TOMASZ PRZEBINDA

Contents

1. Curriculum Vitae

Personal Data:

Date and place of birth: May 11 1956; Kalisz (Poland).
Nationality (citizenship): USA and Poland
Marital status: married; three grownup children, born in 1980, 1985 and 1990.

Occupation:

Professor of Mathematics, University of Oklahoma, Norman, Oklahoma, USA

Business Address:

Department of Mathematics
University of Oklahoma
Norman, OK 73019, USA
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Home Address:

1325 Beverly Hills
Norman, OK 73072, USA
Phone: +1 405 3666497

Native Language: Polish.

Foreign Languages: English, German, Russian.

Professional Preparation:

1974 : High school diploma, Liceum Mikołaja Kopernika, Kalisz, Poland.
1974 : Admission to study Electrical Engineering at Wrocław Technical University, Wrocław, Poland, based on a competitive entrance exam, seven candidates per one place.
1977 : Transferred to study Basic Problems of Technology at Wrocław Technical University, Wrocław, Poland.

Date: December 22, 2016.

1980 : Graduated with a Masters of Science from the Department of Basic Problems of Technology at Wrocław Technical University, Wrocław, Poland. Specialization, Quantum Chemistry.

1980 : Admitted to the Ph.D. Program in Mathematics at the State University of New York at Albany, USA.

1982 : Transferred to the Ph.D. Program in Mathematics at Yale University, New Haven, CT, USA.

1987 : Received Ph.D. in Mathematics at Yale University, New Haven, CT, USA. *Ph.D. dissertation:* The Oscillator Duality Correspondence for the pair $(\mathrm{O}_{2,2}, \mathrm{Sp}_4(\mathrm{R}))$.
Ph.D. Advisor: Roger Howe.
Ph.D. Committee: Roger Howe, Gregg Zuckerman, David Collingwood.

2014 : Title of Professor of Mathematics given by president of Poland.

Employment:

1980 -1982 : Teaching Assistant, State University of New York at Albany, USA.

1980 -1982 : Teaching Assistant, Yale University, New Haven, CT, USA.

1986-1989 : Instructor (Postdoc), University of Utah, Salt Lake City, Utah, USA.

1989 -1990 : Assistant Professor (tenure track), Louisiana State University, Baton Rouge, LA, USA.

1990 -1993 : Assistant Professor (tenure track), University of Oklahoma, Norman, OK, USA.

1993 -1999 : Associate Professor (with tenure), University of Oklahoma, Norman, OK, USA.

1999 -present : Professor (with tenure), University of Oklahoma, Norman, OK, USA.

Fall 1996 : Visiting Professor, University of Ottawa, Canada.

June 2003 : Visiting Professor, Université de Poitiers, France.

June 2009 : Visiting Professor, Université Paul Verlaine - Metz, France.

June 2010 : Visiting Professor, Université Paul Verlaine - Metz, France.

Fall 2010 : Visiting Professor, University of Wrocław, Wrocław, Poland.

June 2012 : Visiting Professor, Université de Lorraine - Metz, France.

July 2012 : Visiting Professor, University of Wrocław, Wrocław, Poland.

June 2016 : Visiting Professor, Université de Lorraine - Metz, France.

Leaves:

August 1990 - December 1991 : Unpaid leave from Louisiana State University,

August 1996 - December 1996 : Sabbatical leave,

August 2003 - December 2003 : Sabbatical leave,

August 2010 - December 2010 : Sabbatical leave,

2. Research

2.1. **Research Areas.** Representation Theory of Reductive Groups. Classical Harmonic Analysis with applications to Signal Processing. Harmonic Analysis on Symmetric Spaces. Probability Theory on Groups.

2.2. **Funding.** .

Federal Research Grants (USA):

1987-1990 : Postdoctoral Associate, jointly with J. Taylor and H. Hecht at the University of Utah, NSF Grant DMS–8802827.

1990-1992 : Single Principal Investigator at the University of Oklahoma, NSF Grant DMS–9000938.

1992-1995 : Single Principal Investigator at the University of Oklahoma, NSF Grant DMS–9204488.

1996-1998 : Single Principal Investigator at the University of Oklahoma, NSF Grant DMS–9622610.

