

# CURRICULUM VITAE

Marko Robnik

April 26, 2015

- **born on 17 Aug 1954** in Maribor, Slovenia
- **1961.9 - 1969.6** primary school in Maribor
- **1969.9 - 1973.9** high school in Maribor
- **1973.9 - 1975.9** physics undergraduate at University of Ljubljana
- **1975.9 - 1976.9** physics undergraduate at University of Hamburg
- **1976.9 - 1978.6** physics undergraduate at University of Ljubljana
- **June 1978** received the Diploma Degree in physics at the University of Ljubljana
- **1978.6 - 1978.9** research assistant at University of Ljubljana (Professor Ivan Kuščer)
- **1978.9 - 1981.9** graduate student in physics and astrophysics at the University of Bonn, having a Ph.D. grant (Professor Wolfgang Kundt)
- **September 1981** received the Ph.D. Degree (Dr.rer.nat.) at the University of Bonn (Professor Wolfgang Kundt)
- **1980.2 - 1984.12** Research Fellow (full position) at the Institut für Astrophysik, University of Bonn
- **1984.1 - 1985.5** Research Associate (postdoc) at the Department of Physics, H.H. Wills Physics Laboratory, University of Bristol, England (Professor Michael V. Berry)
- **1985.5 - 1987.5** Research Associate in Theoretical Physics, an independent academic staff position at the Department of Physics, University of Bristol, England
- **1987.5 - 1988.8** Research Associate Professor at the Max-Planck-Institut für Kernphysik, Heidelberg, Germany
- **1989.1 - 1989.6** Visiting Associate Research Professor, Institute for Theoretical Physics, University of California, Santa Barbara, USA
- **1989.6 - 1990.6** **Founding Director of CAMTP** the Center for Applied mathematics and Theoretical Physics, University of Maribor, Maribor, Slovenia
- **1990.6 - present** **Director of Research and Managing Director of CAMTP** the Center for Applied Mathematics and Theoretical Physics, University of Maribor, Maribor, Slovenia; Director of the Summer Schools/Conferences "Let's Face Chaos through Nonlinear Dynamics".

- **12. Nov. 1997:** recipient of the Highest State Award of the Republic of Slovenia for the Scientific Research Work in Physics (*Državna Nagrada za znanstveno-raziskovalno delo v letu 1997 za vrhunske dosežke na področju fizike*). This is the highest award for scientific work in the Republic of Slovenia.
- **May 1998:** Elected Full Professor of Physics at the University of Ljubljana, Slovenia, Faculty of Mathematics and Physics.
- **9 - 23 November 1998: JSPS Fellowship visiting Professor** (Japan Society for the Promotion of Science) at Waseda University in Tokyo, Tokyo Metropolitan University, and Kyoto University.
- **12 - 15 May 2000:** Coorganizer and Local Organizer of the 1st WIGV-Konferenz, CAMTP, University of Maribor, Maribor, Slovenia, together with Professor Dr. Julius Wess (Initiative for the Support of Science in Former Yugoslavia).
- **16 - 20 April 2001:** Visiting Professor at the "Osterakademie der Technischen Universität München", Novacella/Neustift, Southern Tyrol.
- **Visiting Research Professor** at ATR - Advanced Telecommunications Research Institute International, Seika-cho, Kyoto, Japan, November 2005.
- **Lecturer at the I. SOCRATES Workshop** at the University of Marburg, Germany, 1 - 5 March 2004.
- **Lecturer at the III. SOCRATES Workshop** at the University of Marburg, Germany, February 2008.
- **15-18 May 2012: Coordinator of the 1st Out of the Box Conference**, *Innovative ways to improve the culture of living*, University of Maribor, Slovenia.
- **9 November 2012: Elected Member of the European Academy of Sciences and Arts, Salzburg**
- **6 September 2014: Leonhard Euler Prize of the International Society of Difference and Differential Equations**

**RESEARCH FIELDS:** variety of topics in theoretical physics and mathematical physics, especially in nonlinear dynamics of classical and quantum chaotic systems, statistical properties of dynamical systems, WKB theory, also theoretical astrophysics.

