



## **Eliade Stefanescu**

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**BORN:** May 11, 1947, Nehoiu / Buzau, Romania

**CHARACTERIZATION:** Professional with multidisciplinary openness: electronics, physics and technology of semiconductor devices, physics of open quantum systems with applications to basic phenomena in quantum optics and nuclear physics.

### **SELECTED RESULTS:**

1. Unitary relativistic quantum theory [1].
2. Physical principle for inducing order in nature, and semiconductor device for converting the environmental heat into usable (electric, electromagnetic) energy [2-7].
3. Quantum master equation for a system of Fermions interacting with an electromagnetic field, with analytic coefficients describing transitions stimulated by thermal fluctuations of environmental Fermions, and the non-Markovian dynamics induced by these fluctuations [2, 6].
4. Quantum master equation of a system of Fermions with explicit microscopic coefficients for the coupling to a complex dissipative environment including Fermions, Bosons and a free electromagnetic field [2, 6, 9-11].
5. Quantum master equation with explicit microscopic coefficients for a harmonic oscillator in a free electromagnetic field [8].
6. Expressions of Lindblad's axiomatic coefficients as functions of the environment operators [12, 14].
7. More or less at the same time with other authors, but independently on these authors, I found that dissipation increases the penetrability of a potential barrier [51, 13, 15, 17], in contradiction with what was believed before, namely that dissipation suppresses the tunneling process.
8. The amplification of a coherent electromagnetic beam by coupling through environment of the population with the polarization [18].

**TECHNOLOGICAL DEVELOPMENTS:** semiconductor devices and characterization equipment – high power, high frequency, low noise, rapid commutation, automation.

## SELECTED PUBLICATIONS:

1. E. Stefanescu (2014), The relativistic dynamics as a quantum effect, Journal of Basic and Applied Research International 1, 13-23.  
<http://www.ikpress.org/abstract.php?iid=432&id=42&aid=3576#.VLTTBSvuizh> .
2. E. Stefanescu (2010), Master equation and conversion of environmental heat into coherent electromagnetic energy, Progress in Quantum Electronics 34, 349-408.  
<http://www.sciencedirect.com/science/journal/00796727/34> .
3. LONGITUDINAL QUANTUM HEAT CONVERTER, Inventors: Eliade Stefanescu and Lucien Eugene Cornescu, US 20090007950 (US Patent Office, Jan. 08, 2009),  
<http://www.freepatentsonline.com/y2009/0007950.html> .
4. TRANSVERSAL QUANTUM HEAT CONVERTER, Inventors: Eliade Stefanescu and Lucien Eugene Cornescu, US 20100019618 (US Patent Office, Jan. 28, 2010),  
<http://www.freepatentsonline.com/y2010/0019618.html> .
5. QUANTUM INJECTION SYSTEM, Inventors: Eliade Stefanescu and Lucien Eugene Cornescu, US 20090007951 (US Patent Office, Jan. 08, 2009),  
<http://www.freepatentsonline.com/y2009/0007951.html> .
6. E. Stefanescu, W. Scheid, and A. Sandulescu, Non-Markovian master equation for a system of Fermions interacting with an electromagnetic field, Ann. Phys. 323 (2008) 1168-1190.
7. E. Stefanescu and W. Scheid, Superradiant dissipative tunneling in a double p-i-n semiconductor heterostructure with thermal injection of electrons, Physica A 374 (2007) 203.
8. E. Stefanescu, Dynamics of a Fermi system with resonant dissipation and dynamical detailed balance, Physica A 350/2-4 (2005) 227-244.
9. E. Stefanescu and A. Sandulescu, Dynamics of a Fermi system in a blackbody radiation field, Int. J. Mod. Phys. E 11 (2002) 379.
10. E. Stefanescu, A. Sandulescu, W. Scheid, Microscopic coefficients for the quantum master equation of a Fermi system, Int. J. Mod. Phys. E 11 (2002) 119.
11. E. Stefanescu, A. Sandulescu, W. Scheid, The collisional decay of a Fermi system interacting with a many-mode electromagnetic field, Int. J. Mod. Phys. E 9 (2000) 17.
12. E. Stefanescu, R. Liotta and A. Sandulescu, Giant Resonances as Collective States