1996-1998 : Single Principal Investigator at the University of Oklahoma, NSA Grant MDA–9049610023.

2002-2006 : Single Principal Investigator at the University of Oklahoma, NSF Grant DMS–0200724.

2013-2015 : Single Principal Investigator at the University of Oklahoma, NSA Grant H98230-13-1-0205.

International Research Grant:

1996-1998 : NATO Grant OUTR.LG951526, jointly with A. Daszkiewicz and W. Kraśkiewicz, M. Copernicus University, Toruń, Poland.

Teaching/Research Grants:

1994-1995 : Co-Principal Investigator at the University of Oklahoma, Research Experience for Undergraduates, NSF Grant DMS–9424172.

1995-1997 : Co-Principal Investigator at the University of Oklahoma, Research Experience for Undergraduates, NSF Grant DMS–9400754.

Internal Grant at the University of Oklahoma:

1997 : Equipment/Facilities Program ($ 10,760).

2.3. **Research Activities.**

Howe's Correspondence

Howe's correspondence or local θ-correspondence, is a theory which overlaps with various branches of mathematics, such as representation theory of Lie groups, the theory of automorphic forms, number theory, invariant theory, the theory of pseudo differential operators and quantum mechanics. My interest and contributions are in the representation theory of Real reductive groups.

The classical groups are organized in pairs, called dual pairs $(\mathrm{G}, \mathrm{G}')$, and are lifted into large metaplectic groups. The Weil representation restricts to such pairs and leads to a bijective correspondence $\Pi \leftrightarrow \Pi'$ of irreducible admissible representations. Each of them has an infinitesimal character and the correspondence of the infinitesimal characters, which governs the bijection in general, was computed in [7].

In contrast to the standard approach via Langlands' parameters, the correspondence is a convenient tool for constructing unitary representations with small Gelfand-Kirillov dimension. In fact, as shown in [6], for a given pair there is a bound on the wave front set of the representations that can occur. Also, in [6] there is a generalization and a simplification of a very influential result of Jian-Shu Li saying that the correspondence preserves unitary for dual pairs in the stable range. Neither of the two approaches covers a similar statement for the dual pair $(\mathrm{O}_{2,2}, \mathrm{Sp}_4(\mathbb{R}))$ proven in [3].

The wave front set of a representation and the associated variety of the primitive ideal of a representation are much finer invariants than the Gelfand-Kirillov dimension. The correspondence of associated varieties of the primitive ideals was studied in a reasonable generality in [6]. However at that time there were not enough tools available to handle the wave front set correspondence. The appropriate approach was created in [15] and further developed in [29], [30], [31] and [32]. At the same time Schmid and Vilonen proved a conjecture of Barbasch and Vogan saying that the wave front set of a representation corresponds to its associated variety via the Sekiguchi correspondence. Three years ago, Loke and Ma computed the correspondence of the associated varieties, which does not solve the problem of the wave front set correspondence because Schmid and Vilonen deal with matrix groups only. Independently, the problem of the wave front set correspondence was

solved in the stable range in [42], by showing that the construction in [15] does indeed provide distribution characters. All these invariants have been computed in [5] for the unitary highest weight representations - a result rediscovered partially later by Kyo, Ochiai, Taniguchi, Yamashita, and Kato (Astérisque, 2001) and Enright and Willenbring (Annals of Math., 2004).

The correspondence of the associated varieties and the wave front sets is governed by the correspondence of the nilpotent orbits via the moment maps which occur naturally in the theory. This has been worked out in [12], [19], [23]. Results relating these moment maps to Springer Correspondence for representations of finite groups of Lie type are contained in [33] and are based on Lusztig's algorithms and the Deligne-Lustig classification.

Interdisciplinary research

Creating orthonormal bases made of functions well concentrated in the time-frequency domain is of continuous great interest in the signal processing community. Since in the applications, the functions are defined on finite sets, the classical Heisenberg uncertainty measure such as the variance in time and the variance in the frequency do not carry over. The approach via entropy, introduced by Hirschman is more natural. In [22] the conjecture of Hirschman is proven in a setting much more general than the original statement. The applications to signal processing followed: [13], [16], [18], [20], [24] and led to several doctoral dissertations in Computer engineering.