**Brief description of research topics in approximately temporal order:**

- Studies of wave propagation in inhomogeneous layered media.
- Studies of reflection of sound waves on the liquid-gas interface, in regimes from hydrodynamical approximation to the Knudsen gas, and proposal for a measurement of condensation coefficient using this effect, i.e. measuring the reflection coefficient of sound waves.
- Physical processes in astrophysics: the structure of magnetic field (lines)

of a point dipole confined by a diamagnetic disc; energy spectrum of hydrogen in strong magnetic field; changing orientation of dipole and spin axes in binary X-ray pulsars; equation of state of hydrogen at high pressures and temperatures; some evolutionary consequences of shock-induced star formation; propagation of relativistic plasma (pulsar) waves: global nonlinear aspects.

- Nonlinear dynamics: demonstrating that the hydrogen atom in strong magnetic field is a generic (mixed type) nonintegrable system, covering all regimes from integrable to fully chaotic; the algebraic quantisation of the Birkhoff-Gustavson normal form; its application to the energy spectrum of hydrogen atom in strong magnetic field.

- Nonlinear dynamics: variety of billiard studies: quadratic conformal map of a unit disc (the so-called Robnik billiard); billiards in magnetic fields; perimeter corrections to the Landau diamagnetism.

- Nonlinear dynamics: quantum chaos: quantum spectrum and its statistical properties and eigenfunctions of the so-called Robnik billiard; studies of semiclassical level spacings distribution in mixed type regime (the so-called Berry-Robnik distribution and statistics was derived); studies of the Aharonov-Bohm billiards with broken antiunitary symmetries; general theory of the relevance of the antiunitary symmetries;

- Mathematical physics: an extremum property of the  $n$ -dimensional sphere: the ground eigenvalue of the  $n$ -dim Laplacian of a volume element of fixed size of the volume is the lowest for the sphere; some properties of nodal cells.

- Nonlinear dynamics of classical nonintegrable Hamiltonian systems: Improved accuracy of the Birkhoff-Gustavson normal form and its convergence properties; On the pade approximations to the Birkhoff-Gustavson normal form.

- Nonlinear dynamics and statistical physics: Energy transport and detailed verification of Fourier heat law in a chain of colliding harmonic oscillators.

- Nonlinear dynamics: quantum chaos: numerical demonstration of the validity of the Berry-Robnik distribution in billiard systems; statistics of matrix elements; analysis of the accuracy of the semiclassical approximations; energy level statistics and localization in sparsed banded random matrix ensemble; on the applicability of the energy level dynamics for the Hamiltonian systems in the transition region between integrability and chaos; series of papers on quantum chaos in mixed-type systems.

- Theoretical physics: the relation between the algebraic complexity, incomputability and chaotic behaviour in dynamical systems.

- Mathematical physics: studies in rigorous WKB theory with the exact explicit solution of the recursion relation to all orders with applications in almost all solvable 1D potentials.

- Nonlinear dynamics: random statistical properties of dynamical systems: How to measure the size of the chaotic components; General Poissonian model of diffusion in chaotic components

- Nonlinear dynamics: quantum chaos: On spectral statistics of classically

integrable systems.

- Mathematical physics and applied mathematics: On Urabe's criteria of isochronicity; On the Green function of linear evolution equations for a region with a boundary.
- Nonlinear dynamics: quantum chaos: Intermediate  $E(k,L)$  statistics in the regime of mixed classical dynamics: high-accuracy confirmation of the Berry-Robnik distribution; systems in mixed type regime: theory and microwave experiments.
- Mathematical physics: Atoms in strong magnetic fields : some new analytic results; two-dimensional hydrogen atom in a strong magnetic field.
- Nonlinear dynamics: quantum chaos: studies of quantum (non)integrability.
- Nonlinear dynamics and mathematical physics: time-dependent linear oscillator (exact theory) and paradigmatic nonlinear oscillators: their statistical properties (of the energy evolution).
- Nonlinear dynamics: quantum chaos: Some generic properties of level spacing distributions of 2D real random matrices.
- Nonlinear dynamics: quantum chaos: Expanded boundary integral method and chaotic time-reversal in quantum billiards.
- Nonlinear dynamics: quantum chaos: Semiempirical theory of level spacing distribution beyond the Berry-Robnik regime : modeling the localization and the tunneling effects.
- Mathematical physics related to the string theories: Gravity trapping on a finite thickness domain wall : an analytic study.
- Nonlinear dynamics: classical chaos: time-dependent dynamical systems, Fermi acceleration and their statistical properties, structures in the phase space and in parameter space, boundary crisis.