- with Dissipative Coupling, Phys. Rev. C. 57 (1998) 798.
13. E.Stefanescu, A. Sandulescu, W. Scheid and W. Greiner, Cold Fission as Cluster Decay with Dissipation, Phys. Rev. C. 53 (1996) 3014.
  14. E. Stefanescu, P. Sterian, Exact quantum master equations for Markoffian systems, Opt.Eng. 35 (1996) 1573.
  15. E.Stefanescu, A. Sandulescu, and W. Greiner, Analytical model for quantum tunneling with dissipation through a fission-like barrier, J. Phys. G: Nucl.Part.Phys. 20 (1994) 811.
  16. A. Isar, A. Sandulescu, H. Scutaru, E. Stefanescu and W. Scheid, Open Quantum Systems, Int. J. Mod. Phys. E 3 (1994) 625-714.
  17. E. Stefanescu, A. Sandulescu and W. Greiner, Quantum Tunneling in Open Systems, Int. J. Mod. Phys. E 2 (1993) 233.
  18. A. Sandulescu, E. Stefanescu, New Optical Equations for the Interaction of a Two-Level Atom with a Single Mode of the Electromagnetic Field, Physica A 161 (1989) 525.

#### **BOOKS/CHAPTERS IN BOOKS:**

19. Eliade Stefanescu (2014), Open Quantum Physics and Environmental Heat Conversion into Usable Energy, Bentham Science Publishers, <http://ebooks.benthamscience.com/book/9781608059867/> .
20. Eliade Stefanescu (2012), Quantum Injection Dots In: Fingerprints in the Optical and Transport Properties of Quantum Dots, INTECH, open access at <http://www.intechopen.com/profiles/105272/Eliade-Stefanescu>
21. E. Stefanescu (2000), Dissipative Systems (in Romanian), The Publishing House of the Romanian Academy (Bucharest).
22. P. Sterian, I. M. Popescu, E. Stefanescu (1988), Optical Bistability, New Dimensions of the Scientific and Technical Revolution (in Romanian), Scientific and Encyclopedic Publishing House (Bucharest).

#### **EDUCATION:**

Master - Physics, Electronic Devices, Electronics (1965-1970)

**Institution:** Polytechnic University of Bucharest

**Department:** Faculty of Electronics and Telecommunications, section of Physicist Engineers

**Advisor:** George Ionescu

**Title of Thesis or Research :** Thickness Measuring System with Beta-Radiation

**Description:** Electronic circuits for pulse formation, numbering, and integration.

## Specialization in Physics and Technology of Semiconductor Devices (1974-1975)

**Institution:** Polytechnic University of Bucharest + Research Institute for Electronic Components

**Department:** Department of Electronic Devices

**Advisor:** Constantin Bulucea

**Title of Thesis or Research :** Problems of Semiconductor Devices

**Description:** Course of lectures on semiconductor devices, with sets of problems, and intermediate and final exams.

## Doctorate - Theoretical Physics: Open Quantum Systems (1989-1991)

- **Institution:** Institute of Atomic Physics, Bucharest
- **Department:** Department of Theoretical Physics
- **Advisor:** Aureliu-Emil Sandulescu
- **Title of Thesis:** Derivation of New Optical Equations for the Interaction of a Two-Level Atom with a Single Mode of the Electromagnetic Field on the Basis of the Theory of Open Quantum Systems (published in Physica A, 1989)
- **Description:** The application of Lindblad's theory of open quantum systems to a two-level atom interacting with a single mode of the electromagnetic field, and comparison of the theoretical results with well-known experimental data. I obtained the interesting effect that, for some values of the atomic detuning, an energy transfer from the dissipative environment to the coherent electromagnetic field arises.

## POSITION:

### Senior Scientist I – the highest scientific degree in Romania (April 2004 - Present)

**Employer Name:** Institute of Mathematics "Simion Stoilow" of the Romanian Academy

**Department:** Center of Advanced Studies in Physics of the Romanian Academy

**Sector:** Academic

**Responsibilities:** Basic research (open quantum systems).

## AWARDS: The Prize of the Romanian Academy for Physics, 1983.

## MEMBERSHIPS:

- **Academy of Romanian Scientists,**
- **German-Romanian Academy,**
- **American Chemical Society – Physical Chemistry Division – Energy Subdivision.**

## EXPERIENCE:

### Senior Scientist I (July 2000 - March 2004)

**Employer Name:** National Institute of Physics and Nuclear Engineering "Horia Hulubei"

**Department:** Department of Theoretical Physics

**Sector:** Academic

**Responsibilities:** Basic research (open quantum systems).

### Senior Scientist I (December 1998 - June 2000)

- **Employer Name:** Institute of Optoelectronics
- **Department:** Optoelectronic Devices
- **Sector:** Academic
- **Responsibilities:** Basic research (open quantum systems).