Resonance of the Laplacian

The notion of resonance was introduced in quantum mechanics to study metastable states of a system, that is long-lived states from which the system deviates only with sufficiently strong disturbances. Mathematically, resonances replace discrete eigenvalues of linear operators on non-compact domains and appear as poles of the meromorphic continuation of their resolvents.

The resolvent of a Laplacian is a holomorphic function defined on the complement of the spectrum with values in the space of the square integrable functions. However, if one considers it as a function from the space of the smooth compactly supported functions to distributions than it often admits a meromorphic extension to a Riemannian surface over a region which overlaps with parts of the spectrum. The residues at the singular points define the resonance operators. The first example of a resonance operator of infinite rank is provided in [40]. In contrast, [41] and [42] show that, contrary to general expectations, the rank is finite for the Laplace-Beltrami operator on the product of two rank one symmetric spaces, as well as symmetric spaces with root system of type BC2.

2.4. **List of publications.**

Thesis:

(1) *The Oscillator Duality Correspondence for the pair* $O(2,2), Sp(2,\mathbf{R})$, Ph.D. dissertation, Yale University, New Haven, CT, USA 1987.
(2) *Holomorphicity of a class of semigroups of measures operating on* $L^p(G/H)$, Masters Thesis, Wrocław Technical University, Wrocław, Poland, 1980.

Refereed Publications:

(1) Holomorphicity of a class of semigroups of measures operating on $L^p(G/H)$, *Proceedings of the Amer. Math. Soc.* **87** (1983), 637–643.
(2) On Howe's Duality Theorem, *J. Funct. Anal.* **81** (1988), 160–183.
(3) The Oscillator Duality Correspondence for the pair $O(2,2), Sp(2,\mathbf{R})$, *Memoirs of the Amer. Math. Soc.* **403** (1989).
(4) The wave front set and the asymptotic support for p-adic groups, *Pac. J. Math.* **141** (1990), 383–389.
(5) Characters, Dual Pairs and Unipotent Representations, *J. Funct. Anal.* **98** (1991), 59–96.
(6) Characters Dual Pairs and Unitary Representations, *Duke Mathematical Journal.* **63** (1993), 547–592.
(7) The Duality Correspondence of Infinitesimal Characters, *Coll. Math.* **70** (1996), 93–102.

