

**Programme for Research-Development-Innovation for
*Space Technology and Advanced Research - STAR***

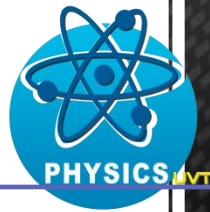
**COMPUTATIONAL
METHODS IN SCIENTIFIC
INVESTIGATION OF SPACE
COMISIS**

Dumitru Vulcanov

Romanian Space Week - 2015 , 27-29 May 2015, Bucharest, Romania



COMISIS



- Short description of the project:

The project proposes a joint research program having the following main directions:

- Providing an entire computer library devoted to numerical, symbolic computation and algebraic programming methods in space science areas as numerical relativity, nonlinear flow equations and other applications.
- Analytical and numerical models for remote solar and space plasma diagnostics.
- Semi-analytical methods in studying the stability of constrained space flight dynamics.

- Project goal/ objectives:

The main goal of the COMISIS project is to study and develop techniques dedicated to point out:

- effects and new measurements to be done in space for testing the alternative theories and models in astrophysics
- solar and space plasma diagnostics
- semi-analytical studying of the stability of constrained space flight dynamics.

- Human resources involved:

- CO: 4 senior researchers + 1 PhD student
- P1: 6 senior researchers + 1 PhD student
- P2: 3 senior researchers+ 1 PhD student +1 MA student

- Start date of the project / End date of the project: November 2013- November 2016

- Work plan of the project

WP no.	Work package title	Involved partners	Start month (1 ... n-1)	End month (2 ... n)
1	Computer library devoted to numerical, symbolic computation and algebraic programming methods in space science	CO, P1,P2	4	34
2	Analytical and numerical models for remote solar and space plasma diagnostics.	CO,P1, P2	6	34
3	Semi-analytical methods in studying the stability of constrained space flight dynamics.	CO, P1,P2	15	34
4	Dissemination, communication, training and education	CO, P1, P2	6	30
5	Management / administration	CO, P1, P2	1	36

- Implementation status and results of this phase of the project

The main contributions of UVT (CO):

WP 1: COMPUTER LIBRARY DEVOTED TO NUMERICAL, SYMBOLIC COMPUTATION AND ALGEBRAIC PROGRAMING METHODS IN SPACE SCIENCE.

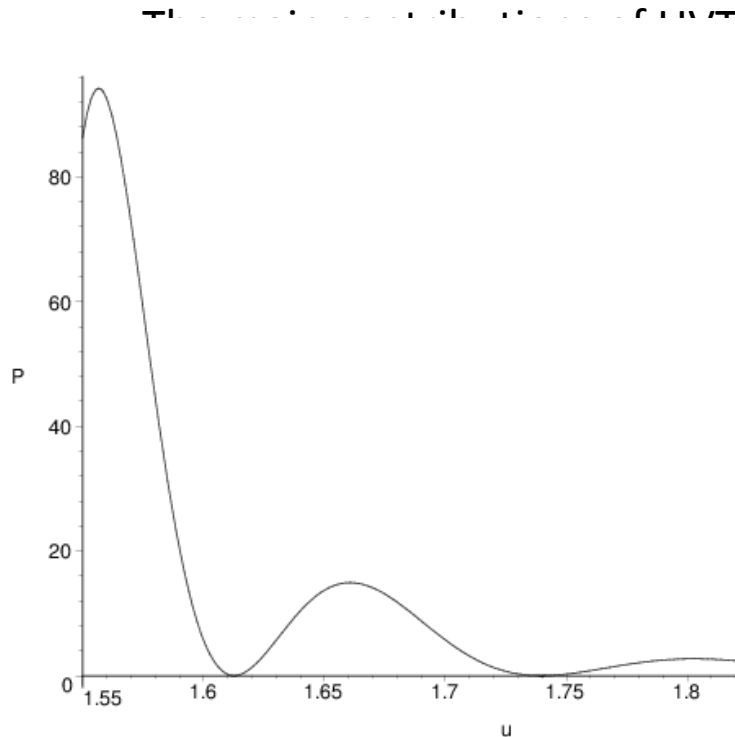
Task 1.2 - Investigations on the flow equations by building new programs for their numerical, computer algebra solving. Testing the accuracy and convergence of routines and testing them on flow eqs. In plasmas and turbulent media. (CO)

Task 1.3 - Identifying possible effects of different cosmological models on the astrophysical measurements in space.