### Senior Scientist I (January 1997 - November 1998)

- **Employer Name:** National Institute for Research and Development in Microtechnologies (former Research Institute for Electronic Components)

- **Department:** Department of Nanotechnology
  - **Sector:** Academic
  - **Responsibilities:** Basic research (open quantum systems).
- Professor (October 1995 - June 2000)
- **Employer Name:** Polytechnic University of Bucharest
  - **Department:** Photonics
  - **Sector:** Academic
  - **Responsibilities:** Teaching a course of lectures entitled "Dissipative Systems".
- Senior Scientist II (August 1990 - December 1996)
- **Employer Name:** Research Institute for Electronic Components
  - **Department:** Reliability Department
  - **Sector:** Industry
  - **Responsibilities:** Basic research (open quantum systems).
- Senior Scientist III (March 1986 - July 1990)
- **Employer Name:** Research Institute for Electronic Components
  - **Department:** Reliability Department
  - **Sector:** Industry
  - **Responsibilities:** Non-contact characterization of silicon wafers. Basic research in theoretical physics - open quantum systems.
- Senior Scientist III (January 1979 - March 1986)
- **Employer Name:** Research Institute for Electronic Components
  - **Department:** Division of Discrete Semiconductor Devices
  - **Sector:** Industry
  - **Responsibilities:** Research and development of facilities for the dynamic characterization of high frequency, high power transistors; rapid commutation, high power transistors; automation systems with high immunity to electromagnetic perturbations. Basic research of devices for optical communications.
- Scientist (certified) (January 1976 - December 1978)
- **Employer Name:** Research Institute for Electronic Components
  - **Department:** Division of Discrete Semiconductor Devices
  - **Sector:** Industry
  - **Responsibilities:** Research and development of facilities for the dynamic characterization of high frequency, high power transistors; dynamic characterization of rapid commutation, high power transistors.
- Researcher (October 1973 - December 1975)
- **Employer Name:** Research Institute for Electronic Components
  - **Department:** Rating Department of Semiconductor Devices
  - **Sector:** Industry
  - **Responsibilities:** Head of the research and development group for the characterization of the high power devices.
- Researcher (November 1972 - September 1973)
- **Employer Name:** Research Institute for Electronic Components
  - **Department:** Rating Department of Electronics Semiconductor Devices
  - **Sector:** Industry
  - **Responsibilities:** Research and development of electronic systems for measuring the blocking time t-off of high power thyristors.
- Diplomat Engineer (August 1970 - November 1972)
- **Employer Name:** Mounting Chemical Equipment Company, Bucharest
  - **Department:** Development Department
  - **Sector:** Industry
  - **Responsibilities:** Development of defectoscopy techniques with radioactive isotopes.