(8) The oscillator character formula, for isometry groups of split forms in deep stable range, with A. Daszkiewicz, *Invent. Math.* **123** (1996), 349-376.
(9) The oscillator correspondence of orbital integrals in the stable, with A. Daszkiewicz, *Duke Mathematical Journal.* **82** (1996), 1–20.
(10) On the Moment Map of a Multiplicity Free Action, with A. Daszkiewicz, *Coll. Math.* **71** (1996), 107–110.
(11) Platonic Orthonormal Wavelets, with M. Özaydın, *Applied and Computational Harmonic Analysis* **4** (1997), 351–365.
(12) Nilpotent Orbits and Complex Dual Pairs, with A. Daszkiewicz, W. Kraśkiewicz, *Journal of Algebra* **190** (1997), 518–539.
(13) Resolution in Time-Frequency, with V. DeBrunner and M. Özaydın, *IEEE Transactions on Signal Processing.* **47** (1999), 783–788.
(14) Strictly Positive Definite Functions on a Compact Group, with M. Allali, *Proceedings of the AMS.* **29** (2001), 1459–1462.
(15) A Cauchy Harish-Chandra Integral, for a real reductive dual pair, *Invent. Math.* **141** (2000), 299–363.
(16) Analysis in a finite time-frequency plane, with V. DeBrunner, M. Özaydın, *IEEE Transactions on Signal Processing* **48** (2000), 1831.
(17) Reply to "Comments on 'Resolution in Time-Frequency'", with V. DeBrunner and M. Özaydın, *IEEE Transactions on Signal Processing.* **48** (2000), 3586.
(18) The optimal transform for the discrete Hirschman uncertainty principle, with V. DeBrunner and M. Özaydın, *IEEE Transactions on Information Theory* **47** (2001), 2086-2090.
(19) Dual Pairs and Kostant–Sekiguchi Correspondence I, with A. Daszkiewicz and W. Kraśkiewicz, *Journal of Algebra.* **50** (2002), 408–426.
(20) The Donoho-Stark Uncertainty Principle for a Finite Abelian Group, with E. Matusiak and M. Özaydın, *Acta Mathematica, Universitatis Comenianae* **73** (2004), 155-160.
(21) A Capelli Harish-Chandra Homomorphism, *Trans. Amer. Math. Soc.* **356** (2004), 1121-1154.
(22) An Entropy Based Uncertainty Principle for a Locally Compact Abelian Group, with M. Özaydın, *J. Funct. Anal.* **215** (2004), 241-252.
(23) Dual Pairs and Kostant–Sekiguchi Correspondence II Classification of Nilpotent Elements, with A. Daszkiewicz and W. Kraśkiewicz, *Central European Journal of Mathematics.* **3** (2005), 430-464.
(24) Entropy Based Uncertainty Measures for $L^2(R^n)$, $l^2(Z)$, $l^2(Z/NZ)$ with A Hirshman Optimal Transform for $l^2(Z/NZ)$, with V. DeBrunner, Havlicek J. and M. Özaydın, *IEEE Transactions on Signal Processing.* **53** (2005),2690-2699.
(25) Local Geometry of Orbits for an Ordinary Classical Lie Supergroup, *Central European Journal of Mathematics.* **4** (2006), 449-506.
(26) A Cauchy Harish-Chandra Integral for the pair $\mathfrak{u}_{p,q}, \mathfrak{u}_1$, with A. Daszkiewicz, *Central European Journal of Mathematics* **5** (2007), 654–664.
(27) On the occurrence of admissible representations in the real Howe correspondence in stable range, with V. Protsak, *Manuscripta Mathematica.* **126** (2008), 135-141.
(28) Howe's Correspondence for a Generic Harmonic Analyst, with M. McKee, *Colloquium Mathematicum.* **118** (2010), 539-557.
(29) Boundedness of the Cauchy Harish-Chandra integral, with F. Bernon, *Journal of Lie Theory.* **21** (2011), 499–613.
(30) Normalization of the Cauchy Harish-Chandra integral, with F. Bernon, *Journal of Lie Theory.* **21** (2011), 615–702.

(31) The Cauchy Harish-Chandra integral and the invariant eigendistributions, with F. Bernon, *International Mathematics Research Notices.* **14** (2014), 3818–3862.
(32) Howe correspondence and Springer correspondence for real reductive dual pairs, with A.-M. Aubert and W. Kraśkiewicz, *Manuscripta Mathematica.* **143** (2013), 81–130.
(33) Howe correspondence and Springer correspondence for dual pairs over a finite field, with A.-M. Aubert and W. Kraśkiewicz, "Non-commutative Geometry and Representation Theory", LSU, Batorn Rouge, LA, 5.11.2013, Proceedings of Symposia in Pure Mathematics Volume 92, 2016 http://dx.doi.org/10.1090/pspum/092/01580.
(34) A reverse engineering approach to the Weil Representation, with A.-M. Aubert, *Central European Journal of Mathematics.* **12** (2014), 1200–1285.
(35) On the rate of convergence in the Kesten renewal theorem, with D. Buraczewski and E. Damek, *Electronic Journal of Probability.* **20** (2015), 1–35.
(36) Semisimple orbital integrals on the symplectic space for a real reductive dual pair, with M. McKee and A. Pasquale, *J. Funct. Anal.* **268** (2015), 278–335.
(37) *Howe's Correspondence and Characters*, Geometric methods in Physics, XXXIV Workshop 2015, Trends in Mathematics, 167-174, 2016 Springer International Publishing.
(38) *Resonances for Laplacian: The cases the cases* BC_2 *and* C_2 *(except* $\mathrm{SO}_0(p,2)$ *with* $\mathrm{p} > 2$ *odd)*, with J. Hilgert and A. Pasquale, Geometric methods in Physics, XXXIV Workshop 2015, Trends in Mathematics, 143-166, 2016 Springer International Publishing.

Preprints accepted for publication, available at my web page crystal.ou.edu:

(39) *Resonances for the Laplacian on Products of two Rank One Riemannian Symmetric Spaces*, with J. Hilgert and A. Pasquale, arxiv:1508.07032, 39 pages, 2015, to appear in Journal of Functional Analysis.