## **SELECTION OF MOST IMPORTANT ORIGINAL RESEARCH PAPERS**

BERRY, Michael V., ROBNIK, Marko. Semiclassical level spacing when regular and chaotic orbits coexist. *J. phys. A*, 1984, vol. 17, str. 2413-2421. (516 citations)

ROBNIK, Marko. Hydrogen atom in a strong magnetic field: on the existence of the third integral of motion. *J. phys. A*, 1981, vol. 14, str. 3195-3216. (104 citations)

ROBNIK, Marko. Classical dynamics of a family of billiards with analytic boundaries. *J. phys. A*, 1983, vol. 16, str. 3971-3986. (209 citations)

ROBNIK, Marko. Quantising a generic family of billiards with analytic boundaries. *J. phys. A*, 1984, vol. 17, str. 1049-1074. (157 citations)

BERRY, Michael V., ROBNIK, Marko. Statistics of energy levels without time-reversal symmetry: Aharonov-Bohm chaotic billiards. *J. phys. A*, 1986, vol. 19, str. 649-668. (218 citations)

ROBNIK, Marko, BERRY, Michael V. False time-reversal violation and energy level statistics: the role of anti-unitary symmetry. *J. phys. A*, 1986, vol. 19, str. 669-682. (151 citations)

HASEGAWA, Hiroshi, ROBNIK, Marko, WUNNER, Günter. Classical and quantal chaos in the diamagnetic Kepler problem. *Prog. theor. phys., Suppl.*, 1989, no. 98, str. 198-286. (225 citations)

ROBNIK, Marko, KUNDT, Wolfgang. Hydrogen at high pressures and temperatures. *Astron. astrophys. (Berl.)*, 1983, 120, str. 227-233. (31 citations)

ROBNIK, Marko, ROMANOVSKI, Valery. Some properties of WKB series. *J. phys. A*, 2000, 33, str. 5093-5104. (35 citations)

ROBNIK, Marko, ROMANOVSKI, Valery. Exact analysis of adiabatic invariants in the time-dependent harmonic oscillators. *J. phys. A*, 2006, 39, str. L35-L41. (14 citations)

PROSEN, Tomaž, ROBNIK, Marko. Semiclassical energy level statistics in the transition region between integrability and chaos: transition from Brody-like to Berry-Robnik behaviour. *J. phys. A*, 1994, vol. 27, str. 8059-8077. (127 citations)

PROSEN, Tomaž, ROBNIK, Marko. Intermediate  $E(k,L)$  statistics in the regime of mixed classical dynamics. *J. phys. A*, 1999, 32, str. 1863-1873. (25 citations)

BATISTIĆ, Benjamin, ROBNIK, Marko. Semiempirical theory of level spacing distribution beyond the Berry-Robnik regime : modeling the localization and the tunneling effects. *J. phys., A, Math. theor. (Print)*, 2010, issue 21, vol. 43, str. 215101-1-215101-28, doi: 10.1088/1751-8113/43/21/215101. (18 citation)

ROBNIK, Marko, ROMANOVSKI, Valery. Energy evolution and exact analysis of the adiabatic invariants in time-dependent linear oscillator. V: ROBNIK, Marko (ur.), ROMANOVSKI, Valery (ur.). 7th International Summer School/Conference at the University of Maribor, 29 June - 13 July 2008, Maribor, Slovenia. "Let's face chaos through nonlinear dynamics", (AIP conference proceedings, vol. 1076). Melville: American Institute of Physics, 2008, str. 185-212. (12 citations)

VEBLE, Gregor, ROBNIK, Marko, LIU, Junxian. Study of regular and irregular states in generic systems. Progress of theoretical physics. Supplement, ISSN 0375-9687, 2000, no. 139, str. 421-427. (27 citations)

ROBNIK, Marko, VEBLE, Gregor. On spectral statistics of classically integrable systems. Journal of physics. A, Mathematical and general, ISSN 0305-4470, vol. 31, 1998, str. 4669-4704. (45 citations)

VEBLE, Gregor, PROSEN, Tomaž, ROBNIK, Marko. Expanded boundary integral method and chaotic time-reversal in quantum billiards. New journal of physics, ISSN 1367-2630. [Online ed.], 2007, 9, str.1-17. (24 citations)

GROSSMANN, Siegfried, ROBNIK, Marko. Some generic properties of level spacing distributions of 2D real random matrices. Z. Nat.forsch., A J. phys. sci., 2007, vol. 62a, no. 9, str. 471-482.