## OTHER PUBLICATIONS:

23. Eliade Stefanescu, Taking energy from environment, Annals of the Academy of

- Romanian Scientists, Physics Series, 1 (2009) 7-32.
24. Eliade Stefanescu and Aureliu-Emil Sandulescu, Master equation of the matter-field dynamics with energy dissipation, Annals of the Academy of Romanian Scientists, Anniversary volume 1 (2006) 83-104.
  25. Eliade Stefanescu and Aurel Sandulescu, Dissipative dynamics of a system of Fermions, Rom. J. Phys. 52 (2007) 193-215.
  26. Eliade Stefanescu and Aurel Sandulescu, Dynamics of a superradiant dissipative system of electrons tunneling in a micro-cavity, Rom. J. Phys. 50 (2005) 629-638.
  27. E. Stefanescu and A. Sandulescu, Dynamics of a super radiant dissipative system of tunneling electrons, Rom. J. Phys. 49 (2004) 199-207.
  28. E. Stefanescu, Quantum master equation for a system of charged fermions interacting with the electromagnetic field, Rom. J. Phys. 48 (2003) 763-770.
  29. E. Stefanescu and A. Sandulescu, The decay of a Fermi system through particle-particle dissipation, Rom. J. Phys. 47 (2002) 199-219.
  30. E. Stefanescu and A. Sandulescu, Dissipative Processes through Lindblad's Master Equation, Rom. J. of Optoelectronics 7 (2000) 59.
  31. E. Stefanescu, P. Sterian, Open systems of fermions interacting with the electromagnetic field, Rom. J. Opt. 9, (2001) 35-55.
  32. E. Stefanescu, P. Sterian, I. M. Popescu and D. Nicolaescu, The Dynamical Operation of an Optical Bistable Fabry-Perot Resonator, Rev. Roum. Phys. 31 (1989) 397-404.
  33. I. M. Popescu, P. Sterian, A. Podoleanu, E. Stefanescu and V. Vlad, Theoretical and Experimental Aspects of Optical Bistability, Rev. Roum. Phys. 33 (1988) 825-834.
  34. E. Stefanescu, P. Sterian, and Alina Gearba, Spectral Line Broadening in Two-Level Systems with Dissipative Coupling (in Romanian), Romanian Journal of Optoelectronics 6 (1998) 17.
  35. Sterian, P. E.; Stefanescu, E. N.; Popescu, I. M., Operation conditions for the absorptive and dispersive optical bistability (in Romanian), Buletinul Institutului Politehnic Bucuresti, Seria Electrotehnica, Volume: 49, Pages: 29-34, Published: 1987.
  36. I. M. Popescu, E. Stefanescu, and P. Sterian, A Semiclassical Analysis of an Optical Bistable Fabry-Perot Resonator, Rev. Roum. Phys. 31 (1986) 221-235.
  37. E. Stefanescu, P. Sterian, and I. M. Popescu, Time-Dependent Problem Algorithm of

- the Optical Bistability, Rev. Roum. Phys. 31 (1986) 345-350.
38. E. Stefanescu, I. M. Popescu, and P. Sterian, The Semiclassical Approach of the Optical Bistability, Rev. Roum. Phys. 25 (1984) 183-188.
  39. I. M. Popescu, P. Sterian, and E. Stefanescu, Amplification capabilities of the optoelectronic devices realized on the basis of the optical bistability effect (in Romanian), Studii si Cercetari de Fizica Volume: 34, Issue:10, Pages: 905-20, Published: 1982.
  40. I. M. Popescu, E. Stefanescu, and P. Sterian, Bistability analysis in electro-optical Fabry-Perot devices (in Romanian), Buletinul Institutului Politehnic Bucuresti, Seria Electrotehnica, Volume: 44, Issue: 3, Pages: 29-35, Published: July-September 1982.
  41. E. Stefanescu and F. Dimitriu, A measuring method of the blocking time of thyristors (in Romanian), Electrotehnica, Electronica si Automatica, Volume: 23 Issue: 1 Pages: 38-40 Published: March 1979.
  42. E. Stefanescu and A. Angelescu, The influence of the impurity profile on the carrier transit time through the base of a bipolar transistor (in Romanian), Electrotehnica, Electronica, si Automatica (1979).
  43. E. Stefanescu, A. R. Sterian, P. Sterian, Study of the Fermion systems coupled by electric dipole interaction with the free electromagnetic field, Proc. SPIE on the Conference "Advanced Laser Technologies 2004", Rome, Italy (2004), 5850 (Eds. I. A. Scherbakov, A. Giardini, V. I. Konov, V. I. Pustovoy, SPIE Bellingham (USA)), (2005) 160 – 165, ISBN 9780819458476.
  44. E. Stefanescu, P. Sterian and Andreea Sterian, The Lindblad dynamics of a Fermi system in a particle dissipative environment, Proc. SPIE on Int. Conference on Advanced Laser Technologies, Adelboden, Switzerland, Sept. 15-20 (2002) 160-168.
  45. E. Stefanescu, Quantum master equation for a system of charged fermions interacting with the electromagnetic field, Proc. on Nat. Conf. Th. Phys., Sept. 13-16, Bucharest-Magurele, 2002.
  46. E. Stefanescu and P. Sterian, Dynamics of a Fermi System in a Complex Dissipative Environment, Int. Conf. on Advanced Laser Technologies, Constanta, Sept. 11-14, SPIE 4762 (2001) 247-259.
  47. E. Stefanescu and P. Sterian, Optical Equations for an Open System of Fermions, Proc. on 11<sup>th</sup> General Conference of the European Physical Society: "Trends in Physics", London, 6-10 Sept. 1999.

