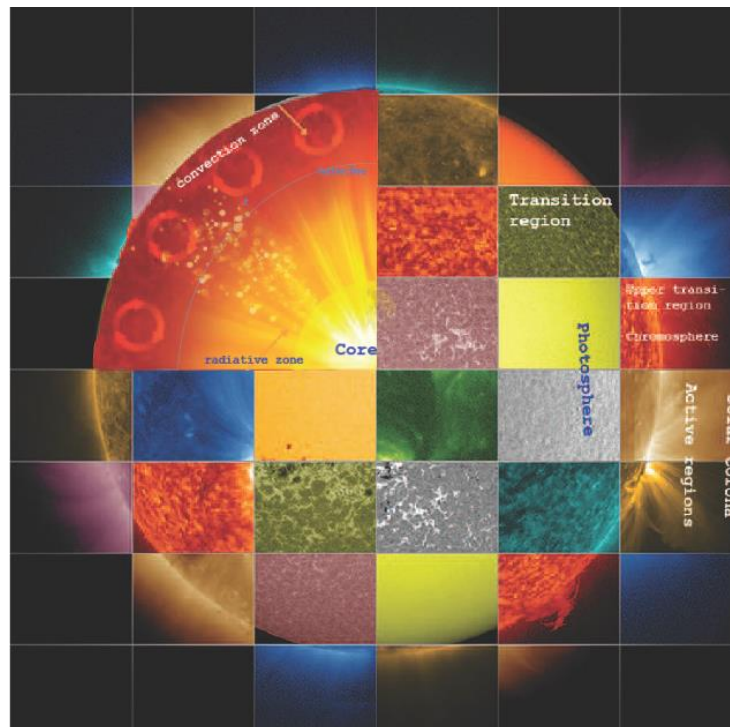


Laboratorul de astrofizică și cercetări spațiale

Director: Dr. Alexandru Marcu



Concept

1. We plan to go beyond the present resolution of most performing observational facilities and investigate the diagnostic possibilities at the sub-resolution structuring
2. We aim to develop a new model of plasma dynamics and the associated diagnostics procedure in non-stationary plasmas
3. In reality, high resolution EUV and X-ray observations show that plasma parameters do not vary smoothly and random or stochastic descriptions of, e.g. density and magnetic field are necessary. In a stochastic or random process there is some indeterminacy in its future evolution, described by probability distribution functions, with some evolutionary paths more probable and others less so. This fundamentally new approach towards the remote diagnostics of solar and space plasma is one of our goals
4. The exoplanets studies and how the ohmic heating influences the contraction of gas giants

Objectives

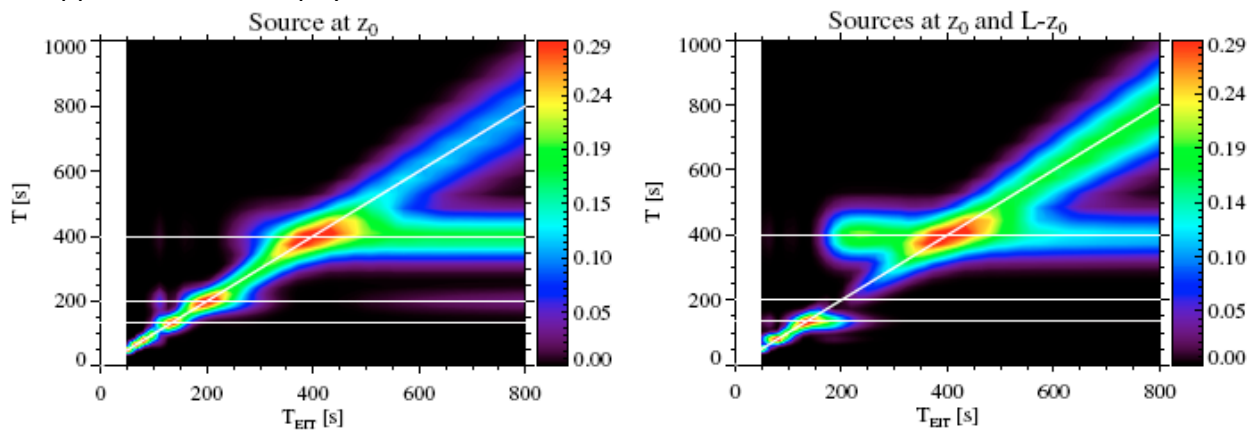
1. Analytical methods describing EIT waves, flares, filaments and brightening/loop motions
2. Seismological diagnostics of solar and space plasmas
3. Analytical and numerical models for remote solar and space plasma diagnostics
4. Complementing and validating the proposed methods of solar and space plasma diagnostics by novel observations and corresponding data assimilation procedures.
5. Refinement of reconnection models based on stochastic behaviour of magnetic fields and to application to astrophysical events, like the intraday variability observed in the spectra of accretion disks of AGNs (Active Galactic Nuclei).