Preprints submitted for publication, available at my web page crystal.ou.edu:

(39) *Weyl calculus and dual pair*, with M. McKee and A. Pasquale, arxiv:1405.2431, 99 pages, 2014.
(40) *Resonances for the Laplacian on Riemannian symmetric spaces: the case of* $\mathrm{SL}(3,\mathbb{R})/\mathrm{SO}(3)$, with J. Hilgert and A. Pasquale, arxiv:1411.6527, 43 pages, 2014.
(41) *The character and the wave front set correspondence in the stable range*, arxiv:1602.08401, 19 pages, 2016.

Other scientific publications:

(43) *Using a new uncertainty measure to determine optimal bases for signal representations*, with V. DeBrunner and M. Özaydın, IEEE Conference on Acoustics, Speech and Signal Processing, paper 1575, Phoenix, AZ (1999).
(44) *Uncertainty and Entropy in Time-Frequency: Continuous versus Finite*, with V. DeBrunner, Joe Havlicek and M. Özaydın, IEEE Conference on Acoustics, Speech and Signal Processing, Istanbul, Turkey (2000).
(45) *Spectral Analysis of Uterine Junctional Zone Contractions: Continuous versus Finite*, with P. Leśny, M. Allali, and SR Kilick, The Second World Congress on Controversies in Obstetrics, Gynecology and Infertility, Paris, Sept. 5, (2001).
(46) *Three Uncertainty Principles*, Representation Theory of Real and p-adic Groups, edited by Eng-Chye Tan and Chen-Bo Zhu Singapore University Press, (2004), 1-18.

2.5. **Invited talks.** .

(1) Special session talk at AMS meetings: Logan, UT, 10/11/1986.
(2) Special session talk at AMS meetings: UCLA, 11/18/1989.
(3) Special session talk at AMS meetings: Denton, TX, 11/10/1990.

(4) Seminar talk: Department of Mathematics, Warsaw University, Poland, 12/13/1990.
(5) Seminar talk: Department of Mathematics, University of Wrocław, Poland, 12/20/1990.
(6) Conference talk: Mathematical Research Institute in Oberwolfach, Germany, 1/10/1991.
(7) Seminar talk: Department of Mathematics, Indiana University, Bloomington, 5/23/1991.
(8) Seminar talk: Department of Mathematics, University of Maryland, 10/10/1991.
(9) Colloquium talk: Department of Mathematics, Oklahoma State University, Stillwater Oklahoma, 10/9/1992.
(10) Colloquium talk: Department of Mathematics, University of Ottawa, Ottawa, Canada, 11/20/1992.
(11) Colloquium talk: Department of Mathematics, N. Copernicus University, Toruń, Poland, 6/10/1993.
(12) Conference talk: Mathematical Research Institute in Oberwolfach, Germany, 2/9/1994.
(13) Special session talk at AMS meetings: Stillwater, OK, 10/29/1994.
(14) Conference talk: Tuczno, Poland, 7/1/1995.
(15) Colloquium talk: Department of Mathematics, University of Ottawa, Ottawa, Canada, 11/7/1996.
(16) Colloquium talk: Department of Mathematics, Yale University, 11/21/1996.
(17) Colloquium talk: Department of Mathematics, N. Copernicus University, Toruń, Poland, 5/15/1997.
(18) Colloquium talk: School of Meteorology, University of Oklahoma, 12/18/1997.
(19) Conference talk: Oklahoma State University, A workshop Lie Groups, Lie Algebras and their representations February 6-7, 1999.
(20) Colloquium talk: Department of Mathematics, University of Metz, France, 6/25/1999.
(21) Conference talk: A conference: "Harmonic Analysis on Homogeneous Real and Complex Manifolds (June 28 - July 3)", Zakopane, Poland, 6/30/1999.
(22) Seminar talk: Department of Obstetrics and Gynecology, the University of Hull, UK, 7/26/1999.
(23) Colloquium talk: Department of Mathematics, Pittsburgh State University, KS, 2/17/2000.
(24) Colloquium talk: Department of Mathematics, University of Central Oklahoma, Edmond, OK, 3/8/2000.
(25) Colloquium talk: Department of Mathematics, University of Karlsruhe, Germany, 7/6/2000.
(26) Colloquium talk: Department of Mathematics, Wichita State University, 9/23/2000.
(27) Seminar talk: Department of Mathematics, Ohio State University, 10/5/2000.
(28) Conference talk: a conference on Applied Mathematics (CAM 2001), the University of Central Oklahoma, 2/23/2001.
(29) Conference talk: MATHFEST, a conference designed to recruit new graduate students, Department of Mathematics, University of Oklahoma, 1/17/2002
(30) Conference talk: a conference: "Analysis and Probability related to Solvable Lie Groups (June 15 - June 22)", Zakopane, Poland, 6/20/2002.
(31) A one week long tutorial and two research talks at a conference: "Representation Theory of Lie Groups (July 2002 - January 2003)", Institute for Mathematical Sciences, National University of Singapore, July, 2002.
(32) Seminar talk: Department of Mathematics, University of Colorado, 9/30/2002.
(33) Seminar talk: Department of Mathematics, Université de Poitiers, France, colloquium, 6/17/003.
(34) Colloquium talk: Department of Mathematics, Oklahoma State University, 9/11/2003.
(35) Seminar talk: Department of Mathematics, Oklahoma State University, 9/12/2003.
(36) Seminar talk: Department of Mathematics, C.A.-Universitaet Kiel, Germany, 1/6/2004.
(37) Conference talk: a conference on Nilpotent Orbits and Representation Theory, Fuji-Sakura So, Japan, 9/8/2004.