48. E. Stefanescu and P. Sterian, Non-Markovian Effects in Dissipative Systems, FIFTH CONFERENCE ON OPTICS (ROMOPTO '97): PROCEEDINGS OF THE SOCIETY OF PHOTO-OPTICAL INSTRUMENTATION ENGINEERS (SPIE) Volume: 3405, Pages: 877-882, Part 1- 2, Published: 1998.
49. E. Stefanescu, A. Sandulescu, and P. Sterian, Quantum Tunneling through a Dissipative Barrier, Proceedings on Fourth Conference in Optics, SPIE - The International Society for Optical Engineering 2461 (1995) 218.
50. W. Scheid, A. Isar, A. Sandulescu, E. Stefanescu, Application of Lindblad theory to problems of nuclear dissipation, Proc. on Int. Res. Workshop, "Heavy Ion Physics at Low, Intermediate and Relativistic Energies", Poiana Brasov, Romania, 1996 (Eds. M. Petrovici et al., Singapore, 1997) 38 – 51.
51. E. Stefanescu, P. Sterian and Alina Gearba, Absorption Spectra in Dissipative Two-Level System Media, Proc. EPS 10 Trends in Physics - 10<sup>th</sup> General Conference of the European Physical Society, September 9-13, 1996.
52. A. Sandulescu, E. Stefanescu, W. Scheid, and W. Greiner, Neutronless Fission: a New Kind of Nuclear Spectroscopy with Heavy Fragments, Proc. on 5-th International Spring Seminar on Nuclear Physics "New Perspectives in Nuclear Structure" (Ed.: A. Covello), Ravello, Italy, May 22-26, 29 (World Scientific, 1996).
53. A. Sandulescu and E. Stefanescu, Cluster Decay with Dissipation, Istituto per Ricerca di Base, International Workshop, August 8-12, 1995 (N. Tsagas, Chair of Nuclear Physics).
54. E. Stefanescu, E. Halmagean, and A. Sandulescu, Dissipative Effects in Quantum Tunneling, in Quantum Transport in Ultrasmall Devices, NATO-ASI Series, Series B: Physics 342 (Ed.: D. K. Ferry, Kluwer Academic, January 1995), pp. 111-116. (World Scientific, 1995)



- Conf. On "Trends in Quantum Electronics" (Eds.: A. Prokhorov and I. Ursu) SPIE 1033 (1988), 140.
58. I. M. Popescu, E. Stefanescu, and P. Sterian, The Applicability of the Mean-Field Approximation in the Optical Bistability, Proc. on the 2-nd Conf. on "Trends in Quantum Electronics" (Eds: A. Prokhorov and I. Ursu), 173 (Springer Verlag, 1986).
  59. I. M. Popescu, P. Sterian, and E. Stefanescu, The Bistability of a Two-Arm Interferometer Device, Proc. on the Int. Conf. "Laser and Applications" , Bucharest, 329 (Eds: A. Prokhorov and I. Ursu, 1982).
  60. E. Stefanescu, Open Systems of Fermions Interacting with the Electromagnetic Field, Proc. on The 6<sup>th</sup> Symposium of Optoelectronics - SIOEL, Bucharest, Romania, 22-24 Sept. 1999.
  61. E. Stefanescu and A. Sandulescu, Quantum Tunneling with Dissipation, Proc. on the Annual Conference on Semiconductors, 75 (Ed: R. Grigorovici, 1993).
  62. E. Stefanescu and G. Dobrescu, Quantum equations for the interaction of a laser radiation with an assembly of two-level atoms (in Romanian), Proc. on the 4-th National Conf. on Electronics, Telecommunications, Automation and Computers, 329 (Bucharest, 1988).
  63. G. Dobrescu and E. Stefanescu, Self-reflection in an environment of two-level atoms, Proc. on the 4-th National Conf. on Electronics, Telecommunications, Automation and Computers, 335 (Bucharest, 1988).
  64. I. M. Popescu, P. Sterian, E. Stefanescu, A. Podoleanu and M. Dumitru, Optical Bistability Research, Lasers and Applications, 113 (Central Institute of Physics, 1986).
  65. E. Stefanescu, I. M. Popescu, P. Sterian, and P. Cernea, Intrinsic optical bistability in a resonator filled with a system of two-level atoms (in Romanian), Proc. on the Annual Conference on Semiconductors (Ed: C. Bulucea, Sinaia, 1983) 203.
  66. E. Stefanescu, I. M. Popescu, and P. Sterian, Analysis of an optical bistable device with an integrated interferometer (in Romanian), Proc. on the 2-nd National Conference on the Microwave Technique (Ed: G. Rulea, Bucharest, 1981) 469.
  67. P. Sterian, I. M. Popescu and E. Stefanescu, Stability conditions of an optical bistable device with Fabry-Perot cavity (in Romanian), Proc. on the 2-nd National Conference on the Microwave Technique (Ed: G. Rulea, Bucharest, 1981) 459.
  68. E. Stefanescu, P. Sterian and I. M. Popescu, Calculation of the amplification

parameters of an optical bistable device (in Romanian), Proc. on the 2-nd National Conference on the Microwave Technique (Ed: G. Rulea, Bucharest, 1981) 443.

