

## Curriculum Vitae

### Personal Data:

Name: Tomasz Józef WOJTOWICZ



Nationality: Polish

Marital Status: Married, two children

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OrcidID: [0000-0003-4498-4622](https://orcid.org/0000-0003-4498-4622)

Position: Professor

Deputy Head of the [International Centre for Interfacing Magnetism and Superconductivity with Topological Matter – MagTop \(ON6\)](#).

Head of the Molecular Beam Epitaxy Group (ON6.2).

Languages: Polish, English, Russian.

## Education:

Scientific title of Professor of Physical Sciences conferred by President of Poland, October 2005

Habilitation – Solid State Physics, Institute of Physics, Polish Academy of Sciences, April 2000  
Subject of the habilitation: “Excitonic and polaronic states in three- and two-dimensional structures of  $\text{Cd}_{1-x}\text{Mn}_x\text{Te}$ ”.

Ph.D. – Solid State Physics, Institute of Physics, Polish Academy of Sciences, 1988,  
*thesis awarded* by the Scientific Board of the Institute of Physics, Polish Academy of Sciences. Thesis: “The influence of the exchange interaction on the transport phenomena in  $\text{Hg}_{1-x}\text{Mn}_x\text{Te}$ ”. Professor conferring a degree: Professor R.R. Gałazka

M.Sc. – Physics of Semiconductors, Department of Physics, Warsaw University, 1980,  
*with distinguished diploma, thesis awarded by the Polish Physical Society*.  
Thesis: “Far infrared magneto-optical studies of the narrow gap semiconductors”.  
Supervisor: Professor M. Grynberg.

## Employment history:

2018– present Professor, Deputy Head of International Centre for Interfacing Magnetism and Superconductivity and with Topological Matter – MagTop (ON6) and Head of the Molecular Beam Epitaxy Group (ON6.2) of the Institute of Physics Polish Academy of Sciences, Warsaw, Poland

2017– 2018 Professor, Head of the Molecular Beam Epitaxy Group, representative of the board of the foundation, Research Foundation – MagTop, International Centre for Interfacing Magnetism and Superconductivity with Topological Matter, Warsaw, Poland

2012– 2018 Professor, Deputy Head of the Laboratory of Physics and Growth of Low Dimensional Crystals (SL3) and Head of the Group of Technology of Low Dimensional Structures (SL3.1) of the Institute of Physics Polish Academy of Sciences, Warsaw, Poland

2009– 2011 Professor, Head of the Laboratory of Physics and Growth of Low Dimensional Crystals (SL3) and Head of the Group of Technology of Low Dimensional Structures (SL3.1) of the Institute of Physics Polish Academy of Sciences, Warsaw, Poland

2006– 2009 Professor, Head of SL3.1 Group of Technology of Low Dimensional Structures In the Laboratory of Physics and Growth of Low Dimensional Crystals of the Institute of Physics Polish Academy of Sciences, Warsaw, Poland

2001– 2005 Associate Professor (docent), SL3 Laboratory of the Institute of Physics Polish Academy of Sciences, Warsaw, Poland

April 2001-October 2004

Visiting Research Associate Professor and Senior Fulbright Scholar,  
Department of Physics, University of Notre Dame, Notre Dame, Indiana, USA

1996 – 2003 Head of SL3.1 Group of Physics and Growth of Low Dimensional Semiconducting Crystals in the Laboratory of Physics and Growth of Low Dimensional Crystals of the Institute of Physics Polish Academy of Sciences, Warsaw, Poland

1993 – 2001 Assistant Professor (adiunkt), SL3 Laboratory of the Institute of Physics Polish Academy of Sciences, Warsaw, Poland

1991-1992 Assistant Professor (adiunkt), ON-1 Division of the Institute of Physics, Polish Academy of Sciences, Warsaw, Poland

1988-1991 Post-Doctoral Research Associate, Physics Department, University of Notre Dame, Notre Dame, Indiana, USA

1980-1987 Research Assistant, ON-1 Division of the Institute of Physics, Polish Academy of Sciences, Warsaw, Poland

#### **Research stays abroad (longer than two weeks):**

1984/85 University of Montpellier, France (together 2 months),

1988/90 University of Notre Dame, USA - (36 months long stay),

1994 Heriot-Watt University, Great Britain (1 month),

1996/99 Würzburg University, Germany (four visits, altogether 8 months)

2000/01 Tohoku University, Sendai, Japan – visiting professor (3 months)

2011/13 University of Notre Dame, Notre Dame, Indiana, USA - Visiting Professor (4 months)

2014/2015 Visiting Scientist, Purdue University, West Lafayette, Indiana, USA – recipient of Sabbatical Fellowship of the Foundation for Polish Science (6 months)

#### **Membership of Scientific Councils, Evaluating Panels and Program Committees of International Conferences and Schools:**

1. Member of the Program Committee of the 20th International Conference on Modulated Semiconductor Structures (MSS-20) in 2021
2. Member of the Program Committee of the 50<sup>th</sup> International School and Conference on the Physics of Semiconducting Compounds, „Jaszowiec 2022“
3. Member of the Program Committee of the 19th International Conference on Modulated Semiconductor Structures (MSS-19)
4. Member of the Program Committee of the 11th International Conference on the Physics & Applications of Spin Phenomena in Solids (PASPS XI)

5. Member of the Scientific Council of the Institute of Physics, Polish Academy of Sciences, 2019 – present.
6. Member of the Committee for Independent Scientific Employees of the Scientific Council of the Institute of Physics, Polish Academy of Sciences, 2019 – present.
7. Member of the Scientific Council of the Centre for Advanced Materials and Technologies CEZAMAT, 2015 – present
8. Member of the International Program Committee of the 18th International Conference on II-VI Compounds, San Juan, Puerto Rico, 2017.
9. Member of the Interdisciplinary Panel of Expert for the First Team Programme of the Foudation for Polish Science, Warsaw, Poland, 2017.
10. Member of the Scientific Council of the Institute of Physics, Polish Academy of Sciences, 2006 – 2017.
11. Expert of the Ministry of Science and Higher Education, Member of the panel for evaluation of applications for financing of a purchase or a production of scientific equipment (being a large infrastructure) as well as applications for financing of construction investments serving educational, scientific and R&D institutions in Poland. 2011-2014.
12. Member of the International Program Committee of the 17th International Conference on Modulated Semiconductor Structures, MSS-17, Sendai, Japan, 2015.
13. Member of the Scientific Committee of the 7<sup>th</sup> National Conference on Nanotechnology NANO 2015, Poznań, Poland, 2015.
14. Member of the Scientific Committee of the 6<sup>th</sup> National Conference on Nanotechnology NANO 2013, Szczecin, Poland, 2013.
15. Member of the International Program Committee of the 15<sup>th</sup> International Conference on II-VI Compounds, Mayan Riviera (Mexican Caribbean), Mexico, 2011.
16. Member of the Program Committee of the 40<sup>th</sup> International School and Conference on the Physics of Semiconducting Compounds, „Jaszowiec 2011“, Krynica, Poland, 2011.
17. Member of the Scientific Committee of the 5<sup>th</sup> National Conference on Nanotechnology NANO 2011, Gdańsk, Poland, 2011.
18. Member of the Program Committee of the 39<sup>th</sup> International School and Conference on the Physics of Semiconducting Compounds, „Jaszowiec 2010“, Krynica, Poland, 2010.
19. Member of the International Program Committee of the 14<sup>th</sup> International Conference on II-VI Compounds, St Petersburg, Russia, 2009.
20. Member of the Program Committee of the 38<sup>th</sup> International School and Conference on the Physics of Semiconducting Compounds, „Jaszowiec 2009“, Krynica, Poland , 2009.
21. Member of the Program Committee of the 3<sup>rd</sup> National Conference on Nanotechnology NANO 2009, Warsaw, Poland, 2009.
22. Member of the International Program Committee of the 13<sup>th</sup> International Conference on II-VI Compounds, Seoul, Korea, 2007.
23. Member of the International Program Committee of the 12<sup>th</sup> International Conference on II-VI Compounds, Warsaw, Poland, 2005.
24. Member of the Program Committee of the Electronic Materials Conference, EMC 2004, Notre Dame, USA, 2004.
25. Member of the Program Committee of the XXXII International School on the Physics of Semiconducting Compounds "Jaszowiec 2003", Jaszowiec, Poland, 2003.
26. Member of the Program Committee of the XXXI International School on the Physics of Semiconducting Compounds "Jaszowiec 2002", Jaszowiec, Poland, 2002.

27. Member of the Program Committee of the XXX International School on the Physics of Semiconducting Compounds "Jaszowiec 2001", Jaszowiec, Poland, 2001.

**Graduate students advised:** two graduated dr M. Kutrowski and dr G. Cywinski, one before graduation: Msc. W. Zaleszczyk, current: Msc. Rafał Rudniewski, Msc. Jakub Polaczyński, Msc. Bratłomiej Turowski

**Activity for the promotion of science:** „Nanotechnology day” - lectures and visits to labs in the Institutes of Physics PAS – yearly.

**Scientific Interests:**

Electrical transport (including band and hopping conductivity), localization and weak localization, metal-insulator transition in doped semiconductors.

Band structure, optical and electrical properties of narrow-gap semiconductors, including Hg-based alloys.

Spectroscopy of semiconductor thin layers, superlattices, quantum wells (including graded potential quantum wells – e.g. parabolic), quantum wires and dots.

Band structure, optical, electrical and magnetic properties of diluted magnetic semiconductors: both bulk and low-dimensional structures.

- DX centers
- Photomemory effect (persistent photoconductivity)
- Magnetic polarons
- Spin resonance of bound electrons
- Excitons and charged excitons (trions)
- Influence of free carriers (combined exciton-cyclotron resonances, band gap renormalization) on optical properties of low dimensional system
- Spin engineering

MBE growth of semiconductor nanostructures, including these made of topological materials.

Physics of low-dimensional systems.

Physics of ferromagnetic semiconductors.

Physics of topological matter.