(38) Conference talk: a conference on Harmonic Analysis and Related Problems (IHP network), Zakopane, Poland, 1/14/2006.
(39) Colloquium talk: Department of Mathematics, LSU, Baton Rouge, LA, 4/27/2006.
(40) Seminar talk: Department of Mathematics, LSU, Baton Rouge, LA, 4/28/2006.
(41) A series of lectures on Harmonic Analysis on a unit sphere: Department of Mathematics, University of Wrocław, Poland, 6/26/2006 - 7/21/2006.
(42) Seminar talk: Department of Mathematics, Oklahoma State University, Stillwater, OK, 10/11/2006.
(43) Conference talk: MATHFEST, a conference designed to recruit new graduate students, Department of Mathematics, University of Oklahoma, 1/26/2007.
(44) Special session talk at AMS meetings: Baton Rouge, LA, 3/8/2008.
(45) Special session talk at AMS meetings: Kalamazoo, MI, 10/18/2008.
(46) Colloquium talk: Department of Mathematics, University of Paderborn, Germany, 1/13/2009.
(47) Conference talk: a conference: "Seminar Sophus Lie", Paderborn, Germany, Jan 16th-17th, 2009.
(48) Conference talk: Workshop on Supergeometry, Metz, France, 6/19/2009.
(49) Seminar talk: Department of Mathematics, University of Wrocław, Poland, 7/6/2009.
(50) Conference talk: a conference "Thorie des reprsentations et Analyse Harmonique", Nancy, France 7/24/2010.
(51) Seminar talk: Institute of Mathematics Polish Academy of Sciences, Wrocław, Poland, 11/10/2010.
(52) Seminar talk: Institute of Mathematics Polish Academy of Sciences, Wrocław, Poland, 11/17/2010.
(53) Seminar talk: Department of Mathematics, University of Wrocław, Wrocław, Poland, 11/18/2010.
(54) Conference talk: a conference: "Lie Groups, Lie Algebras and their Representations", Louisiana State University, Baton Rouge, February 12-13, 2011.
(55) Seminar talk: Laboratoire de Mathématiques et Applications de Metz (UMR CNRS 7122), Université Paul Verlaine Metz, F-57045 Metz, France, 6/1/2012.
(56) Conference talk: Texas Oklahoma Representation theory and Automorphic Forms conference, Norman, OK, 9/29/2012.
(57) Conference talk: Mathematical Research Institute in Oberwolfach, Germany, 3/11/2013.
(58) Conference talk: a conference: "Non-commutative Geometry and Representation Theory", LSU, Batorn Rouge, LA, 5/11/2013
(59) Invitation by the city of Wrocław, Poland, to give lectures to high school students, May 22, 25, 27, and college students, May 23 and June 13, 2013.
(60) Seminar talk: Department of Mathematics, University of Padeborn, Germany 1/2/2014.
(61) Invitation by the elementary school number 3, in Kalisz, Poland, to give lectures to two groups of 10 and 12 years old children, March 19, 2015.
(62) Conference talk at "XXXIV Workshop on Geometric Methods in Physics", Bialowieża, Poland, 7/3/2015.
(63) Conference talk at "New Developments in Representation Theory", Singapore, March 15, 2016.
(64) Conference talk at "Journées SL_2R", Institut Elie Cartan de Lorraine, Metz, June 9-10, 2016.
(65) Conference talk at "MADACA project", Domaine de Chalès, June 20-24, 2016.

