

# Prof. Dr. Horst Reinhard BEYER

## PERSONAL INFORMATION

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GOOGLE SCHOLAR <https://scholar.google.com/citations?user=XvL-Td8AAAAJ&hl=en>

## EDUCATION

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- NOVEMBER 1991 PhD in THEORETICAL PHYSICS, **University of Hamburg (DESY)**  
Thesis: “*Zur kanonischen lokalen Quantisierung des freien neutralen Skalarfeldes auf einer statischen Raum-Zeit (On the canonical local quantization of the free scalar field on a static spacetime)*” | Advisors: Hans-Joachim SEIFERT and Rudolf HAAG
- JUNE 1984 Diplom Degree in PHYSICS, **University of Cologne**  
Thesis: “*Das relativistische Wasserstoffatom für den gleichmässig beschleunigten Beobachter (On the Uniformly Accelerated Hydrogen Atom)*” | Advisor: Jürgen NITSCH
- JUNE 1977 Abitur (High School Diploma), **Hansa-Gymnasium Cologne** | Final Average Grade: 1.5

## PROFESSIONAL EXPERIENCE

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- 2019-CURRENTLY | **Investigador** at the Instituto Tecnológico Superior de Uruapan (TecNM Campus Uruapan), Uruapan, Mexico  
**Research on the stability of rotating (Kerr-) Black Holes: on crack propagation in materials**, in collaboration with the U.S. Army Research Laboratory, Aberdeen Proving Ground, Aberdeen; **on applications of fractional derivatives in the description of visco-elastic damping**, in collaboration with the Institute for Nonlinear Mechanics at the University of Stuttgart.
- 2018-2019 | **Investigador** at the Universidad Politécnica de Uruapan UPOLU, Uruapan, Mexico  
**Research on crack propagation in materials**, in collaboration with the U.S. Army Research Laboratory, Aberdeen Proving Ground, Aberdeen; **applications of fractional derivatives in the description of visco-elastic damping**, in collaboration with the Institute for Nonlinear Mechanics at the University of Stuttgart.
- 2017-2018 | **Investigador Asociado** at the Instituto de Matemáticas, UNAM Mexico City, and **Profesor Invitado** at the MESOAMERICAN INSTITUTE FOR THEORETICAL PHYSICS (MCTP), Chiapas, Mexico  
In support of the Program for a Global and Integrated Advancement of Mexican Mathematics, UNAM  
**Teaching:** Among others: **Diplomado Mesoamericano en Ecuaciones Diferenciales Parciales (140 horas)**, MCTP, Chiapas, 04-29 de Septiembre, 2017; **Curso-Taller de Operadores en la Mecánica Cuántica (Diplomado, 160 horas)**, MCTP, Chiapas, 03 de Octubre - 08 de Diciembre, 2017; **Curso introductorio de ecuaciones diferenciales parciales para Físico-Matemáticos**, MCTP, Chiapas, 04-08 de Diciembre, 2017.  
**Research on crack propagation in materials**