PAPAMIKOS, Georgios, ROBNIK, Marko. Statistical properties of 1D time-dependent Hamiltonian systems: from the adiabatic limit to the parametrically kicked systems. J. phys., A, Math. theor. (Print), 2011, vol. 44, str. 315102-1 - 315102-29.

PAPAMIKOS, Georgios, ROBNIK, Marko. WKB approach applied to 1D time-dependent nonlinear Hamiltonian oscillators. J. phys., A, Math. theor. (Print), 2011, vol. 45, no. 1, str. 015206-1 - 015206-11.

MANOS, Thanos, ROBNIK, Marko. Survey on the role of accelerator modes for anomalous diffusion : the case of the standard map. Physical review. E, Statistical, nonlinear and soft matter physics, ISSN 1550-2376. [Online ed.], 2014, vol. 89, iss. 2, str. 022905-1 - 022905-12.

ANDRESAS, Dimitris, BATISTIĆ, Benjamin, ROBNIK, Marko. Statistical properties of one-dimensional parametrically kicked Hamilton systems. Physical review. E, Statistical, nonlinear, and soft matter physics, ISSN 1539-3755, 2014, vol. 89, no. 6, str. 062927-1-062927-14.

BATISTIĆ, Benjamin, MANOS, Thanos, ROBNIK, Marko. The intermediate level statistics in dynamically localized chaotic eigenstates. Europhysics letters, ISSN 0295-5075, 2013, vol. 102, no. 5, str. 50008-1-50008-6.

BATISTIĆ, Benjamin, ROBNIK, Marko. Dynamical localization of chaotic eigenstates in the mixed-type systems: spectral statistics in a billiard system after separation of regular and chaotic eigenstates. Journal of physics. A, Mathematical and theoretical, ISSN 1751-8113, 2013, vol. 46, no. 31, str.

315102-1-315102-17.

MANOS, Thanos, ROBNIK, Marko. Dynamical localization in chaotic systems: spectral statistics and localization measure in the kicked rotator as a paradigm for time-dependent and time-independent systems. Physical review. E, Statistical, nonlinear and soft matter physics, ISSN 1550-2376. [Online ed.], 2013, vol. 87, iss. 6, str. 062905-1 - 062905-17.

BATISTIĆ, Benjamin, ROBNIK, Marko. Quantum localization of chaotic eigenstates and the level spacing distribution. Physical review. E, Statistical, nonlinear and soft matter physics, ISSN 1550-2376. [Online ed.], 2013, vol. 88, no. 5, str. 052913-1 - 052913-7.

GRUBELNIK, Vladimir, LOGAR, Marjan, ROBNIK, Marko. Quantum Fermi acceleration in the resonant gaps of a periodically driven one-dimensional potential box. Journal of physics. A, Mathematical and theoretical, ISSN 1751-8113, 2014, vol. 47, no. 35, str. 355103-355108.

ANDRESAS, Dimitris, ROBNIK, Marko. Statistical properties of the energy in time-dependent homogeneous power law potentials. Journal of physics. A, Mathematical and theoretical, ISSN 1751-8113, 2014, vol. 47, issue 35, str. 355102-1 - 355102-10.

MANOS, Thanos, ROBNIK, Marko. Statistical properties of the localization measure in a finite-dimensional model of the quantum kicked rotator. Physical review. E, Statistical, nonlinear and soft matter physics, ISSN 1550-2376. [Online ed.], 2015, vol. 91, iss. 4, str. 042904-1 - 042904-11.

## ORGANIZER

- **Director of the International Summer Schools/Conferences "Let's Face Chaos through Nonlinear Dynamics"** in Ljubljana (1993 and 1994, and Maribor (1996, 1999, 2002, 2005, 2008, 2011 and 2014).
- **Since 2000 Co-Organizer and Co-Director of European Advanced Studies Conferences, jointly with Professor Tassos Bountis, Patras, and Dr. Andreas Ruffing, TUM Munich** (Bexbach, Germany 2000; Otočec, Slovenia 2001; Trakošćan, Croatia 2002, Novacella, Italy 2003; Patras and Ancient Olympia 2004, Maribor 2005, Novacella, Italy 2006, Homburg, Germany 2007, Maribor 2008, Homburg, Germany 2014).
- **12 - 15 May 2000:** Coorganizer and Local Organizer of the 1st WIGV-Konferenz, CAMTP, University of Maribor, Maribor, Slovenia, together with Professor Dr. Julius Wess, Ludwig Maximilian University, Munich and Max-Planck-Institute for Physics, Munich. (Initiative for the Support of Science in Former Yugoslavia).