Team description

Dr. Alexandru Marcu

The general researches interest is in magnetohydrodynamics waves in solar and space plasmas and the areas he is particularly interested in are:

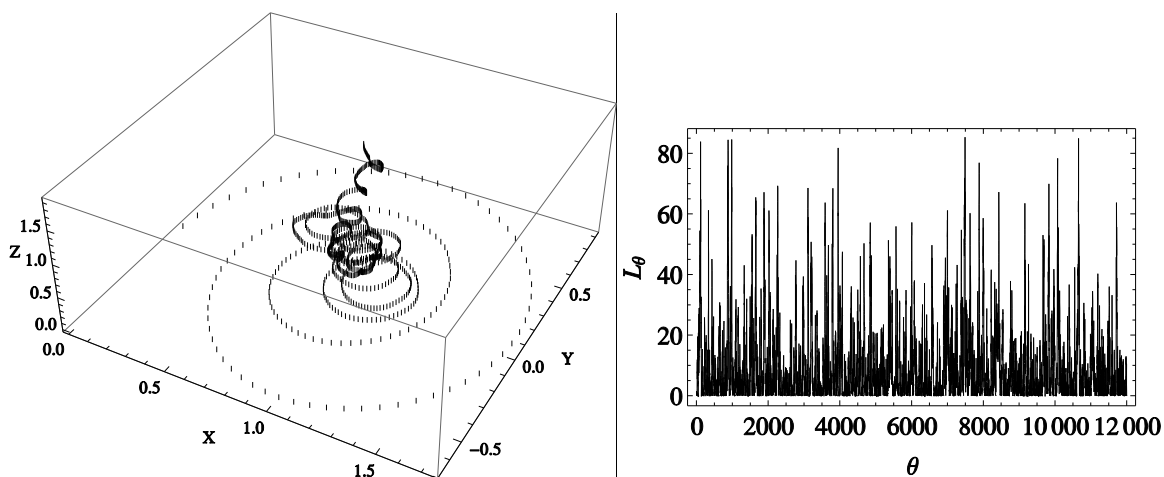
1. Waves and oscillations in solar atmosphere,
2. Magneto- seismology,
3. Satellite data acquisitions,
4. Simulations (SOHO, TRACE, HINODE),
5. Theoretical and observational studies on Algol Y Leonis system,
6. Refinement of reconnection models based on stochastic behaviour of magnetic fields and to application to astrophysical events.



Dr. Gabriela Mocanu

Team Member dr. Gabriela Mocanu is a young researcher who has obtained her PhD title in July 2013. She has a six years background in Magnetohydrodynamics and a three year experience in stochastic physics and stochastic simulations. Her research focuses on:

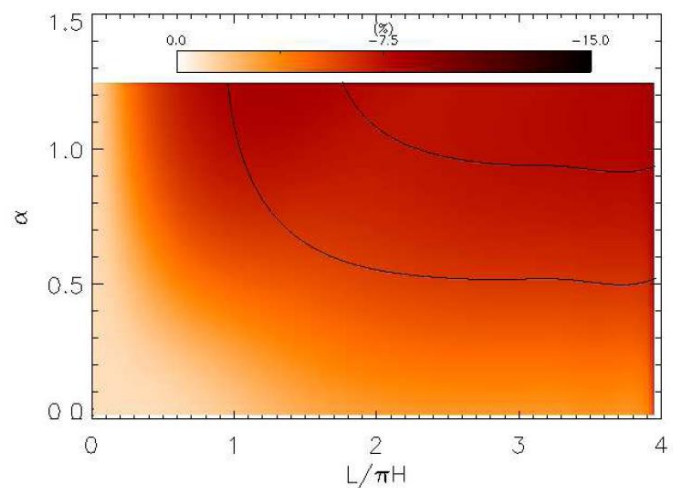
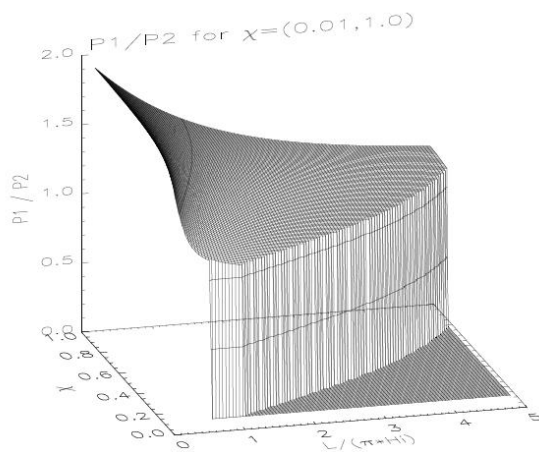
1. Waves and oscillations in solar atmosphere,
2. Magneto- seismology,
3. The effects of magnetic fields (deterministic and stochastic) on the behavior of astrophysical plasma systems and the resulting signature in the electromagnetic radiation of these systems