## PROFESSIONAL EXPERIENCE

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- 2009 - 2017 | I held a succession of positions as Full Professor in Mathematics at various institutions in MEXICO, University of Michoacana San Nicolás de Hidalgo (UMSNH), Instituto Tecnológico Superior de Uruapan, Universidad Politécnica de Uruapan) and TURKEY (TOBB University of Economics and Technology, Ankara)  
**Teaching** courses in Functional Analysis, Spectral Theory of Operators and Applications, Lebesgue Integration, Operator Methods in Quantum Mechanics, Abstract Evolution Equations, Partial Differential Equations and Diplomados in Calculus in the Continuing Mathematics Education of mathematics professors at technical universities (Tecnológicos and Politécnicas) in Mexico;  
**Research** on the stability of rotating (Kerr-) Black Holes, crack propagation in materials and the Genetic Method for teaching mathematics
- 2003-2009 | **Professor** at the Department of Mathematics and the Center of Computation and Technology (CCT) of the LOUISIANA STATE UNIVERSITY (LSU), USA  
**Teaching** Calculus I, II and III courses and courses in the area of applications of Semigroups of Operators at the Department of Mathematics;  
**Research** on the stability of rotating (Kerr-) Black Holes, Quasinormal Modes of Black Holes and Initial-Boundary-Value problems for Einsteins' Field equations
- 8 YEARS | **Wissenschaftlicher Mitarbeiter** (Researcher, Full-Time Position) at MAX-PLANCK INSTITUTES IN GERMANY (6 years at the *mathematics division of the Max-Planck Institute for Gravitational Physics in Potsdam (AEI)* & 2 years at the *Max-Planck Institute for Astrophysics in Garching*)  
**Research** on the Stability of Stars, Stability of Rotating (Kerr-) Black Holes & Quasinormal Modes of Black Holes
- 2 YEARS | **Wissenschaftlicher Mitarbeiter** (Researcher, Full-Time Position) at the INSTITUTE FOR MECHANICS A OF THE UNIVERSITY STUTTGART, GERMANY  
**Research** in Aerodynamics as well as work as a **coordinator** of the German side of a collaboration project of the German Science Foundation (DFG) in the area of aerodynamics with the University Kazan, Russia
- 7.5 YEARS | **Wissenschaftlicher Mitarbeiter** (Researcher, Full-Time Position, 5 years) and **Teaching Assistant** (Half-Time Position, 1.5 years) at the MATHEMATICS DIVISION (HANS-JOACHIM SEIFERT) OF THE UNIVERSITY OF THE FEDERAL ARMED FORCES IN HAMBURG (UNIBW HAMBURG)  
**Teaching** of Example Classes in Calculus and Linear Algebra in the mathematics education of mechanical engineers;  
**Research** in quantum field theory in curved space-times and the application of fractional derivatives in the description of visco-elastic damping
- 2 YEARS | **Teaching Assistant** (Half-Time Position) at the DEPARTMENT OF THEORETICAL PHYSICS IN COLOGNE  
**Teaching** of Example Classes in Theoretical Physics;  
**Research** in relativistic quantum theory

## PRIZES, AWARDS, DISTINCTIONS

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- JANUARY 2011 - to date | **National System for Researchers in Mexico, (SNI-CONACyT)**
- OCTOBER 2008 | My Springer Lecture Notes in Mathematics 1898, "Beyond partial differential equations", were highlighted by "ZENTRALBLATT MATH."  
<http://emis.mi.sanu.ac.rs/ZMATH/zmath/en/highlights/> .

## PLENARY TALKS

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- OCTOBER 2017 Congreso de Educación y Didáctica de las Matemáticas, 27 de Octubre de 2017, “El método genético para la enseñanza de las matemáticas”, Morelia, Michoacán, México, <http://www.cambiodemichoacan.com.mx/nota-n29155>
- JANUARY 2013 3<sup>er</sup> Encuentro Estatal de Profesionalización Docente 2013, “Construyendo Prácticas Integradoras,” *La Integración de la Enseñanza: Un Enfoque Moderno para Nivel Medio Superior*, Teatro Morelos del Centro de Convenciones, Morelia, Michoacán, México
- DECEMBER 2009 Plenary talk at the VIII Mexican School of the Gravitation and Mathematical Physics Division of the Mexican Physical Society, Playa Del Carmen, 6 - 12 December 2009, *On the stability of the scalar field in the gravitational field of a rotating (Kerr-) black hole*

## FUNDING

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- SEPTEMBER 2010 The continuation of the project ‘*Investigation of the stability properties of fields propagating in the gravitational field of a Kerr black hole in a functional analysis setting*’ (updated) receives funding by the ‘CONSEJO DE LA INVESTIGACION CIENTIFICA’ (CIC) in the amount of 35,000.00 Pesos  $\approx$  2,800 USD.
- SEPTEMBER 2009 The project ‘*Applications of evolution equations in the theory of General Relativity*’ receives funding by the ‘SUBSECRETARIA DE EDUCACION SUPERIOR’ (SEP) in the amount of 376,002.00 Pesos  $\approx$  30,000 USD.
- JUNE 2009 The project ‘*Investigation of the stability properties of fields propagating in the gravitational field of a Kerr black hole in a functional analysis setting*’ (updated) receives funding by the ‘CONSEJO DE LA INVESTIGACION CIENTIFICA’ (CIC) in the amount of 48,000.00 Pesos  $\approx$  3,200 USD.