- **Since 1999 Co-Organizer and Co-Director of Slovenia-Japan Seminars, jointly with Professor Yoji Aizawa, Waseda University, Tokyo**  
So far 13 meetings: Maribor 1999; Maribor 2002; Tokyo November 2002; Maribor, July 2003; Tokyo and Kyoto November 2003; Maribor July 2005; Novacella, Italy October 2006; Maribor July 2007; Osaka November 2007; Maribor July 2008; University of Tokyo November 2008; Maribor October 2009, Waseda University Tokyo and Osaka Prefecture University 2010, Waseda University Tokyo and Nara Women's University 2014. Typically 3 working days per event and place.
- **Since 2002 Director and Organizer of the Symposia of Physicists at the University of Maribor - Christmas Symposia** (since December 2002 every year in December, 3 working days).
- **Organizer of the SOCRATES Workshops:** II. SOCRATES Workshop at the University of Maribor, CAMTP, September 2004, and IV. SOCRATES Workshop, February 2009.
- **Coordinator of the 1st Out of the Box Conference, *Innovative ways to improve the culture of living***, University of Maribor, Slovenia, 15-18 May 2012, with 30 eminent invited speakers, among them 3 Nobel Prize Laureates.

## MEMBERSHIPS

Member of the European Academy of Sciences and Arts, Salzburg  
 German Physical Society  
 European Physical Society  
 Society of Mathematicians, Physicists and Astronomers of Slovenia  
 Royal Astronomical Society

## HONOURS

- Prešeren Faculty Award for undergraduate research, University of Ljubljana, 1978.
- Recipient of the State Award of the Republic of Slovenia for the Scientific Research Work in Physics (*Državna Nagrada za znanstveno-raziskovalno delo v letu 1997 za vrhunske dosežke na področju fizike*). This is the highest award for scientific work in the Republic of Slovenia (November 1997).
- JSPS Fellowship visiting Professor (Japan Society for the Promotion of Science) at Waseda University in Tokyo, Tokyo Metropolitan University, and Kyoto University (November 1998).
- Member of the European Academy of Sciences and Arts, Salzburg, 9 November 2012.
- 6 September 2014: Leonhard Euler Prize of the International Society of Difference and Differential Equations.



## **PUBLICATIONS**

More than 149 papers, among them 121 original research papers in international journals

More than 3805 citations (Google Scholar), h-index=32, i10-index=66

The most cited paper having more than 516 citations.

Editor and/or Co-Editor of more than 10 volumes (Proceedings of international conferences)

## **INVITED TALKS AT INTERNATIONAL CONFERENCES AND RESEARCH VISITS WITH SEMINAR OR COLLOQUIUM**

More than 100, worldwide, every year about 4 events

## **MEMBER OF EDITORIAL BOARDS OF INTERNATIONAL JOURNALS**

Open Systems and Information Dynamics (OSID)

Nonlinear Phenomena in Complex Systems (NPCS)

Discrete Dynamics in Nature and Society (DDNS)

## **REFeree**

Referee for the variety of international journals: Phys.Rev.Lett., Phys.Rev.A, Phys.Rev.E, J.Phys.A: Math.Theor., Phys.Lett.A, Phys. Scripta, Europhys.Lett., New J. Phys., Nonlinear Phenomena in Complex Systems (Minsk).

## **PhD STUDENTS**

Prof.Dr. Tomaž Prosen, now University of Ljubljana, Slovenia, 1995

Prof.Dr. Gregor Veble, now University of Nova Gorica and Pipistrel, Slovenia, 2001

Dr. Gregor Vidmar, now Institute for Civil Engineering of the Republic of Slovenia, Ljubljana, Slovenia, 2008

Dr. Georgios Papamikos, now University of Kent, England, 2011

Dr. Diego Fregolente Mendes de Oliveira, now University of Indiana, Bloomington, USA, 2012

Dr. Benjamin Batistić, now CAMTP, 2015

Dr. Dimitrios Andreas, now University of Patras, Greece, 2015

## **LANGUAGES**

Slovenian, English, German, Serbian and Croatian, and Russian

**OTHER DETAILS, esp. on CAMTP: <http://www.camtp.uni-mb.si/>**