**Main research achievements:**

1. Extensive experimental studies of the “boil-off” effect and giant negative magnetoresistance in p-  $\text{Hg}_{1-x}\text{Mn}_x\text{Te}$  (including its anisotropy in the hopping conductivity regime).
2. Discovery of the magnetic field induced nonmetal-metal transition in novel universality class determined by the giant spin splitting in diluted magnetic semiconductors (DMS).

3. Discovery of photomemory effect in In and Ga doped  $\text{Cd}_{1-x}\text{Mn}_x\text{Te}_{1-y}\text{Se}_y$  bulk crystals and its explanation by the presence of DX centers.
4. First direct measurement of the magnetization of donor bound magnetic polarons in DMS and observation of electric dipole spin resonance allowed by magnetization fluctuations (with the use of photomemory effect).
5. Development of the MBE growth technology of the group II tellurides and diluted magnetic semiconductor quantum structures including:
  - Cubic MnTe, MgTe and  $\text{Mg}_{1-x}\text{Mn}_x\text{Te}$  - nonexistent in the bulk form.
  - Quantum structures made of weakly diluted  $\text{Cd}_{1-x}\text{Mn}_x\text{Te}$  ( $0.7 \leq x \leq 1$ ).
  - Digital alloy quantum well structures.
  - Graded potential quantum wells (parabolic, half-parabolic, and triangular QWs).
  - “Wedge” quantum structure – having precisely controlled profile of the layer thickness in the direction perpendicular to the growth axis.
  - Modulation doped CdTe/CdMgTe and CdMnTe/CdMgTe quantum structures with **world record high mobility of electrons in the wide gap II-VI quantum wells**, approaching  $500\,000\text{ cm}^2/\text{Vs}$ , and revealing fractional quantum Hall effect for the first time in II-VI tellurides, both nonmagnetic ([B. A. Piot, J. Kunc, M. Potemski, D. K. Maude, C. Betthausen, A. Voql, D. Weiss, G. Karczewski, and T. Wojtowicz, Phys. Rev. B \*\*82\*\*, 081307 \(2010\)](#)) and magnetic ([C. Betthausen, P. Giudici, A. Iankilevitc, C. Preis, V. Kolkovsky, M. Wiater, G. Karczewski, B.A. Piot, J. Kunc, M. Potemski, T. Wojtowicz, D. Weiss, Phys. Rev. B \*\*90\*\*, 1153021 \(2014\)](#)).
  - Self assembled CdTe quantum dots on ZnTe substrates (grown via Stranski-Krastanov growth mode), including QDs containing single Mn ions.
  - Nanowires (NWs) and nanowire heterostructures (core-shell and axial, e.g. QDs in NWs) grown by gold assisted vapour-liquid-growth (VLS) mechanism, growth of the **first  $\text{Zn}_{1-x}\text{Mn}_x\text{Te}$  DMS NWs** ([W. Zaleszczyk, E. Janik, A. Presz, P. Dłużewski, S. Kret, W. Szuszkiewicz, J.F. Morhange, E. Dynowska, H. Kirmse, W. Neumann, A. Petrouchik, L.T. Baczewski, G. Karczewski, T. Wojtowicz, Nano Letters \*\*8\*\*, 4061 \(2008\)](#)).
  - Development of MBE technology for the growth of III-Mn-V ferromagnetic semiconductors and their nanostructures, including the first growth of **ferromagnetic  $\text{In}_{1-x}\text{Mn}_x\text{Sb}$**  ([T. Wojtowicz, G. Cywinski, W. L. Lim, X. Liu, M. Dobrowolska, J. K. Furdyna, K. M. Yu, W. Walukiewicz, G. B. Kim, M. Cheon, X. Chen, S. M. Wang, and H. Luo, Applied Physics Letters \*\*82\*\*, 4310 \(2003\)](#)) and **ferromagnetic GaAs/Ga<sub>1-x</sub>Mn<sub>x</sub>As core-shell nanowires** ([A. Rudolph, M. Soda, M. Kiessling, T. Wojtowicz, D. Schuh, W. Wegscheider, J. Zweck, C. Back, E. Reiger, Nano Letters \*\*9\*\*, 3860 \(2009\)](#)).
6. Observation and unambiguous identification of negatively charged excitons  $X^-$  in diluted magnetic semiconductor quantum wells.
7. Demonstration of the various methods of **spin splitting engineering** possible in DMS quantum structures, especially those containing two dimensional electron gas with ultra-high mobility (graded distribution of magnetic component, heating of Mn ions via free carriers, modification of the exchange parameters with the well width, and **the use**

**of electrostatic gates** - [A. Kazakov, G. Simion, Y. Lyanda-Geller, V. Kolkovsky, Z. Adamus, G. Karczewski, T. Wojtowicz, and L.P. Rokhinson, Phys. Rev. B \*\*94\*\*, 075309 \(2016\)](#)).

8. Application of the spin splitting engineering for the studies of g-factor dependence of the evolution of optical properties of quantum well with the increase of 2DEG concentration. First observation of the nonmonotonic dependence of X line intensity vs. magnetic field caused by the reversal of the ordering of electron spin sublevels.
9. Studies of excitons in parabolic quantum wells and determination of the valence band offsets in CdTe/MnTe and CdTe/MgTe systems.
10. Studies of the effect of low temperature annealing on the electrical and magnetic properties of GaMnAs showing that the increase of Curie temperature is related to the rearrangement of Mn atoms in the lattice. Identification of the thermodynamical limit of the free hole concentration and hence the limitation for the Curie temperature (the paper by [K. M. Yu, W. Walukiewicz, T. Wojtowicz, I. Kuryliszyn, X. Liu, Y. Sasaki, and J. K. Furdyna, Physical Review B \*\*65\*\*, 201303\(R\) \(2002\)](#)) **was cited already 500 times**).
11. Studies of the effect of Be co-doping on the magnetic properties of ferromagnetic GaMnAs and identification of the mechanism of the observed decrease of Curie temperature caused by the co-doping.
12. The first studies of the Be modulation doped GaMnAs QWs proving that Mn substitutional incorporation is determined by Fermi energy position during the growth ([T. Wojtowicz, W. L. Lim, X. Liu, M. Dobrowolska, J. K. Furdyna, K. M. Yu, W. Walukiewicz, I. Vurgaftman, and J. R. Meyer, Applied Physics Letters \*\*83\*\*, 4220 \(2003\)](#)).
13. Experimental demonstration, together with the group of Prof. D. Weiss from University of Regensburg, of a **new type of spin transistor** based upon a high mobility two-dimensional electron gas localized inside a CdMnTe quantum well ([C. Betthausen, T. Dollinger, H. Saarikoski, V. Kolkovsky, G. Karczewski, T. Wojtowicz, K. Richter, D. Weiss, Science \*\*337\*\*, 324 \(2012\)](#)). This new and efficient design uses adiabatic spin propagation to protect spin information, along with tunable non-adiabatic Landau-Zener transitions between spin eigenstates for spin-transmission control. In contrast to other spin-transistor designs, this adiabatic spin transistor is quite tolerant against disorder caused by material imperfections. This is a major step toward practical implementation of spin-based semiconductor devices.
14. Clear demonstration of THz radiation from spin-waves excited in DMS via efficient Raman generation process (together with group from Paris: [R. Rungsawang, F. Perez, D. Oustinov, J. Gómez, V. Kolkovsky, G. Karczewski, T. Wojtowicz, J. Madéo, N. Jukam, S. Dhillon, and J. Tignon, Phys. Rev. Lett. \*\*110\*\*, 177203 \(2013\)](#)).
15. Demonstration, together with the group from Dortmund University, of a new method for storing optical information. This method uses a stimulated photon echo, in which the information contained in an optical field (light pulse) is transferred to the electron spin system of the CdTe QW and after a while again radiated in the form of a light pulse that is a copy of the original light pulse. In the "storage" state, information in the form of the quantum excitation of the spin system, isolated from the optical field of the vacuum, can last considerably longer than the optical excitation itself. It has been shown ([L. Langer, S.V. Poltavtsev, I.A. Yuqova, M. Salewski, D.R. Yakovlev, G. Karczewski, T. Wojtowicz, A.V. Akimov, M. Bayer, Nature Photonics \*\*8\*\*, 851 \(2014\)](#)), that the time of the information

storage in this new type of spintronic memory can be extended by more than three orders of magnitude, from the picosecond range up to tens of nanoseconds.

16. Revealing (together with the group from Dortmund University) of the new mechanism of a long range  $p$ - $d$  exchange interaction mediated by elliptically polarized phonons ([V.L. Korenev, M. Salewski, I.A. Akimov, V.F. Sapega, L. Langer, I.V. Kalitukha, J. Debus, R.I. Dzhioev, D.R. Yakovlev, D. Müller, C. Schröder, H. Hövel, G. Karczewski, M. Wiater, T. Wojtowicz, Y. Kusrayev, M. Bayer, Nature Physics 12, 85 \(2016\)](#) ).
17. Demonstration, together with the group from Purdue University in U.S.A., of the feasibility of building of a new platform supporting non-Abelian excitations based on magnetic-2DEG system made of (Cd,Mn)Te QWs ([A. Kazakov, G. Simion, Y. Lyanda-Geller, V. Kolkovsky, Z. Adamus, G. Karczewski, T. Wojtowicz, L.P. Rokhinson, Phys. Rev. Lett. 119, 046803 \(2017\)](#)) and providing theoretical substantiation of the proposal, together with proposition of devices allowing basic operations of topological computer ([G. Simion, A. Kazakov, L.P. Rokhinson, T. Wojtowicz, and Y.B. Lyanda-Gelle, Phys. Rev. B 97, 245107 \(2018\)](#)).
18. Prediction and experimental demonstration, together with the group from Dortmund University, of the new physical phenomena of controlling direction of the light by an in-plane magnetic field, named transverse magnetic routing of light emission –TMRLE, with potentials for applications ([F. Spitzer, A.N. Poddubny, I.A. Akimov, V.F. Sapega, L. Klompmaker, L.E. Kreilkamp, L.V. Litvin, R. Jede, G. Karczewski, M. Wiater, T. Wojtowicz, D.R. Yakovlev, and M. Bayer, Nature Physics 14, 1043 \(2018\)](#)).
19. Experimental demonstration, together with the group from University of Paris VI, of a gate control of the direction and velocity of propagation of spin waves, with potentials for a new type of spin transistor ([F. Perez, F. Baboux, C.A. Ullrich, I. D'Amico, G. Vignale, G. Karczewski, and T. Wojtowicz, Phys. Rev. Lett. 117, 137204 \(2016\)](#)).