Dr. Orza Beniamin

Team Member B. Orza is a bright PhD student (who has obtained her PhD title in Oct. 2013), graduated at BBU, currently under the supervision of dr. I. Ballai at the University of Sheffield. His research focuses on:

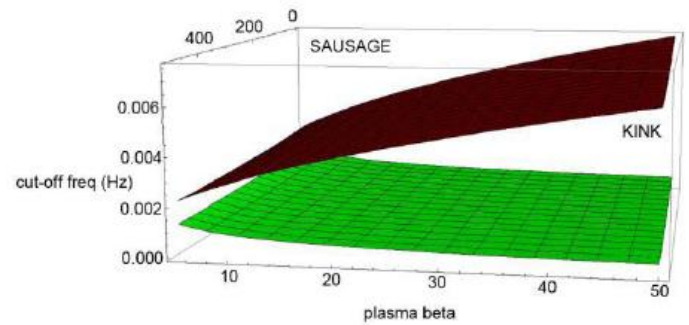
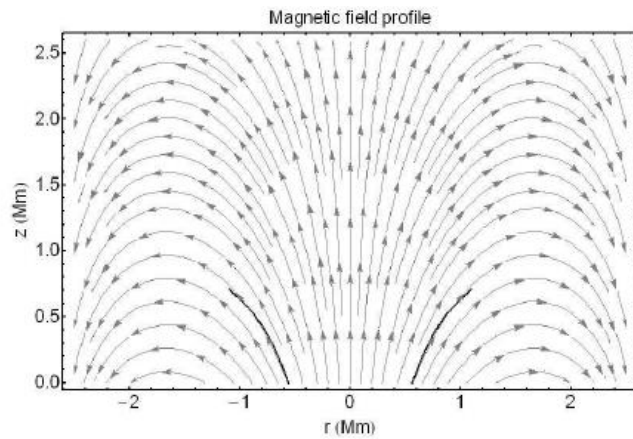
1. The analytical/numerical side of dynamics over short length scales as well as the diagnostic possibilities related to the P1/P2 period ratio.
2. Mode Propagation in a Thick Magnetic Flux Tube
3. Transverse kink oscillations of expanding coronal loops
4. Standing waves in a solar periodic structures
5. The problem of phase mixed shear Alfvén waves in the solar corona
6. Solar Dynamical phenomena



PhD Pardi Anabele-Linda

Team Member A. Pardi is PhD student, an outstanding theoretical physicist, very thorough with theoretic models, mathematical methods and results interpretation, her enthusiasm and dedication is fuelled by her passion for observational astrophysics. Graduated at BBU, currently under the supervision of dr. Spruit at The International Max Planck Research School on Astrophysics at the Ludwig Maximilians University Munich. Her research focuses on:

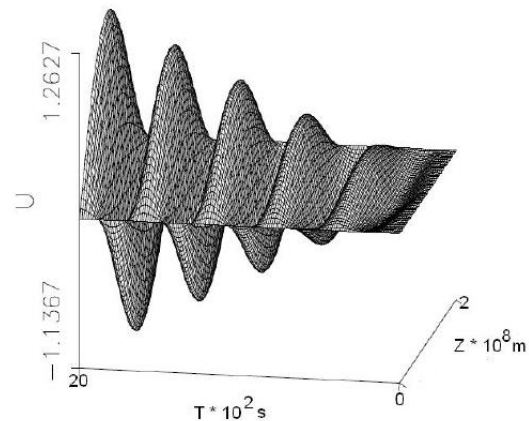
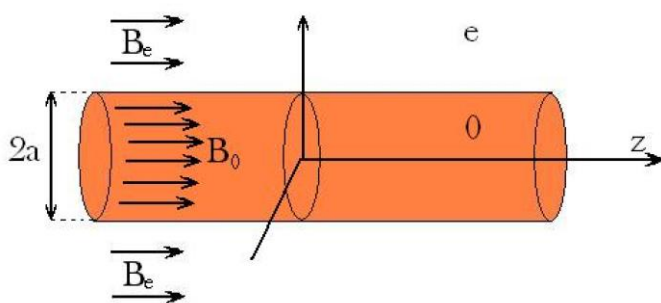
1. Sausage mode propagation in in athik magnetic flux tubes
2. The effect of cooling on oscillation modes in expanding coronal loops
3. Exoplanets



Master's, year 2 - Computational Physics Magyar Norbert

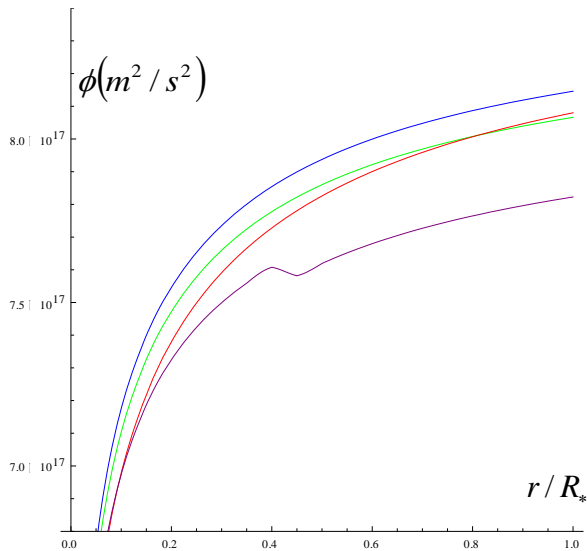
His work consist in studying the wave propagation equations and specific plasma oscillations in solar magnetic structures consistent with observational data. Now is in Leuven working on simulation of cooling effect in expanding coronal loops

1. Effect of structuring and shape on coronal loop oscillations
2. Dynamical and physical processes in celestial bodies - an astrophysical insight
3. How cooling of the coronal plasma influences the oscillation properties (amplitude and oscillation period) of impulsively generated kink MHD waves in coronal loops (numerical analysis).
4. The effect of loop expansion on oscillation properties of coronal loops
5. Skilled programmer (C, Pascal, C++, Java, Python, Fortran, and also HTML, CSS, Javascript, Pde2D)



Master's, year 2 - Computational Physics Serban Ontanu Craciun

Past work: Study of some interior parameters on four neutron stars in the framework of three general-relativistic models. Currently developing a molecular dynamics - based simulation program for studying the formation, evolution and collision of stellar clusters and galaxies. Program will be thoroughly optimized and will take into account relativistic and dark matter effects



Students: Radu Gheorghiu (III FT), Danila Bogdan (III F)

Papers:

1. Sausage Mode Propagation in a Thick Magnetic Flux Tube
Pardi, A.; Ballai, I.; Marcu, A.; Orza, B.
Solar Physics, Online First. 08.2013 DOI: 10.1007/s11207-013-0380-y (2013)
2. The effect of cooling on sausage and kink oscillation modes in expanding coronal loops”
Pardi, N. Magyar, G. R. Mocanu and A. Marcu, AIP Conf. Proc. 1564, 194-199 (2013) ; <http://dx.doi.org/10.1063/1.4832817>
3. Rms-flux relation in the optical fast variability data of BL Lacertae object S5 0716+714
Mocanu, Gabriela Raluca; Sándor, Bulcsú
Astrophysics and Space Science, Volume 342, Issue 1, pp.147-153,2012
4. Power spectral distribution of the BL Lacertae object S5 0716+714
Mocanu, G. R.; Marcu, A.
Astronomische Nachrichten, Vol.333, Issue 2, p.166-173, 2012
5. Transverse kink oscillations of expanding coronal loops
Ballai, I.; Orza, B.
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6. The effect of the environment on the P1/P2 period ratio for kink oscillations of coronal loops
Orza, B.; Ballai, I.; Jain, R.; Murawski, K.
Astronomy & Astrophysics, Volume 537, id.A41, 10 pp.
7. Self-organized criticality in boson clouds around black holes
Mocanu, Gabriela; Grumiller, Daniel
Physical Review D, vol. 85, Issue 10, id. 105022, 2012
8. Simulation model for transversal loop oscillations: the effects induced by shock waves and opposition of the external medium
Mocanu, Gabriela R.; Marcu, A.
Romanian Astronomical Journal, Vol. 22, No. 1, p. 23-42, 2012
9. Cosmological evolution of finite temperature Bose-Einstein condensate dark matter
Harko, Tiberiu; Mocanu, Gabriela
Physical Review D, vol. 85, Issue 8, id. 084012, 2012