Results: scientific articles will be published:

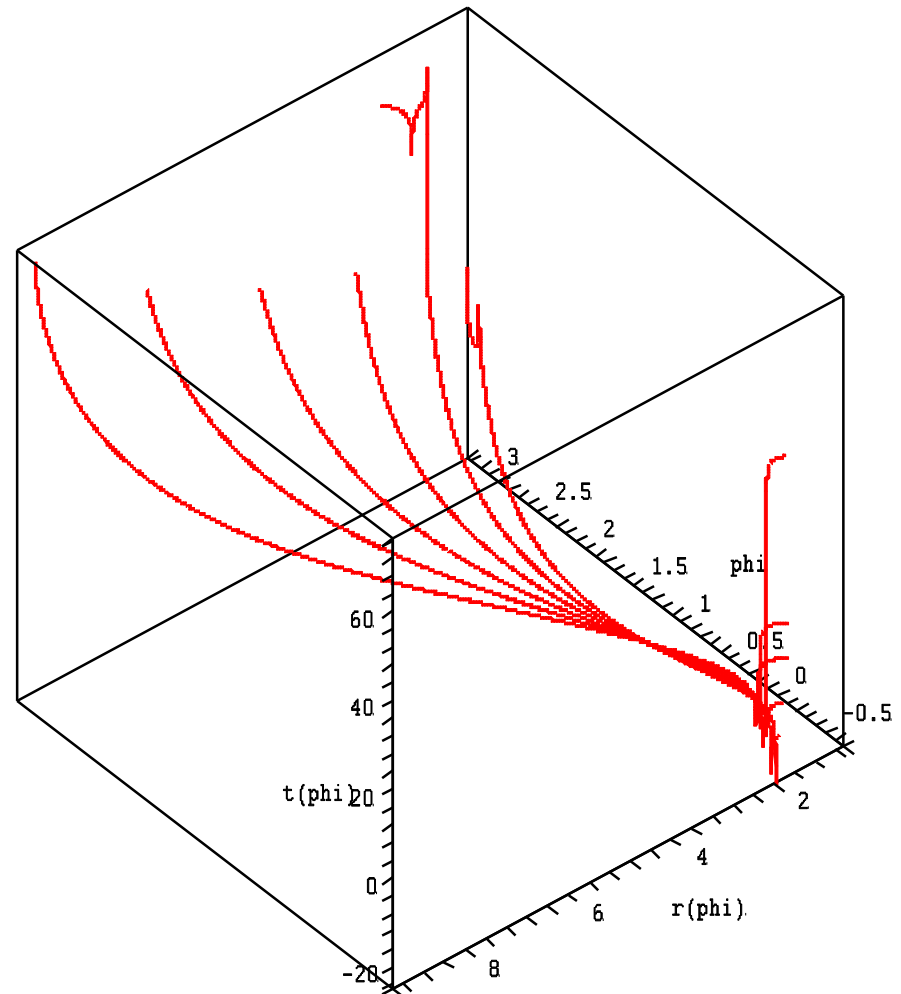
- 1) Cosmin Crucean and Mihaela-Andreea Baloi - *Interaction between Maxwell field and charged scalar field in de Sitter universe*, accepted for publication in Int.J.Mod.Phys.A.
- 2) Ion Cotaescu, Cosmin Crucean and Ciprian Sporea - *Partial wave analysis of the Dirac fermions scattered from Schwarzschild black holes*.