## Organisational achievements

- Co-founder (1992-) (with Prof. J. Kossut, then Institute's Deputy Director for Scientific Affairs) and head of the construction and operation of the Laboratory of Molecular Beam Epitaxy (MBE) at the Institute of Physics PAS, currently Laboratory of Growth and Physics of Low Dimensional Crystals. This MBE Laboratory was equipped with the first in Poland, commercial molecular beam epitaxy (MBE) system from American company EPI (currently VEECO). Over the years the Lab has been improved and expanded. This expansion included purchase of the second MBE chamber connected with the first one through UHV, as well as setting a number of experimental set-ups for extensive characterization of produced nanostructures (optical and electrical). Quite recently the Lab has been equipped with a new multi chamber MBE system based on two GENxplor growth chambers from VEECO (one for II-VIs and one for IV-VIs). The laboratory was very successful and for more than 27 years has been producing top quality II-VI nanostructures used for a variety of experiments not only in many scientific institutions in Poland but also all over the world. It suffices to say that over 8500 structures have been grown in the Lab since its creation and the results obtained with the use of these structures have been published in over 600 scientific papers.



- Co-founder (2008-) (with the Laboratory of Cryogenic and Spintronic Research SL2, headed by Prof. T. Dietl) of the Microscopy and Nanolithography Laboratory. This Laboratory was equipped with a new generation ZEISS Auriga cross-beam system having the functionality of high definition electron-beam (EB) and focus ion beam (FIB) lithography, gas injection system (GIS) for in-situ deposition of metals and oxides and Energy Dispersive X-ray (EDX) spectroscopy. Later the Lab was upgraded by installing additional SEM system with the functionality of low temperature cathodoluminescence (CL) and electron beam induced current (EBIC). This Laboratory played a crucial role in the process of developing bottom-up growth technology of nanowires (based on gold catalyst and Vapour-Liquid-Solid mechanism), top-down EBL technology of making wires (such as the first ever made CdTe-based Quantum Point Contact) and making the first devices from PbTe and HgTe/(Hg,Cd)Te layered nanostructures.
- Initiator and Co-founder (2017-) (with dr T. Wojciechowski) of the Institute's Interdivisional Laboratory of Technology of Semiconductor Nanostructures and Devices with Universal Technological Line for Studies of Fabrication Processes of Nanostructures and Prototypes of Semiconductor, Superconductor and Metallic Devices (2013-). This Laboratory is equipped with the two-chamber MBE system, atomic layer deposition system (ALD), ultra high vacuum (UHV) metal deposition system, two reactive ion etching systems (one chlorine based and another fluorine based) and optical lithography.
- Co-founder (with Prof. T. Dietl) (2018-) of the new scientific division of the Institute of Physics, Polish Academy of Sciences: [International Centre for Interfacing Magnetism and Superconductivity with Topological Matter – MagTop \(ON6\)](#)

### Research experience:

Far infrared spectroscopy techniques, including generation, magnetospectroscopy, and far infrared detection.

Magneto-optical methods of the studies of semiconductors, including reflectivity, absorption, PL and PLE.

Deep Level Transient Spectroscopy technique.

Cryogenic techniques (down to mK temperatures -dilution refrigerator) - use and development.

Electrical transport and magnetotransport techniques (*ac* and *dc*), including Hall and resistivity at mK temperatures and for very high resistivity materials (up to  $10^{12} \Omega\text{cm}$ ), specialized contact preparation.

SQUID magnetometry.

General preparation and characterization of semiconductor specimens, including polishing, etching, preparation of ultra thin samples, samples annealing, etc.

Molecular Beam Epitaxy (MBE) technology –use and development.

Growth of advanced quantum structures (“wedge-like” structures, graded quantum wells –e.g. parabolic, high electron mobility structures, self-assembled quantum dots, T-shaped quantum

wires, VLS grown nanowires) – experience with II-VI semiconductors, especially with diluted magnetic semiconductors.

MBE growth of III-V ferromagnetic semiconductors and their nanostructures (QWs, nanowires)

### **Research Grants:**

(listed only those in which served as Principal or Co-Principal Investigator):

2019 – 2021 project MAB/2017/1-AS/1, from the Foundation for Polish Science  
„*Equipment package for the GENxplor MBE system*”  
964 000 € - *Principal Investigator*

2017 – 2023 project MAB/2017/1, from the Foundation for Polish Science  
„*International Centre for Interfacing Magnetism and Superconductivity with Topological Matter*”  
under the programme entitled: “International Research Agendas”, financed with the European Union’s structural funds, with the European Regional Development Fund, under the Smart Growth Operational Programme, Axis IV: Increasing the research potential, measure 4.3. International Research Agendas  
10 500 000 € - *Co-Principal Investigator*

2013 – 2019 project No. DEC-2012/06/A/ST3/00247, from National Centre of Science (Poland)  
„*New generation of quantum nanostructures with ultra high mobility of electrons and unique spin properties: from technology to basic research*”  
715 000 € - *Principal Investigator*

2008 – 2013 project No. POIG.01.01.02-00-008/08, co-financed by EU within European Regional Development Fund, through grant Innovative Economy:  
„*Semiconductor quantum structures for applications in biology and medicine*”  
*Co-Principal Investigator responsible for Task No. 3: “ ZnO/metal Schottky junctions and optimization of their parameters. Development of oxide nanostructures.”*  
1 000 000 € - budget of Task No. 3

2009 – 2011 project No. POIG.02.09.00-00-003/08, co-financed by EU within European Regional Development Fund, through grant Innovative Economy:  
“*National Laboratory of Quantum Technologies*”  
*Co-Principal Investigator, Project coordinator for scientific and technical matters in the Institute of Physics, PAS*  
1 000 000 € - budget of the Institute of Physics,

2007 – 2010 project No. 12/2007 from the Foundation for Polish Science (Program „Master”)  
„*II-VI semiconductor nanowires for nanoelectronics, biology and medicine*”  
150000 \$ - *Principal Investigator*

2006 – 2008 project No. N-507 030 31/0735 from the Ministry of Science and Higher Education, Poland  
„*Technology of catalytic MBE growth of A<sup>II</sup>B<sup>VI</sup> semiconductor nanowires for electronics of the future*”  
110000 \$ - *Principal Investigator*

- 2004 – 2007 project No. INTAS 03-51-5266 from EC  
 „Spin properties of charge carriers confined in II-VI semiconductor nanostructures”  
 12000 € and  
 3900 € support from Poland - *Principal Investigator*
- 1997 – 2000 project No. PBZ 028.11/P8 from the Polish State Committee for Scientific Research,  
 “Two-, one- and zero-dimensional semiconductor heterostructures of group II  
 tellurides and diluted magnetic semiconductors within a perspective of  
 optoelectronics applications”.  
 250000 \$ - *Principal Investigator*
- 1996 – 1998 project No. 8T11B 014 11 from the Polish State Committee for Scientific Research,  
 “Band gap engineering in molecular beam epitaxy grown low dimensional  
 structures made of II-VI semiconductors for optoelectronic applications”.  
 65000 \$ - *Principal Investigator*

Main Investigator and Investigator in many other research projects.

#### **Awards:**

1. Award of the Polish Physical Society for the master degree thesis, 1980.
2. Award of the Director of the Institute of Physics, Polish Academy of Sciences, 1983,  
 for the development of the computer controlled system for studies of transport properties of  
 high resistivity semiconductors (up to  $10^{12} \Omega\text{cm}$ ) at low temperatures and in the presence of  
 high magnetic fields.
3. Award of the Director of the Institute of Physics, Polish Academy of Sciences, 1985,  
 for the studies of “magnetic boil-off” and giant negative magnetoresistance in the hopping  
 conductivity regime in  $p\text{-Hg}_{1-x}\text{Mn}_x\text{Te}$ .
4. Award of the Scientific Secretary of the Polish Academy of Sciences, 1986,  
 for the studies of electrical transport in the regime of weak localization and the discovery of  
 the magnetic field induced metal-insulator transition in the spin polarized universality class.
5. Award of the Scientific Board of the Institute of Physics, Polish Academy of Sciences, 1988,  
 for the Ph.D. thesis.
6. Award of the Director of the Institute of Physics, Polish Academy of Sciences, 1994,  
 for the development of the Molecular Beam Epitaxy method for the growth of quantum  
 structures made of II-VI weakly diluted magnetic semiconductors (based on  $\text{MnTe}$ ).
7. Award of the Director of the Institute of Physics, Polish Academy of Sciences, 1996,  
 for the studies of low dimensional structures made of  $\text{Cd}_{1-x}\text{Mn}_x\text{Te}$  diluted magnetic  
 semiconductor.
8. **Gold Cross of Merit**, awarded by President of Poland in 2003.
9. **Subsidy „Master” from the Foundation for Polish Science**, 2007.
10. **Order Polonia Restituta of fifth class (Knight’s Cross)** for outstanding achievements in the  
 field of science awarded by President of Poland in 2013.