10. Sausage Mode Frequency Windows at the Interface of the Sun's Atmospheric Layers
Pardi, Anabele-Linda; Marcu, Alexandru
Source: PROCEEDINGS OF THE PHYSICS CONFERENCE TIM - 11 Book Series: AIP Conference Proceedings Volume: 1472 Pages: 245-252 DOI: 10.1063/1.4748095 Published: 2012
11. Stochastic oscillations of general relativistic discs
Harko, Tiberiu; Mocanu, Gabriela Raluca
Monthly Notices of the Royal Astronomical Society, Volume 421, Issue 4, pp. 3102-3110, 2012
12. The intriguing orbital period variability of Y Leonis
Pop, Alexandru; Turcu, Vlad; Marcu, Alexandru
Astrophysics and Space Science, Volume 333, Issue 1, pp.17-28, 2011
13. Y Leonis: light curve solution revised and search for photometric variations of the primary minima
Turcu, Vlad; Pop, Alexandru; Marcu, Alexandru; Moldovan, Dan
Astrophysics and Space Science, Volume 331, Issue 1, pp.105-113, 2011
14. On the Short-Term Orbital Period Modulation of Y Leonis
Pop, Alexandru; Turcu, Vlad; Marcu, Alexandru
Romanian Astronomical Journal, Vol. 21, No. 1, p.27-33, 2011
15. Excitation and Damping of Transversal Coronal Loop Oscillations
Marcu, A.; Mocanu, G.
Proceedings of the Physics Conference. AIP Conference Proceedings, Volume 1262, pp. 39-44, 2010
16. New approach on the excitation and damping of transversal coronal loop oscillations
Mocanu, G.; Marcu, A.
ROMANIAN REPORTS IN PHYSICS Volume: 62 Issue: 4 Pages: 897-905, 2010
17. Excitation and Damping of Transversal Coronal Loop Oscillations
Marcu, A.; Mocanu, G.
TIM-09: PROCEEDINGS OF THE PHYSICS CONFERENCE Book Series: AIP Conference Proceedings Volume: 1262 Pages: 39-44 DOI: 10.1063/1.3482234 2010
18. The problem of phase mixed shear Alfvén waves in the solar corona revisited
Mocanu, G.; Marcu, A.; Ballai, I.; Orza, B.
Astronomische Nachrichten, Vol.329, Issue 8, p.780, 2008
19. Y Leonis reloaded
Pop, Alexandru; Turcu, Vlad; Marcu, Alexandru
EXPLORING THE SOLAR SYSTEM AND THE UNIVERSE. AIP Conference Proceedings, Volume 1043, pp. 420-421, 2008
20. Standing waves in a solar periodic structures
Marcu, Alexandru; Mocanu, Gabriela; Orza, Benjamin
EXPLORING THE SOLAR SYSTEM AND THE UNIVERSE. AIP Conference Proceedings, Volume 1043, pp. 314-317, 2008
21. Forced oscillations of coronal loops driven by EIT waves
Ballai, I.; Douglas, M.; Marcu, A.
Astronomy and Astrophysics, Volume 488, Issue 3, 2008, pp.1125-1132, 2008
22. Thermally damped linear compressional waves in a 2D solar coronal model
Marcu, A.; Ballai, I.; Orza, B.
Waves & Oscillations in the Solar Atmosphere: Heating and Magneto-Seismology, Proceedings of the International Astronomical Union, IAU Symposium, Volume 247, p. 320-323, 2008

Granturi

IDEI 531/2007

Modelare teoretica si computationala in seismologia coronala globala solara si stelara: conexiuni unde globale-locale, campuri magnetice-variabilitati

Director : Lect. Dr. Alexandru Marcu

C2-2013-STAR-ROSA /2014

Computational methods in scientific investigation of space

Partener: Lect. Dr. Alexandru Marcu