- Implementation status and



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- 2) Ion Cotaescu, Cosmin Crucu
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- Implementation status and results of this phase of the project

The main contributions of UCV (Partner 1):

WP 3: SEMI-ANALYTICAL METHODS IN STUDYING THE STABILITY OF CONSTRAINED SPACE FLIGHT DYNAMICS

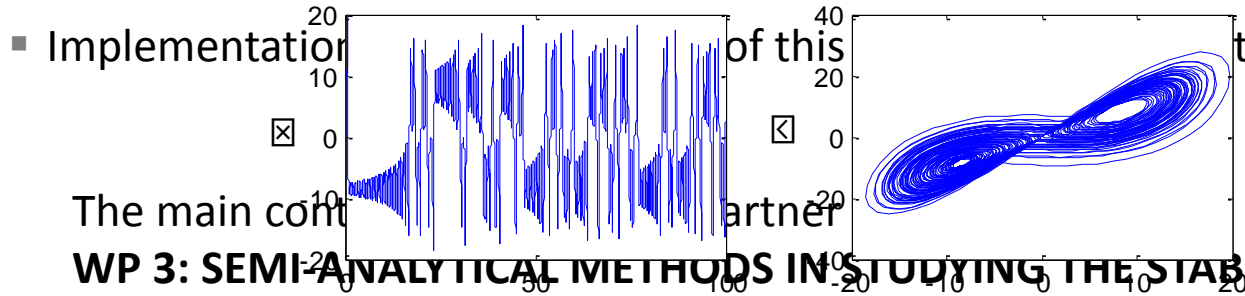
Task 3.4: Symmetry method and similarity solutions for nonlinear evolutionary equation appearing in space dynamics.

Results: Three papers were already published or accepted for publication in ISI Journals:

Rodica Cimpoiasu – “On symmetry groups of a 2D nonlinear diffusion equation with source”, *Pramana Journal of Physics*, Volume 84, Issue 4, 2015, 543-553.

Carmen Ionescu, Emilian Panaintescu, Gabriel Florian, Iulian Petrisor – “Nonlinear control of chaotic circuits described by jerk type equations”, will appear in *Romanian Journal of Physics*, Volume 59, issue 1, 2016

Radu Constantinescu – “Generalized conditional symmetries, related solutions of the Klein–Gordon–Fock equation with central symmetry”, will appear in *Romanian Journal of Physics*, Volume 59, issue 1, 2016.



WP 3: SEMI-ANALYTICAL METHODS IN STUDYING THE STABILITY OF CONSTRAINED SPACE FLIGHT DYNAMICS

Task 3.4: Symmetry in the stability of evolutionary equation

appearing in space

Results: Three papers published in ISI Journals:

Rodica Cimpoeasa, "On the stability of a 2D nonlinear evolutionary equation", *Pramana*

Journal of Physics, Volume 54, issue 1, 2016, 543-555

Carmen Ionescu, Emilian Panaitescu, Gabriel Florian, Iulian Petrisor, "Nonlinear control of chaotic circuits described by jerk type equations", will appear in *Romanian Journal of Physics*, Volume 59, issue 1, 2016

Radu Constantine, "Stability of the Klein-Gordon-Fock equation with a general potential", *Romanian Journal of Physics*, Volume 59, issue 1, 2016.

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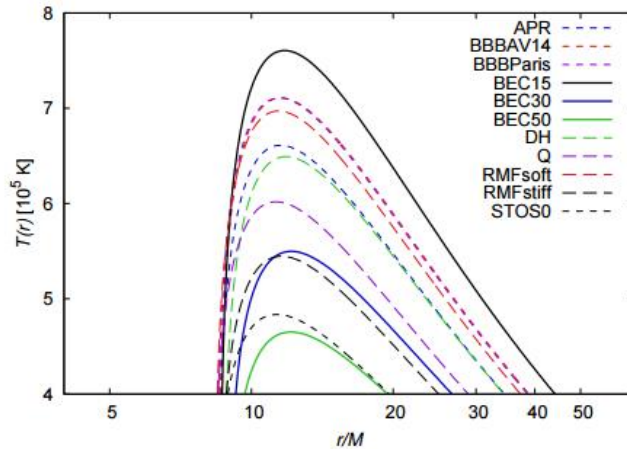
Radu Constantine, "Stability of the Klein-Gordon-Fock equation with a general potential", *Romanian Journal of Physics*, Volume 59, issue 1, 2016.