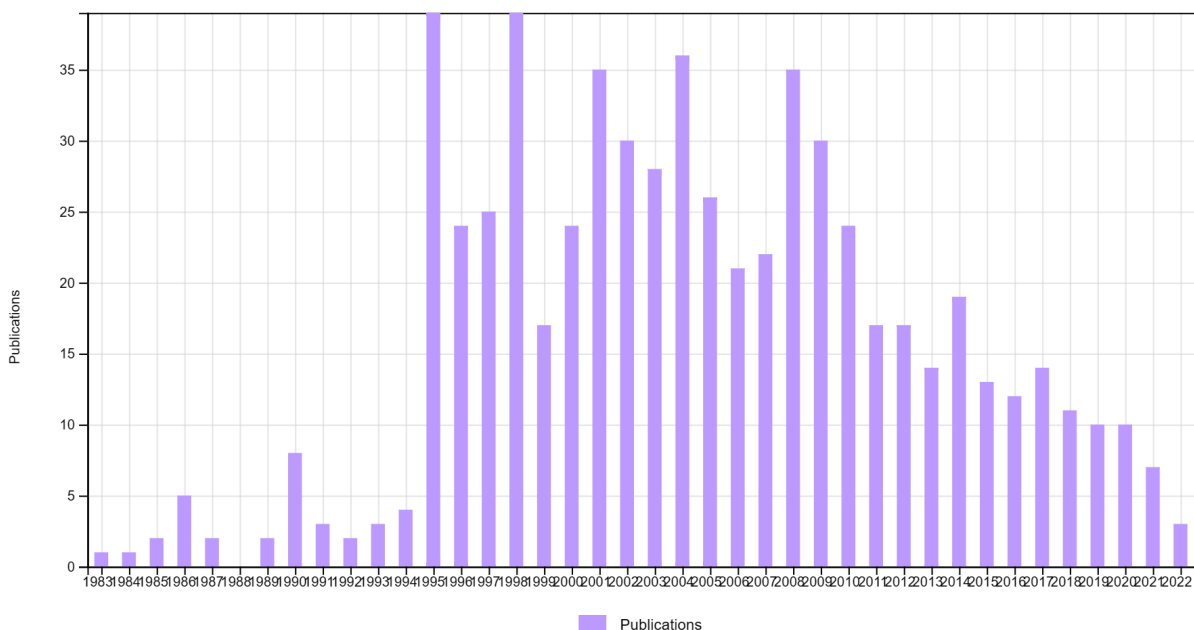
11. [Award of the Minister of Science and Higher Education for the Outstanding Scientific Achievements in the category of basic science, 2013.](#)  
[“for fundamental contributions to development of molecular beam epitaxy and studies of unique quantum structures with programmable spin properties”](#)
12. Sabbatical Fellowship of the Foundation for Polish Science 2014.

## Publications

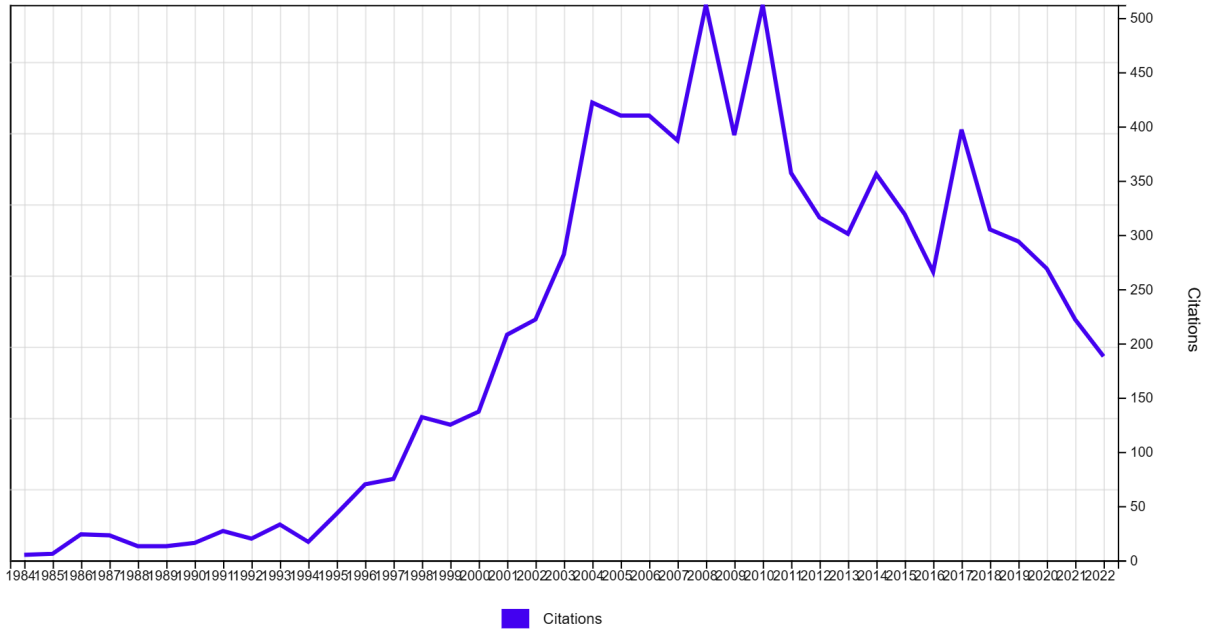
Co-author of chapters in four books (3 from Elsevier, 1 from Springer) and **over 600 published English peer-reviewed research papers** (as of January 3, 2023, according to Web of Science), including: **1 in Science (IF<sub>2021</sub>=63.8)**, **1 in Nature Materials (IF<sub>2021</sub>=47.6)**, **1 in Nature Photonics (IF<sub>2021</sub>=39.7)**, **2 in Nature Physics (IF<sub>2021</sub>=19.7)**, **1 in Physical Review X (IF<sub>2021</sub>=14.4)**, **1 in Nature Communications (IF<sub>2021</sub>=17.7)**, **5 in Nano Letters (IF<sub>2021</sub>=12.3)**, **23 in Physical Review Letters (IF<sub>2021</sub>=9.2)**, **1 in Nanoscale (IF<sub>2021</sub>=8.3)**, **1 in Nanophotonics (IF<sub>2021</sub>=7.9)**, **2 in Grystal Growth & Design (IF<sub>2021</sub>=4.1)**, **114 in Physical Review B (IF<sub>2021</sub>=3.9)**, **10 in Nanotechnology (IF<sub>2021</sub>=3.9)** and **43 in Applied Physics Letters (IF<sub>2021</sub>=3.9)**. Apart from the regular papers co-author of over **350** presentations (poster, oral, invited and plenary) at International Conferences and Schools and published in the form of **“abstract only”**. Co-author of **over 110 invited or plenary talks at International Conferences and Schools**, 55 of which he presented himself (including both published and “abstract only”). In recognition of his contribution to the physics and technology of diluted magnetic semiconductor nanostructures, he was invited to deliver plenary talks at the **18<sup>th</sup> International Conference on Molecular Beam Epitaxy (Flagstaff, 2014)** and at the **Joint 20<sup>th</sup> International Conference on Electronic Properties of Two-Dimensional Systems - EP2DS & 16<sup>th</sup> International Conference on Modulated Semiconductor Structures – MSS (Wrocław, 2013)**, and invited talk at the **34<sup>th</sup> International Conference on the Physics of Semiconductors – ICPS (Montpellier 2018)**.

### Citation report from Web of Science (January 3, 2023)

#### Published Items in Each Year



### Citations in Each Year



### Web of Sciences Categories



Results found: **636**

Sum of the Times Cited: **8 134**

Sum of the Times Cited without self-citatoons: **6 754**

Average Citation per Item: **12.79**

Average Total Citation Rate per year during past two decades (2003-2022): **345/year average**

**H-index: 43**

## Invited and plenary talks at international conferences and schools.

- I-1. *"Acceptor states in Semimagnetic Semiconductors"*,  
T. Wojtowicz,  
Int. Symposium on Semimagnetic Semiconductors, Bad Honnef, Germany (1984) - abstract only - **invited**.
- I-2. *"Semimagnetic Semiconductors near the metal-insulator transition"*,  
T. Dietl, M. Sawicki, T. Wojtowicz, J. Jaroszynski, W. Plesiewicz, and A. Lenard,  
19-th Int. Conf. on Phys. of Semiconductors, Warsaw, Poland, 1988, ed. W. Zawadzki (Institute of Physics  
Polish Academy of Sciences, Warsaw, 1988) p. 1189 (1988) - **invited**.
- I-3. *"Interaction Effects near the Metal-Insulator Transition in Semimagnetic Semiconductors"*,  
T. Dietl, M. Sawicki, T. Wojtowicz, J. Jaroszynski, W. Plesiewicz, L. Swierkowski, and J. Kossut,  
Int. Symposium on Anderson Localization, Tokyo 1988, in: Anderson Localization, ed. T. Ando and H.  
Fukuyama (Springer, Berlin 1988) p. 58 (1988) - **invited**.
- I-4. *"Localization in Diluted Magnetic Semiconductors"*,  
T. Dietl, M. Sawicki, J. Jaroszynski, J. Wrobel, T. Wojtowicz, and A. Lenard,  
Localization and Confinement of Electrons in Semiconductors, ed. F. Kuchar, H. Heinrich and G. Bauer Springer  
Series in Solid State Sciences, Vol 97 (Springer Verlag, Berlin, Heidelberg, 1990) p. 127 (1990) - **invited**.
- I-5. *"Far-infrared magneto-optical studies of HgTe-CdTe superlattices in the semimetallic regime"*,  
T. Wojtowicz, M. Dobrowolska, J. K. Furdyna, J. R. Meyer, F. J. Bartoli, C. A. Hoffman, and L. R. Ram-Mohan,  
Acta Physica Polonica A **80**, 245 (1991)- **invited**.
- I-6. *"Photomemory effect in II-VI Semimagnetic Semiconductors"*,  
T. Wojtowicz,  
German - Polish Symposium on Semimagnetic Semiconductors, Jachranka, (1993) - abstract only - **invited**.
- I-7. *"MBE growth and characterization of layers and low-dimensional structures of II-VI compounds with Mn  
in the SL-3 Laboratory of the Institute of Physics in Warsaw"*,  
T. Wojtowicz,  
2-nd Symposium on Surface and Thin Film Structures, Kazimierz Dolny, Poland, September 14-17 (1994) -  
abstract only - **invited**.
- I-8. *"Spin tracing: a tool of interface characterization in structures with semimagnetic semiconductors"*,  
J. Gaj, P. Kossacki, Nguyen-The-Khoi, J. Cibert, W. Grieshaber, Y. M. D'Aubigne, G. Karczewski, and J. Kossut,  
Proc. SPIE Conf. on Laser and Optoelectronics, San Jose 1995, ed. by M. Razeghi, Y. S. Park, G. L. Witt, Vol.  
2397, p. 105 (1995) - **invited**.
- I-9. *"MBE growth of CdTe:In layers"*,  
G. Karczewski, T. Wojtowicz, and J. Kossut,  
3-rd Symposium on Surface and Thin Film Structures, Spala, Poland (1995)- abstract only - **invited**.
- I-10. *"In situ doping of CdMnTe layers grown by molecular beam epitaxy"*,  
G. Karczewski, T. Wojtowicz, and J. Kossut,  
International School-Conference "Solid State Physics, Fundamentals and Applications", Ukraina (1995)-  
abstract only - **invited**.
- I-11. *"Weakly diluted magnetic CdTe/Cd<sub>1-x</sub>Mn<sub>x</sub>Te semiconductor structures grown by MBE"*,  
T. Wojtowicz, G. Karczewski, and J. Kossut,  
Acta Physica Polonica A **88**, 631 (1995) - **invited**.
- I-12. *"CdTe/CdMnTe diluted magnetic semiconductor structures grown by MBE"*,  
T. Wojtowicz, G. Karczewski, and J. Kossut,  
Polish-Lithuanian Symposium, Warsaw, Poland (1995)- abstract only - **invited**.
- I-13. *"MBE growth and characterization of layers and low-dimensional structures of Diluted Magnetic  
Semiconductors"*,  
T. Wojtowicz,  
Dutch-Polish Colloquium, Nijmegen, The Netherlands, January 26-27 (1995) - abstract only - **invited**.
- I-14. *"Universal conductance fluctuations in submicron wires of Cd<sub>1-x</sub>Mn<sub>x</sub>Te"*,  
T. Dietl, J. Jaroszynski, G. Grabecki, J. Wrobel, M. Sawicki, T. Skoskiewicz, E. Kaminska, A. Piotrowska, G.  
Karczewski, T. Wojtowicz, and J. Kossut,  
Semiconductor Science and Technology **11**, 1618 (1996)- **invited**.