3. Teaching

Over the last thirty years I taught a variety of undergraduate and graduate courses at various institutions: the University of Utah (1986-1989), Louisiana State University (1989 - 1990), University of Oklahoma (1990 - present), University of Ottawa, Canada, (Fall 1996) and University of Wrocław, Poland, (Fall 2010). On the undergraduate level these were mainly Calculus, Linear Algebra, Complex Variables, Ordinary Differential Equation, Applied Statistics and on the graduate level, Wavelets, Error Correcting Codes, Distribution Theory, Functional Analysis, Fourier Transform, Representation Theory and Partial Differential Equations. The average undergraduate class size varied between 25 and 35 students. Occasionally I taught a large calculus class of more than 100 students. A typical graduate class had between 5 and 15 students.

In the late 1990's, in order to improve our graduate program, my collegues and I created an interdisciplinary program in Signal Processing and Applied Mathematics. My collegues were a mathematician Murad Özaydın and two electrical Engineers, Joe Havlicek and Viktor DeBrunner. We created a research collaboration centered on topics closely related to the theory of wavelets, which engaged a few graduate students in this joint research. This lead to an increase of the number of high quality students in the Department of Mathematics and in the School of Computer Engineering at the University of Oklahoma. The students who joined this program had financial support from both departments and were required to write a thesis (on MS or Ph.D. level) on topics of truly interdisciplinary nature and, as we discovered, did quite well in the job market after graduation. For example, our former student Shamim Nemati (University of Oklahoma interdisciplinary M.S. and MIT Ph.D.), is currently a postdoc at Harvard's Medical School.

During the summers of 1992, 1994 and 1995 I participated in an NSF funded Research Experience for Undergraduates program (REU). The aim of this program is to attract top quality undergraduates from all over the USA for a period of two months during which we engage them in genuine mathematical research. We successfully recruited excellent undergraduates from various top institutions, such as Harvard, Yale, and UC Berkeley, who came to Oklahoma during their summer vacation and worked enthusiastically on tough math problems.

Projects directed:

Summer 1992:

(1) Asymptotic cones of elliptic orbits in $\mathfrak{sp}_4(R)$, L. Chang (Duke University), M. Kleber (Harvard), E. Mosteig (University of Michigan, Ann Arbor).
(2) The Rossmann-Harish-Chandra-Kirillov Character formula for $SL(2, R)$, S. Picciotto (Yale University).

Summer 1994:

(1) Asymptotic cones of regular elliptic orbits in $\mathfrak{u}_{1,q}$ and $\mathfrak{o}_{2,q}$, J. S. Fawcett (Rice University), S. McDougal (Williams College), J. Ridenour, A. Sahai (University of California, Berkeley).

Summer 1995:

(1) Asymptotic cones of elliptic orbits in $\mathfrak{sp}_{1,q}$, D. Braithwaite, L. Wilson (Harvard University).
(2) Asymptotic cones of elliptic orbits in $\mathfrak{o}^*_{2n}$, $n \leq 4$, M. McKee (Brown University), D. Pollock (University of Oklahoma)

Many of the students listed above did well later in their professional development. For example Michael Kleber was Harvard undergraduate, a postdoc at MIT, an assistant professor at Brandeis and currently is a successful employee at Google.

During the same period I participated in our special program for gifted 6th graders (twelve years old children from local elementary schools). They came to the university campus and were exposed to various lectures and hands on research experience run by faculty from various departments.

Later, I was very happy to see their evaluations of our program, which included statements like "psychology sucks,..., math rules."