The main contributions of UBB (Partner 2):

WP 2: ANALYTICAL AND NUMERICAL MODELS FOR REMOTE SOLAR AND SPACE PLASMA DIAGNOSTICS.

Results: Three scientific papers were published:

- B. Danila, T. Harko, Z. Kovacs, *Thin Accretion Disks around cold Bose-Einstein Condensate star*, accepted for publication in EPJC, DOI: 10.1140/epjc/s10052-015-3428-3
- T. Harko, G. Mocanu, N. Stroia, *Self Organized Criticality in an one dimensional magnetized grid. Application to GRB X-ray afterglows*, Astrophysics and Space Science, 357 (2015), 1-9
- B. Dănilă, A. Marcu, G. Mocanu, *New statistical results on the optical IDV data of BL Lac S5 0716+714*, Research in Astronomy and Astrophysics, 15 (2015), No. 3, 327-332



Temperature distribution of the accretion disks around compact general relativistic objects with fixed central density $\rho_c = 10^{15}$ g/cm³ and $r_p/r_e = 0.85$.

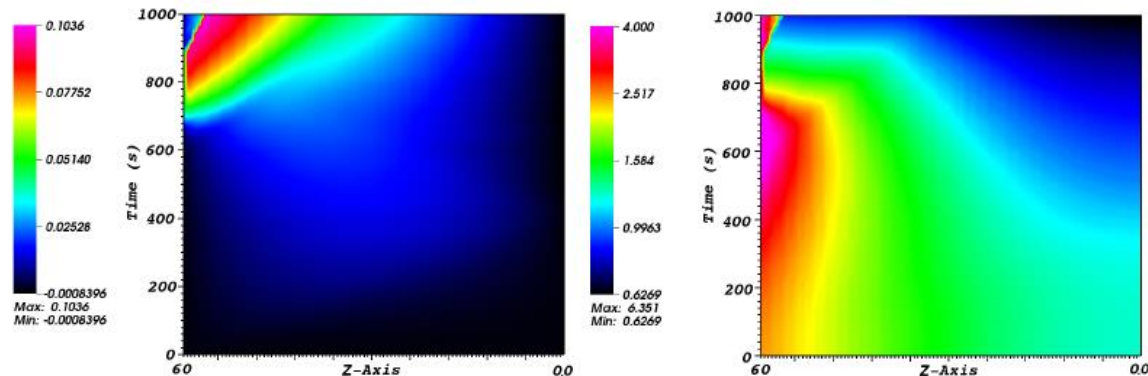
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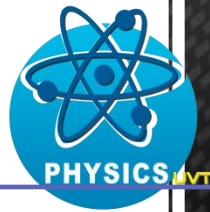
Self Organized Criticality in an
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- Project's contribution to the goal of the STAR Programme:
- Context and contribution to ESA Programmes:

Within the general ESA and STAR objectives, the COMISIS Project has the following general aims:

- Producing high-level scientific results and output increasing the international recognition and relevance of the Romanian science.
- Improving the capacity of the partner institutions to built research and educational projects in space science and technology.
- Development of software technologies as support of experiments and measurements in space missions.

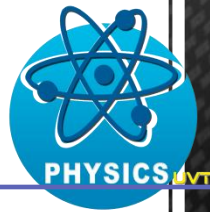
- Dissemination activities:

Various dissemination activities of COMISIS Project were organized within scientific and public events as:

- TIM' 14 International Conferences (organized by CO)
- “Joint Meeting in Quantum Field Theory and Dynamical Systems” (organized by P1).
- Open Days of West University of Timisoara (April 2015)
- “Craiova between Stars” (meeting of students from Craiova with Dumitru Prunariu).



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- Conclusions:

- 1) The tasks and the objectives assumed are in the right schedule.
- 2) The results of this stage of the project are included in 9 ISI articles published or to be published.
- 3) The teams provide a healthy collaboration inside the consortium.

The main conclusion is that there are good opportunities to bring the tasks and objectives of the project to a successful end.