- I-15. *"Doping and characterization of wide-gap II-VI epilayers"*,  
G. Karczewski and T. Wojtowicz,  
Acta Physica Polonica A **90**, 635 (1996)- **invited**.
- I-16. *"Graded low dimensional structures"*,  
T. Wojtowicz,  
Seminar on Technology, Research and Applications of Epitaxially Grown Low Dimensional Structures,  
Bachotek, Poland (1996)- abstract only - **invited**.
- I-17. *"Resonant Polaron Effect of Shallow Indium Donors in CdTe"*,  
M. Grynberg, S. Huant, M. L. Sadowski, G. Martinez, J. Kossut, T. Wojtowicz, G. Karczewski, J. M. Shi, F. M. Peeters, and J. T. Devreese,  
Proc. 7th Int. Conf. on Phys. of Shallow-Level Centres in Semiconductors (Amsterdam 1996), Eds. C. A. J. Ammerlaan and B. Pajot, (World Scientific, Singapore 1997) p. 1 (1997) - **invited**.
- I-18. *"Iodine- and indium-doping of diluted magnetic semiconductors - a comparative study"*,  
G. Karczewski, J. Jaroszynski, M. Kutrowski, A. Barcz, T. Wojtowicz, and J. Kossut,  
Extended abstracts of Japanese-Polish Symposium on Diluted Magnetic Semiconductor, Warsaw, September 1997, p. 86 (1997) - **invited**.
- I-19. *"On the Possibility of Real Exciton Free-Magnetic Polarons in Two-Dimensional Diluted Magnetic Semiconductors"*,  
S. Takeyama, T. Karasawa, G. Karczewski, T. Wojtowicz, and J. Kossut,  
Int. Symposium on Quantum Structure for Photonic Applications, (IMR Workshop, Tohoku University, March 6-9, 1997), in Nonlinear Optics Principles, Materials, Phenomena, and Devices, (Gordon & Breach Science Publishers), Vol 18 (2-4), p. 199 (1997) - **invited**.
- I-20. *"Spatially Graded Diluted Magnetic Semiconductor Quantum Structures"*,  
T. Wojtowicz, M. Kutrowski, G. Cywinski, G. Karczewski, E. Janik, E. Dynowska, J. Kossut, P. Kossacki, R. Fiederling, D. R. Yakovlev, and W. Ossau,  
Extended abstracts of Japanese-Polish Symposium on Diluted Magnetic Semiconductor, Warsaw, September 1997, p. 26 (1997) - **invited**.
- I-21. *"Excitons in novel diluted magnetic semiconductor quantum structures"*,  
T. Wojtowicz, G. Karczewski, and J. Kossut,  
Thin Solid Films **306**, 271 (1997)- **invited**.
- I-22. *"Spin exchange interaction between excitons and magnetic ions in CdTe/Cd(1-x)Mn(x)Te single quantum well structures under high magnetic field and pressure"*,  
H. Yokoi, Y. Kukudate, S. Fujiwara, S. Takeyama, H. Kunimatsu, K. Uchida, T. Schmiedel, S. Tozer, T. Wojtowicz,  
G. Karczewski, and J. Kossut,  
Extended abstracts of Japanese-Polish Symposium on Diluted Magnetic Semiconductor, Warsaw, September 1997, p. 94 (1997) - **invited**.
- I-23. *"Novel II-VI low-dimensional structures with spatial grading"*,  
T. Wojtowicz,  
IV Dutch-Polish Colloquium on Condensed Matter Physics: Low-dimensional systems, mesoscopics and localization, Krakow, Przegorzaly, Poland (1998) - abstract only - **invited**.
- I-24. *"Graded quantum well structures made of diluted magnetic semiconductors"*,  
T. Wojtowicz, M. Kutrowski, G. Karczewski, and J. Kossut,  
Acta Physica Polonica A **94**, 199 (1998) - **invited**.
- I-25. *"Combined exciton-electron processes in modulation doped quantum well structures"*,  
V. Kochereshko, D. R. Yakovlev, T. Wojtowicz, M. Kutrowski, G. Karczewski, J. Kossut, J. Nurnberger, W. Faschinger, M. Keim, A. Waag, W. Ossau, and G. Landwehr,  
Int. Workshop on "Exciton and Carriers in Confined Systems", Obory, Poland (1999) - abstract only - **invited**.
- I-26. *"Negatively Charged excitons in modulation doped graded Cd(1-x)Mn(x)Te/Cd(1-y)Mg(y)Te structures"*,  
M. Kutrowski, T. Wojtowicz, G. Karczewski, J. Kossut, D. R. Yakovlev, W. Ossau, G. Landwehr, V. Kochereshko,  
G. V. Astakhov, F. J. Teran, and M. Potemski,  
Int. Workshop on "Exciton and Carriers in Confined Systems", Obory, Poland (1999) - abstract only - **invited**.
- I-27. *"Photo-induced magnetic polarons in low-dimensional dilute magnetic semiconductors"*,  
S. Takeyama, S. Adachi, Y. Takagi, G. Karczewski, T. Wojtowicz, J. Kossut, and T. Karasawa,  
Materials Science & Engineering B **63**, 111 (1999) - **invited**.

- I-28. *"Formation of negatively charged excitons in high magnetic fields "*,  
P. C. M. Christianen, C. R. L. P. N. Jeukens, F. Pulizzi, W. H. A. Thijssen, J. C. Maan, D. R. Yakovlev, W. Ossau,  
and T. Wojtowicz,  
NATO Advanced Research Workshop on:"Optical Probing of Many Body Effects in Nanostructures",  
Wurzburg, Germany, p. L6 (2000) - abstract only - **invited**.
- I-29. *"Faraday rotation in studies of excitons interacting with 2D carrier gas "*,  
J. Gaj, A. Golnik, P. Kossacki, W. Mac, W. Maslana, J. Cibert, S. Tatarenko, T. Wojtowicz, G. Karczewski, and J.  
Kossut,  
NATO Advanced Research Workshop on:"Optical Probing of Many Body Effects in Nanostructures",  
Wurzburg, Germany, p. L1 (2000) - abstract only - **invited**.
- I-30. *"Faraday rotation in studies of semimagnetic heterostructures with free carriers"*,  
J. Gaj, P. Kossacki, W. Maslana, J. Cibert, S. Tatarenko, and T. Wojtowicz,  
PAS-JSPS, Polish Japanese Seminar on Spin-Related Phenomena in Semiconductors, Sendai, Japan, September  
11-12, 2000, p. 5 (2000) - abstract only - **invited**.
- I-31. *"Cyclotron resonance in 2-dimensional electron systems of diluted magnetic semiconductors"*,  
Y. Imanaka, T. Takamasu, G. Kido, G. Karczewski, T. Wojtowicz, and J. Kossut,  
PAS-JSPS, Polish Japanese Seminar on Spin-Related Phenomena in Semiconductors, Sendai, Japan, September  
11-12, 2000, p. 16 (2000) - abstract only - **invited**.
- I-32. *"Quantum Hall effect in the highly spin-polarized electron system"*,  
J. Jaroszynski, G. Karczewski, T. Andrearczyk, T. Wojtowicz, J. Wrobel, E. Papis, E. Kaminska, A. Piotrowska,  
and T. Dietl,  
Physica B **280**, 378 (2000) - **invited**.
- I-33. *"Dynamics of Charged Excitons in CdTe-based Quantum Wells "*,  
P. Kossacki, V. Ciulin, M. Kutrowski, J. Cibert, S. Tatarenko, S. Haacke, J. D. Ganiere, T. Wojtowicz, B. Deveaud,  
and J. Gaj,  
NATO Advanced Research Workshop on:"Optical Probing of Many Body Effects in Nanostructures",  
Wurzburg, Germany, p. L10 (2000) - abstract only - **invited**.
- I-34. *"Diluted magnetic semiconductor hybrid structures and self-assembled quantum dots "*,  
J. Kossut, K. Fronc, S. Mackowski, G. Karczewski, and T. Wojtowicz,  
Symposium I "Semiconductor Spintronics-Physics, Materials and Applications", Material Research Society  
(MRS) Fall Meeting, Boston, USA (2000) - abstract only - **invited**.
- I-35. *"Optical and electron microscopic studies of CdTe/ZnTe self-assembled quantum dots"*,  
S. Mackowski, G. Karczewski, T. Wojtowicz, A. Szczepanska, S. Kret, P. Dluzewski, J. Kossut, G. Prechtel, and W.  
Heiss,  
PAS-JSPS, Polish Japanese Seminar on Spin-Related Phenomena in Semiconductors, Sendai, Japan, September  
11-12, 2000, p. 17 (2000) - abstract only - **invited**.
- I-36. *"Spin splitting engineering of 2DEG in CdMnTe-based quantum structures"*,  
T. Wojtowicz, M. Kutrowski, G. Karczewski, J. Kossut, B. Konig, A. Keller, D. R. Yakovlev, A. Waag, J. Geurts, W.  
Ossau, G. Landwehr, I. A. Merkulov, G. V. Astakhov, V. Kochereshko, F. J. Teran, and M. Potemski,  
PAS-JSPS, Polish Japanese Seminar on Spin-Related Phenomena in Semiconductors, Sendai, Japan, September  
11-12, 2000, p. 11 (2000) - abstract only - **invited**.
- I-37. *"II-VI quantum structures with tunable electron g-factor"*,  
T. Wojtowicz, M. Kutrowski, G. Karczewski, J. Kossut, B. Konig, A. Keller, D. R. Yakovlev, A. Waag, J. Geurts, W.  
Ossau, G. Landwehr, I. A. Merkulov, F. J. Teran, and M. Potemski,  
Journal of Crystal Growth **214-215**, 378 (2000) - **invited**.
- I-38. *"Formation of negatively charged excitons in high magnetic fields"*,  
C. R. L. P. N. Jeukens, P. C. M. Christianen, J. C. Maan, D. R. Yakovlev, W. Ossau, T. Wojtowicz, G. Karczewski,  
and J. Kossut,  
Proc. XXV Int. Conf. on Physics of Semiconductors, Osaka 2000, Eds. N. Miura and T. Ando, (Springer) Berlin,  
p. 979 (2001) - **invited**.
- I-39. *"Magnetic properties of above-room-temperature ferromagnetic GaSb/Mn digital alloys",,*  
H. Luo, X. Chen, M. Na, M. Cheon, S. Wang, G. B. Kim, B. D. McCombe, X. Liu, F. Sasaki, T. Wojtowicz, J. K.  
Furdyna, S. J. Potashnik, and P. Schiffer, ,