In June 1997, 1999, and 2001 I served as a faculty consultant for the Advanced Placement Calculus Reading Program. An advanced placement course in calculus consists of a full high school academic year of work that is comparable to calculus courses in colleges and universities. It is expected that students who take such a course will seek college credit, college placement, or both, from institutions of higher learning. After completing the course the students take an exam prepared by the College Board, a membership association in the United States that was formed in 1900 as the College Entrance Examination Board (CEEB). The exam is graded by experts chosen by the board. I participated in the grading in order to better understand the community of high school teachers, students, and the structure of the advanced placement program.

Between February 2014 and June 2015, I worked with Emily Scheele, a pre-med, award-winning math major at the University of Oklahoma. I support her with my current NSA grant and we attempt to understand connections between the theory of Error Correcting Codes and Genetics. This is done in part in collaboration with David Durica, a professor of Biology at the University of Oklahoma.

I advised two Ph.D. students: Mohamed Allali and Pedro Olaya. Mohamed Allali, received his interdisciplinary Ph.D. in Mathematics and Electrical Engineering in 2000. He is currently an Associate Professor at the School of Computational Sciences, Chapman University, Los Angeles, California. His thesis, "Digital Signal Processing on the Unit Sphere: Interpolation, Equidistribution and compression via Ramanujan Set of Rotations and Planar Wavelets" concerned wavelet-like algorithms for functions defined on a sphere in R^3. He used the theory of wavelets on the euclidean plane and so called Ramanujan rotations of the sphere discovered by Lubotzky, Phillips and Sarnak. Pedro Olaya graduated in 2007 with a degree in Pure Mathematics. His thesis, "Orbital Integral Correspondence for the Pair $(\mathrm{G}_2, \mathrm{Sp}(1, R))$, via the Cauchy Harish-Chandra Integral", concerned an extension of my theory of Cauchy Harish-Chandra Integral to a situation when an exceptional Lie group (split G_2) was involved. After graduation he got a job at St. Mary's College of California in Moraga, California. Later he moved to the Department of Mathematics, Pontificia Universidad Javerianain Bogota, Colombia, his native country.

Currently I serve as a Ph.D. co-advisor for Allan Merino, Université de Lorraine, Metz, jointly with Angela Pasquale.

I mentored three postocs at the University of Oklahoma: Florent Bernon, 2004-2005, a student of Abderazak Bouaziz, Poitiers, France; Victor Protsak, 2004-2007, a student of Roger Howe, Yale University and Mark McKee, 2007-2010, a student of Peter Sarnak, Princeton University. The work with each of them resulted in joint publications. Florent Bernon left Mathematics, Victor Protsak works as an editor for the AMS Reviews and Mark McKee teaches at the University of Iowa.

4. Service

A typical department of mathematics at an American university has a chairman and a "committee A" consisting of two or three additional elected faculty members helping with administrative duties. I served on our committee A for one period of two years (August 2006 - August 2008) and another period of one year (August 2014 - August 2015).

Between 2000 and 2007, I served as the chair of our "awards committee", responsible nomination of the faculty for various university awards. I was also involved in this activity before 2000 and after 2007. The nomination process resembles the process of creating a tenure dossier for an assistant professor and takes a few months of work. One has to find individuals willing to write letters in support of the nomination. These individuals are colleagues working in similar research areas,

graduate students, undergraduate students and some time staff workers in the department. Based on this information one writes a letter to the appropriate university committee and waits for their decision. In the department of thirty four faculty members, eight of my nominations were successful. According to Paul Goodey, a former chairman of our department, I was "by far the most successful member of the department in putting together award nominations for our colleagues".

As is customary, I served on various departmental committees (hiring, colloquium) and university committees (research council, tenure and promotion). Also, over the last twenty six years I served, on average, on two Ph.D. committees each semester in the Department of Mathematics and in other departments at the University of Oklahoma. Furthermore, I refereed NSF proposals and papers submitted to various professional journal in Mathematics and Electrical Engineering.

Recently I co-organized a conference on "ANALYSIS AND GEOMETRY OF RESONANCES" at CIRM in Luminy, France, in March 9-13, 2015, jointly with Joachim Hilgert, Angela Pasquale and Colin Guillarmou.