69. I. M. Popescu, P. Sterian and E. Stefanescu, Operation parameters of an optical bistable device (in Romanian), Proc. on the 2-nd National Conference on the Microwave Technique (Ed: G. Rulea, Bucharest, 1981) 425.

#### **PATENTS:**

70. Stefanescu Eliade, Method and for non-contact control of semiconductor devices, Patent 95810 (Romanian Patent Office, June 16, 1988).
71. Stefanescu Eliade, Codreanu Nita, Gozner Stefan, Cernea Petronela, Electronic Circuit for the Resistivity Measurements of Sugar Solutions, Patent 87105 (Romanian Patent Office, Feb 11, 1985).
72. Stefanescu Eliade, Codreanu Nita, Gozner Stefan, Nedelcu Liviu, Fetcu Emilian, Cernea Petronela, Electronic Device for the Automatic Control of the Sugar Solution Resistivity in the Crystallization Process, Patent 86837 (Romanian Patent Office, Jan 12, 1985).
73. Codreanu Nita, Stefanescu Eliade, Gozner Stefan, Electronic Device for the Automatic Control of the Boiling Process in the Sugar Fabrication, Patent 84617 (Romanian Patent Office, Jan 31, 1984).
74. Stefanescu Eliade, Gheorghe Sadacliev, Mono-stable Circuit with Large Scale Temporization Domain, Patent 72650 (Romanian Patent Office, Sept 28, 1979).

#### **VISITING SCIENTIST/PROFESSOR:**

1. Joint Institute of Nuclear Research, Dubna (Soviet Union): Characterization of heavy ions beams (3 months in 1985).
2. Institute of Theoretical Physics of “Justus Liebig” University, Giessen (Germany, Prof. Dr. Werner Scheid): Theory of dissipation and fluctuations in quantum mechanics with applications in atomic and nuclear physics (2 months in 1994).
3. Royal Institute of Technology, Stockholm – Department of Theoretical Nuclear Physics (Prof. Dr. Roberto Liotta): Nuclear giant resonances as collective states with dissipation (2 months in 1995).
4. Royal Institute of Technology, Stockholm – Department of Theoretical Nuclear Physics (Prof. Dr. Roberto Liotta): Application of quantum theory of open systems to nuclear giant resonances (2 months in 1996).
5. Royal Institute of Technology, Stockholm – Department of Theoretical Nuclear Physics (Prof. Dr. Roberto Liotta): Nuclear giant resonances as collective states with

- dissipative coupling (3 months in 1997).
6. Royal Institute of Technology, Stockholm – Department of Theoretical Nuclear Physics (Prof. Dr. Roberto Liotta): Dynamics of Fermi open systems (3 months in 1998).
  7. Institute of Theoretical Physics of “Justus Liebig” University, Giessen (Germany, Prof. Dr. Werner Scheid): Dissipation in nuclear physics (2 weeks in 1998).
  8. Royal Institute of Technology, Stockholm – Department of Theoretical Nuclear Physics (Prof. Dr. Roberto Liotta): Dynamics of open quantum systems of Fermions (1 month in 1998).
  9. Royal Institute of Technology, Stockholm – Department of Theoretical Nuclear Physics (Prof. Dr. Roberto Liotta): Dynamics of an open quantum systems of Fermions (1 month in 2000).
  10. Catholic University in Louvain-La-Neuve, Belgium (Paul de Vadder, on a project with private support): Total dynamic conversion (2 months, 2003).
  11. Institute of Theoretical Physics of “Justus Liebig” University, Giessen (Germany, Prof. Dr. Werner Scheid): Non-Markovian dynamics of open quantum systems (1 month in 2005).
  12. Institute of Theoretical Physics of “Justus Liebig” University, Giessen (Germany, Prof. Dr. Werner Scheid): Non-Markovian dynamics of open quantum systems (1 month in 2006).