- Proc 2nd Int. Conf. on Physics and Application of Spin Related Phenomena in Semiconductors (2002) - abstract only - **invited**.
- I-40. *Thermodynamic limits to the maximum Curie temperature in GaMnAs*  
W. Walukiewicz, K.M.Yu, T. Wojtowicz, J.K. Furdyna  
2002 MRS Fall Meeting, December 2-5, 2002, Boston, Massachusetts (USA), abstract only - **invited**.
- I-41. *"Optical studies of charged excitons in II-VI semiconductor quantum wells"*,  
P. Kossacki, J. Cibert, V. Ciulin, M. Kutrowski, W. Maslana, S. Tatarenko, D. Ferrand, T. Wojtowicz, B. Deveaud, and J. Gaj, ,  
Proc. XXVI Int. Conf. on Physics of Semiconductors, Edinburgh (2002)- **invited**
- I-42. *"Ferromagnetic III-Mn-V Semiconductors: Manipulation of Magnetic Properties by Annealing, Extrinsic Doping, and Multilayer Design"*  
J. K. Furdyna, S. Lee, T. Wojtowicz, X. Liu, W. L. Lim, I. Kuryliszyn, Y. Sasaki, K. M. Yu, and W. Walukiewicz, ,  
Journal of Korean Physical Society **42 pt. 1**, S579 (2003)- **invited**.
- I-43. *"Coupling of Mn<sup>2+</sup> spins with 2DEG in quantum Hall regime"*,  
F. J. Teran, M. Potemski, D. K. Maude, A. K. Hassan, D. Plantier, J. Jaroszynski, Z. Wilamowski, T. Wojtowicz,  
and G. Karczewski,  
The Int. Conf. on Superlattices, Nano-structures and Nano-device (ICSNN 2002), Toulouse (2002) - Physica E **17**, 335 (2003) - **invited**.
- I-44. *"Novel ferromagnetism in digital GaAs/Mn and GaSb/Mn alloys"*,  
B. D. McCombe, M. Na, X. Chen, M. Cheon, S. Wang, H. Luo, X. Liu, Y. Sasaki, T. Wojtowicz, J. K. Furdyna, S. J. Potashnik, and P. Schiffer,  
Physica E **16**, 90 (2003) - **invited**.
- I-45. *"Electronic Effects in Epitaxial Growth of Ferromagnetic III<sub>1-x</sub>Mn<sub>x</sub>V Alloys"*  
J. K. Furdyna, X. Liu, W. Walukiewicz, T. Wojtowicz, K. M. Yu,  
Lawrence Symposium on "Critical Issues in Epitaxy", Tempe, Arizona, October 2003 – extended abstract - **invited**.
- I-46. *"Quantum Hall ferromagnetism in II-VI based alloys"*  
J. Jaroszyński , T. Andrearczyk, G. Karczewski, J. Wróbel, T. Wojtowicz, E. Papis, E. Kamińska, A. Piotrowska, Dragana Popovic, and T. Dietl,  
11-th Int. Conf. on II-VI Compounds, Niagara Falls, New York, September 22-26, 2003 (USA)  
Phys. Stat. Sol. (b) **241**, 712 (2004) - **invited**.
- I-47. *"Above-room-temperature ferromagnetism in GaSb/Mn digital alloys"*  
H. Luo , G.B. Kim, M. Cheon, X. Chen, S. Wang, B.D. McCombe, Y. Sasaki, X. Liu, T. Wojtowicz, J.K. Furdyna, G. Boishin and L.J. Whitman  
APS March Meeting 2003, March 3-7, 2003, Austin, Texas (USA) - Bull. of American Phys. Soc. Vol. 48. No. 1, 382 (2003) - abstract only - **invited**.
- I-48. *"Ferromagnetic GaSb/Mn and InAs/Mn Digital Alloys"*  
H. Luo , G.B. Kim, M. Cheon, X. Chen, S. Wang, B.D. McCombe, Y. Sasaki, X. Liu, T. Wojtowicz, J.K. Furdyna, G. Boishin and L.J. Whitman  
11-th International Conference on Narrow Gap Semiconductors, NGS-11, June 16-20, 2003, Buffalo, New York (USA) - Physica E **20**, 338 (2004) – **invited**.
- I-49. *"Mechanisms limiting the Curie temperature in GaMnAs"*  
T. Wojtowicz, W.L. Lim, X. Liu, M. Dobrowolska, J. K. Furdyna, K. M. Yu and W. Walukiewicz  
APS March Meeting 2003, March 3-7, 2003, Austin, Texas (USA Bull. of American Phys. Soc. **Vol. 48. No. 1**, 584 (2003) - abstract only – **invited**.
- I-50. *"Mechanisms limiting the Curie temperature in GaMnAs"*  
T. Wojtowicz, W.L. Lim, X. Liu, M. Dobrowolska, and J. K. Furdyna, K. M. Yu and W. Walukiewicz, I. Vurgaftman and J. R. Meyer  
International Conference and School on Semiconductor Spintronics and Quantum Information Technology, Spintech II, August 4-8, 2003, Brugge (Belgium) - abstract only – **invited**.
- I-51. *"Growth and properties of ferromagnetic In(1-x)Mn(x)Sb alloys"*,  
T. Wojtowicz, W. Lim, X. Liu, G. Cywinski, M. Kutrowski, L. V. Titova, K. Yee, M. Dobrowolska, J. K. Furdyna, K. M. Yu, W. Walukiewicz, G. B. Kim, M. Cheon, X. Chen, S. M. Wang, H. Luo, I. Vurgaftman, and J. R. Meyer,

- 11-th International Conference on Narrow Gap Semiconductors, NGS-11, June 16-20, 2003, Buffalo, New York (USA) - Physica E **20**, 325 (2004) – **invited**.
- I-52. *“Electronic effects determining the formation of ferromagnetic  $III_{1-x}Mn_xV$  alloys during epitaxial growth”*, T. Wojtowicz, J. K. Furdyna, X. Liu, K. M. Yu, and W. Walukiewicz, Phys. E **25**, 171 (2004) - **invited**.
- I-53. *“Fermi level effects on Mn incorporation in modulation-doped ferromagnetic  $III_{1-x}Mn_xV$  heterostructures”*, J. K. Furdyna, T. Wojtowicz, X. Liu, K. M. Yu, W. Walukiewicz, I. Vurgaftman and J. R. Meyer, J. Phys. Condens. Matter. **16**, 1 (2004) - **invited**.
- I-54. *“Magnetic anisotropy in ferromagnetic III-Mn-V semiconductors: issues and observations”*, J. K. Furdyna, X. Liu, T. Wojtowicz, W. L. Lim, U. Welp, V. K. Vlasko-Vlasov Adv. Solid State Phys. **44**, 515, Publisher-Springer-Verlag Heidelberg (2004) - **invited**.
- I-55. *“Quantum Hall ferromagnet in magnetically – doped quantum wells”*, J. Jaroszyński, T. Andrearczyk J. Wróbel G. Karczewski, T. Wojtowicz, E. Papis, E. Kamińska, A. Piotrowska, D. Popović, and T. Dietl, Phys. E **22**, 76 (2004) - **invited**.
- I-56. *“Electronic effects in epitaxial growth of ferromagnetic  $III_{1-x}Mn_xV$  alloys”*, T. Wojtowicz, X. Liu, J. K. Furdyna, K. M. Yu, and W. Walukiewicz, Proc.13th Semi-conducting and Insulating Materials Conference (SIMC-XIII-2004), Beijing, China, September 2004, invited, abstract only - **invited**.
- I-57. *“Effect of Mn site location on the magnetic properties of  $III-1-xMn-xV$  semiconductor”*, K. M. Yu, W. Walukiewicz, T. Wojtowicz, J. D. Denlinger, X. Liu, J. K. Furdyna, Proc. 27<sup>th</sup> International Conference on the Physics of Semiconductors July 26-30, 2004 Flagstaff, Arizona, USA, abstract only - **invited**.
- I-58. *“MBE growth and properties of ferromagnetic III-Mn-V alloys”*, T. Wojtowicz, Proc. of The Second Workshop on Physics of Semiconductors, April 24-26, 2005, Lattakia, Syria, abstract only – **invited**.
- I-59. *“II-VI Graded Quantum Well Structures”*, T. Wojtowicz, Proc. of The Second Workshop on Physics of Semiconductors, April 24-26, 2005, Lattakia, Syria, abstract only – **invited**.
- I-60. *“Electronic effects in epitaxial growth of ferromagnetic III-Mn-V alloys”*, T. Wojtowicz, Proc. of Int. Workshop on Spin Phenomena in Reduced Dimensions, March 10-12, 2005, Regensburg, Germany, abstract only – **invited**.
- I-61. *“Peculiarities of the MBE growth and properties of ferromagnetic III-Mn-V alloys”*, T. Wojtowicz, X. Liu, J. K. Furdyna, B. Janko, K. M. Yu, and W. Walukiewicz R. P. Panguluri, B. Nadgorny, M. Csontos and G. Mihály Proc. XXXIV International School on the Physics of Semiconducting Compounds, June 6-10, 2005, Jaszowiec, Poland, abstract only - **invited**.
- I-62. *„Novel nanowire devices”*, T. Wojtowicz, Proc. XXXV International School on the Physics of Semiconducting Compounds Jaszowiec 2006, abstract only - **invited**.
- I-63. *“Growth and properties of II -VI nanowires based on Zn”*, T. Wojtowicz, II Polish – Korean Workshop on Magnetic Semiconductors, Pułtusk, 19-21.07.2006, Poland, abstract only - **invited**.
- I-64. *„Optical probing of spin-dependent interactions in II-VI semiconductor structures”*, J. A. Gaj, J. Cibert, D. Ferrand, A. Golnik, M. Goryca, G. Karczewski, P. Kossacki, J. Kossut, K. Kowalik, O. Krebs, A. Kudelski, M. Kutrowski, A. Lemaitre, W. Maślana, M. Nawrocki, W. Pacuski, P. Płochocka, P. Senellart, S. Tatarenko, P. Voisin, and T. Wojtowicz, Physica Status Solidi B **243**, 906 (2006), - **invited**.

- I-65. „ZnTe-based semiconductor nanowires grown by catalytically enhanced MBE”,  
T. Wojtowicz,  
First Polish-American Symposium: New Low Dimensional Structures of Wide Gap Semiconductors for Spintronics and New Functional Materials, 24-25 Maj 2007 Warsaw, Poland, abstract only - **invited**.
- I-66. „Zn-based semiconductor nanowires for future electronics, biology and medicine”,  
T. Wojtowicz,  
Inter-Academy Meeting on “Nano-science and Nano-technology: risks and benefits for healths and environment”, November 21-23, 2007, Paris, France, abstract only - **invited**.
- I-67. „Catalytic growth by molecular beam epitaxy and properties of ZnTe-based semiconductor nanowires”,  
T. Wojtowicz, E. Janik, W. Zaleszczyk, J. Sadowski, G. Karczewski, P. Dłużewski, S. Kret, W. Szuszkiewicz, E. Dynowska, J. Z. Domagała, M. Aleszkiewicz, L.T. Baczewski, A. Petrouchik, A. Presz, W. Pacuski, A. Golnik, P. Kossaki, J.F. Morhange, H. Kirmse, and W. Caliebe,  
Fifth International Conference on Solid State Crystals & Eight Polish Conference on Crystal Growth, Zakopane, Poland, 20-24 May, 2007, abstract only - **invited**.
- I-68. „Semiconductor nanowires based on zinc”,  
T. Wojtowicz,  
1-st National Conference on Nanotechnology, 26-28 April 2007 r, Wrocław, Poland, abstract only – **invited**.
- I-69. „Zn<sub>1-x</sub>Mn<sub>x</sub>Te-based diluted magnetic semiconductor nanowires grown by catalytically enhanced MBE”,  
T. Wojtowicz,  
Polish-Japanese Joint Seminar on Ferromagnetism and Magnetic Nanostructures in Semiconductors, September 27-28, 2007, Leszno near Warsaw, Poland, abstract only - **invited**.
- I-70. „Kerr rotation and magnetic circular dichroism spectra of ferromagnetic InMnSb and InMnAs”,  
A. Winter, H. Pasher, M. Hofmayer, H. Krenn, T. Wojtowicz, X. Liu, J. Furdyna,  
II-nd Int. Workshop on New Approaches to High Tech: Nano Design, Technology, Computer Simulations”, September 17-21, 2007, Bayreuth, Germany, in: Proceedings of SPAS, Vol. 11, p. 11 (2007) - **invited**.
- I-71. „MBE growth and properties of ZnTe- and CdTe-based nanowires”,  
T. Wojtowicz, E. Janik, W. Zaleszczyk, J. Sadowski, G. Karczewski, P. Dłużewski,  
S. Kret, W. Szuszkiewicz, E. Dynowska, J. Z. Domagała, M. Aleszkiewicz, L.T. Baczewski, A. Petrouchik, A. Presz, W. Pacuski, A. Golnik, P. Kossaki, J.F. Morhange, H. Kirmse, W. Neumann, and W. Caliebe,  
Proc. 13th International Conference on II-VI Compounds, Jeju, Korea, September 10-14, 2007, J. Korean Journal of the Korean Physical Society **53**, 3055 (2008) – **invited**.
- I-72. “Growth and Properties of Telluride Nanowires”,  
T. Wojtowicz,  
Workshop on Recent Advances in Low Dimensional Structures and Devices (WRA-LDSD), April 7-9, 2008, Nottingham, UK - abstract only - **invited**.
- I-73. „II-VI semiconductor nanostructures for nanoelectronics, biology and medicine of the future”,  
T. Wojtowicz,  
2-nd National Conference on Nanotechnology, 24-28 June 2008 r, Kraków, Poland, abstract only – **plenary**.
- I-74. Zn<sub>1-x</sub>Mn<sub>x</sub>Te-based diluted magnetic semiconductor nanowires grown by catalytically enhanced MBE”,  
T. Wojtowicz,  
Int. Workshop on Spin Phenomena in Reduced Dimensions, September 24-27, 2008, Regensburg, Germany - abstract only – **invited**.
- I-75. “Raman spectroscopy of MBE-grown, ZnTe-based nanowires”,  
W. Szuszkiewicz, J.F. Morhange, E. Janik, W. Zaleszczyk, G. Karczewski, T. Wojtowicz,  
VI International School-Conference on Semiconductor Physics, September 23-26, 2008, Drohobych, Ukraine – abstract only – **invited**.
- I-76. “Raman spectroscopy of ZnTe-based nanowires grown by MBE”,  
W. Szuszkiewicz, J.F. Morhange, E. Janik, W. Zaleszczyk, G. Karczewski, T. Wojtowicz,  
2008 E-MRS Fall Meeting, September 15-19, 2008, Warsaw, Poland – **invited**.
- I-77. “Development of oxide nanostructures”,  
T. Wojtowicz,  
1-st Conference on Quantum Semiconductor Nanostructures for Biology and Medicine Applications, February 3-4, 2009, Warsaw, Poland – **invited**.

- I-78. *"MBE Growth and Properties of Telluride Nanostructures"*,  
T. Wojtowicz,  
 15th European Molecular Beam Epitaxy Workshop, March 8-11, 2009, Zakopane, Poland - **invited**.
- I-79. *„Nanowires and 2D modulation doped nanostructures based on tellurides”*,  
T. Wojtowicz,  
 E-MRS Fall Meeting, September 14 - 18, 2009, Warsaw University of Technology, Warsaw, Poland - **invited**.
- I-80. *„II-VI semiconductor nanostructures for nanoelectronics, biology and medicine of the future”*,  
*„Nanostruktury bazujące na związkach półprzewodnikowych All-BVI dla potrzeb nanoelektroniki, biologii i medycyny przyszłości”*,  
T. Wojtowicz,  
 XL Meeting of the Polish Physical Society, September 6-11 2009, Kraków, Poland - **invited**.
- I-81. *„Self-assembled epitaxial quantum dots formed by phase separation”*,  
 G. Springholz, T. Schwarzl, S. Kriechbaumer, H. Groiss, A. Hochreiner, W. Heiss, F. Schaffler,  
 E. Kaufmann, S. Pichler, T. Wojtowicz, K. Koike, T. Hotei, H. Harada, and M. Yano,  
 SemiconNano 2009, August 9 – 14, 2009, Anan., Tokushima, Japan - **invited**.
- I-82. *„Excitons in motion in II-VI semiconductors”*,  
 J. J. Davies, L. C. Smith, D. Wolverson, V. P. Kochereshko, H. Boukari, J. Cibert, H. Mariette, M. Wiater, G.  
 Karczewski, and T. Wojtowicz,  
 14th International Conference on II-VI Compounds, August 24 - 28, 2009, St. Petersburg, Russia - **invited**.
- I-83. *"Development of oxide nanostructures"*,  
T. Wojtowicz,  
 2-nd Conference on Quantum Semiconductor Nanostructures for Biology and Medicine Applications, April 13-  
 14, 2010, Warsaw, Poland – **invited**.
- I-84. *"A novel synthesis method for fabrication of self-assembled quantum dots based on phase separation"*,  
 G. Springholz, A. Hochreiner, T. Schwarzl, S. Kriechbaumer, H. Groiss, E. Kaufmann, S. Pichler, W. Heiss, F.  
 Schäffler, T. Wojtowicz, K. Koike, T. Hotei, H. Harada, and M. Yano,  
 Villa Conference on Interactions Among Nanostructures (VCIAN), June 21-25, 2010, Santorini, Grece - **invited**.
- I-85. *"Widely tunable mid-infrared photoluminescence from epitaxial PbTe quantum dots embedded in a CdTe matrix"*,  
 A. Hochreiner, T. Schwarzl, S. Kriechbaumer, M. Eibelhuber, H. Groiss, V. Kolkovsky, G. Karczewski, T.  
Wojtowicz, W. Heiss, G. Bauer, and G. Springholz,  
 30th International Conference on the Physics of Semiconductors, July 25-30, 2010, Seul, South Korea -  
**invited**.
- I-86. *„Lead salt microdisk lasers”*,  
 G. Springholz, M. Eibelhuber, A. Hochreiner, T. Schwarzl, H. Groiss, T. Wojtowicz, and W. Heiss,  
 15<sup>th</sup> International Conference on Narrow Gap Semiconductors (NGS15), Virginia, USA, August 1 - 5, 2011-  
**invited**.
- I-87. *„Epitaxial IV-VI quantum dots for mid-infrared devices”*,  
 T. Schwarzl, M. Eibelhuber, A. Hochreiner, H. Groiss, V. Kolkovsky, G. Karczewski, T. Wojtowicz, W. Heiss and  
 G. Springholz,  
 XIII International Conference on Physics and Technology of Thin Films and Nanostructures (ICPTFN-XIII),  
 Ivano-Frankivsk, Ukraine, May 16 – 21, 2011- **invited**.
- I-88. *„MBE growth of IV-VI quantum dots for MIR devices”*,  
 M. Eibelhuber, A. Hochreiner, T. Schwarzl, H. Groiss, W. Heiss, G. Springholz, V. Kolkovsky,  
 G. Karczewski, and T. Wojtowicz,  
 16<sup>th</sup> European Molecular Beam Epitaxy Workshop (Euro-MBE 2011), L’Alpe d’Huez, France, March 20 - 23,  
 2011- **invited**.
- I-89. *„First mid-infrared quantum dot lasers emitting at wavelengths beyond 3  $\mu\text{m}$ ”*,  
 G. Springholz, M. Eibelhuber, A. Hochreiner, M. Witzam, T. Schwarzl, H. Groiss, W. Heiss, and  
T. Wojtowicz,  
 The 15th Conference on Modulated Semiconductor Structures (MSS 15), July 25 -29, 2011, Tallahassee, FL,  
 USA - **invited**.
- I-90. *„High quality 2D electron gas in CdTe quantum wells for the physics of the quantum Hall effect”*,  
 B. A. Piot, J. Kunc, K. Kowalik, F. J. Teran, P. Płochocka, D. K. Maude, M. Potemski, C. Betthausen, A. Vogl, D.

- Weiss, G. Karczewski, and T. Wojtowicz,  
15th International Conference on II-VI Compounds, Mayan Riviera, Mexico, August 21-26, 2011- **invited**.
- I-91. „*High mobility CdTe and CdMnTe based 2 DEG nanostructures: from technology to applications in basic research and applied science*”,  
T. Wojtowicz,  
Joint Polish-Japanese Workshop on Spintronics - from New Materials to Applications, November 15-18, 2011, Warsaw, Poland- abstrakt only - **invited**.
- I-92. “*Terahertz radiation from spin coherence in diluted magnetic semiconductors*”,  
R. Rungsawang, F. Perez, D. Oustinov, J. Gomez, V. Kolkovsky, G. Karczewski, T. Wojtowicz, J. Madéo, N. Jukam, S. S. Dhillon, and J. Mignon,  
37th International Conference on Infrared, Millimeter and Terahertz Waves (IRMMW-THz), Wollongong, Australia, September 23-28, 2012 - **invited**.
- I-93. “*Detection and generation of THz radiation with the use of quantum nanostructures*”,  
T. Wojtowicz,  
4-th Conference on Quantum Semiconductor Nanostructures for Biology and Medicine Applications, April 18-19, 2012, Warsaw, Poland - abstrakt only – **invited**.
- I-94. “*(Cd,Mn)Te-based quantum structures with ultra-high mobility 2D electron gas: from technology to basic and applied research*”,  
T. Wojtowicz,  
42<sup>nd</sup> “Jaszowiec” International School and Conference on Physics of Semiconductors, Wisła, Poland, June 26-27, 2013, abstract only - **invited**.
- I-95. “[II-VI Diluted Magnetic Semiconductor Nanostructures for Spintronic Research](#)”,  
T. Wojtowicz,  
[Joint 20th International Conference on Electronic Properties of Two-Dimensional Systems - EP2DS & 16th International Conference on Modulated Semiconductor Structures - MSS, Wrocław, Poland, July 1-5, 2013 – abstrakt only – plenary.](#)
- I-96. “*Giant spin splitting in ZnMnTe/ZnTgTe core/shell nanowires*”,  
P. Wojnar, E. Janik, J. Suffczyński, J. Papierska, M. Szymura, W. Zaleszczyk, S. Kret, Ł. Kłopotowski, T. Wojciechowski, L. T. Baczewski, G. Karczewski, T. Wojtowicz, and J. Kossut,  
The 16th International Conference on II-VI Compounds and Related Materials, September 9 – 13, 2013, Nagahama, Japan, p. 15. – **invited**.
- I-97. “*Spintronic research with (Cd,Mn)Te-based diluted magnetic semiconductor quantum structures*”,  
T. Wojtowicz,  
The European Conference on Physics of Magnetism, 23-27 June, 2014, Poznań, Poland – **invited**..
- I-98. “*Magnetic-field tunable THz detectors based on GaAs/AlGaAs and CdTe/CdMgTe quantum wells*”,  
J. Łusakowski; M. Białek; I. Grigelionis; Z. Adamus; J. Wróbel; V. Umansky; G. Karczewski; T. Wojtowicz; M. Grynberg  
Terahertz Emitters, Receivers, and Applications V, August 17-18, 2014, San Diego, USA – **invited**.
- I-99. “[MBE-Grown II-VI Diluted Magnetic Semiconductor Nanostructures for Spintronic Research](#)”,  
T. Wojtowicz,  
[18th International Conference on Molecular Beam Epitaxy, 7-12 September, 2014, Flagstaff, Arizona, USA, – abstrakt only – plenary.](#)
- I-100. “*Optically active nanowires and two-dimensional electron gas in II-VI semiconducting compounds for sensor applications*”,  
T. Wojtowicz,  
6-th Conference on Quantum Semiconductor Nanostructures for Biology and Medicine Applications, May 7-8, 2014, Warsaw, Poland – **invited**..
- I-101. “*Spin engineering in diluted magnetic semiconductor nanostructures*”,  
T. Wojtowicz,  
International Conference "Spin physics, chemistry and technology", 1-5 June, 2015, Saint Petersburg, Russia – abstrakt only – **invited**.
- I-102. “*Advances and perspectives in II-VI telluride heterostructures*”,  
T. Wojtowicz,

- 17th International Conference on II-VI Compounds, 13 - 18 September, 2015, Paris, France – abstrakt only – **invited**.
- I-103. "*Semiconductor Quantum Structures with Programable Spin Properties – from Technology to Basic and Applied Research*",  
T. Wojtowicz,  
43-rd Meeting of the Polish Physicist, Kielce, Poland, 6-11 September, 2015, (Polish Physical Society) – **plenary**.
- I-104. "*The State of the Art in (Cd,Mn)Te Heterostructures: Fundamentals and Applications*",  
T. Wojtowicz,  
APS March Meeting, Baltimore, USA, March 14-18, 2016 (American Physical Society) – **invited**.
- I-105. "*Spin splitting enhancement in ZnMnTe diluted magnetic nanowires*",  
P. Wojnar, M. Szymura, W. Zaleszczyk, S. Kret, Ł. Kłopotowski, J. Suffczyński, J. Papierska, P. Kossacki, T. Wojciechowski, L.T. Baczewski, E. Janik, G. Karczewski, T. Wojtowicz, and J. Kossut,  
EMN Meeting on Nanowires, 16-19 May 2016, Amsterdam, Netherlands – **invited**.
- I-106. "*The state of the art in MBE growth of telluride nanostructures*",  
T. Wojtowicz,  
International Conference on Semiconductor Nanostructures for Optoelectronics and Biosensors, Rzeszów, Poland, May 22-25, 2016 – **plenary**.
- I-107. "*Spin-orbit twisted spin waves in magnetic quantum wells*",  
F. Perez, F. Baboux, C. Ullrich, I. D'Amico, G. Vignale, T. Wojtowicz, and G. Karczewski  
APS March Meeting, Los Angeles, USA March 5-9, 2018 (American Physical Society) – **invited**.
- I-108. "*Formation of helical channels in quantum Hall effect regime*"  
A. Kazakov, G. Simion, V. Kolkovsky, Z. Adamus, G. Karczewski, T. Wojtowicz, Y. Lyanda-Geller, L.P. Rokhinson  
47th „Jaszowiec” International School and Conference on the Physics of Semiconductors, Szczyrk, Polska, 16-22 June, 2018– **invited**.
- I-109. "*High mobility 2DEG in magnetic semiconductor structures: fundamentals and applications*",  
T. Wojtowicz,  
34th Int. Conf. on the Phys. of Semicond., 29th July - 3rd August 2018, Montpellier, France – **invited**.
- I-110. "*Coherent optical spectroscopy of charged exciton complexes in semiconductor nanostructures*",  
I. A. Akimov, S. V. Poltavtsev, M. Salewski, I. A. Yugova, G. Karczewski, M. Wiater, T. Wojtowicz, M. Reichelt, T. Meier, D. R. Yakovlev, M. Bayer  
Ultrafast Phenomena and Nanophotonics XXII, January 29 – 31, 2018, San Francisco, USA – **invited**.
- I-111. "*Capabilities of the Institute of Physics in the area of growth, nanostructurization and characterization of topological materials*",  
T. Wojtowicz,  
Workshop – topological matter meets entrepreneurs, 18 October, 2019, Warsaw, Poland – **invited**.
- I-112. "*Developing, Understanding and Functionalizing Topological Materials at MagTop*",  
T. Wojtowicz, T. Story, A. Wiśniewski, T. Dietl,  
French-Polish Science & Technology Meeting, 15-16 October, 2019, Warsaw, Poland – **invited**.

Warsaw, January 3, 2023