## OTHER EXPERIENCE

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- EDITOR Member of the editorial board of the journal “ISRN Mathematical Physics.”
- REFEREE Acta Applicanda Mathematicae, Communications in Mathematical Physics, Physical Review Letters, Physical Review D, Physical Review E and Classical and Quantum Gravity

## COLLABORATIONS

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**Stability of the Solutions of Wave Equations in a Kerr Background**, with M. Alcubierre (Institute for Nuclear Sciences (ICN) of the National Autonomous University of Mexico (UNAM), Mexico City, Mexico.)

**Properties and Asymptotics of the Solutions of the Diffusion Equation with Rough Coefficients & Peridynamics**, with B. Aksoylu (Department of Mathematics and Center for Computation & Technology (CCT), Louisiana State University (LSU), Baton Rouge, USA.)

**Outgoing Boundary Conditions for Evolutions Systems**, with O. Sarbach (Instituto de Física y Matemáticas, Universidad Michoacana de San Nicolás de Hidalgo, Ciudad Universitaria Morelia, Michoacán, Mexico.)

**Fractional Derivatives: Applications in Elasticity**, with S. Kempfle (University of the German Federal Armed Forces Hamburg, Hamburg, Germany) and L. Gaul (University of Stuttgart,

Stuttgart, Germany.)

**Stellar Oscillations: Spectral Properties of Operators**, with B. F. Schutz (AEI Potsdam, Potsdam, Germany), N. Andersson (University of Southampton, Southampton, UK), K. Kokkotas (University Tuebingen, Tuebingen, Germany).

**Quasinormal Modes: Decay Properties of Solutions of Wave Equations**, with K. Kokkotas (University Tuebingen, Tuebingen, Germany), B. Schmidt (Albert-Einstein Institute, Golm, Germany).

## SERVICE

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LSU At the Center of Computation and Technology (CCT), I was head of the library committee responsible for building up a library at CCT.

In addition, I organized the biweekly meetings of the mathematics group at CCT

and co-organized a seminar on partial differential equations, together with F. Neubrander, R. Estrada and M. Tom.

STUTTGART I coordinated the German side of a German-Russian collaboration project by the German Science Foundation (DFG) in the field of aerodynamics.

As part of this coordination, I have organized every aspect of a research symposium. This included raising funds from industry, compiling workshop timetables, and dealing with accommodation and travel requirements for guests.

AEI At the newly founded Max-Planck-Institute for Gravitational Physics (AEI), I was responsible for ordering and cataloging books in the areas of mathematics and physics.

## STUDENT SUPERVISION

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LSU **Direction of the undergraduate education of Irina Craciun and Hari Sundararajan**, in the field of partial differential equations.

This included Irina's undergraduate research project on the stability of rotating black holes in general relativity

**which resulted in her participation in the NCUR undergraduate research conference in 2006 along with the acceptance of her paper for the conference proceedings.**

**In addition, the results of this collaboration were published in 2008 in the journal Classical and Quantum Gravity.**

UMSNH Review of 2 theses in mathematics

## LANGUAGES

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GERMAN: Native Language  
ENGLISH: Fluent  
SPANISH: Basic Knowledge

## COMPUTER SKILLS

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Basic Knowledge: HTML, LINUX, Red Hat/CentOS,  $\LaTeX$ , MATHEMATICA, Maple

## INTERESTS AND ACTIVITIES

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Technology, Chess, Soccer

## REFERENCES

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K. Kokkotas, Professor, Faculty of Mathematics and Physics, Theoretical Astrophysics, University Tuebingen, Auf der Morgenstelle 10, D-72076 Tuebingen, Germany, E-mail: [kostas.kokkotas@uni-tuebingen.de](mailto:kostas.kokkotas@uni-tuebingen.de), Phone: +49(70) 712 975468, Fax:+49(70)71295889.

F. Neubrandner, The Demarcus D. Smith Alumni Professor, Department of Mathematics, Louisiana State University, Prescott Hall, Baton Rouge, LA 70803, USA, E-mail: [neubrand@math.lsu.edu](mailto:neubrand@math.lsu.edu), Phone:+1(225)5787677, Fax:+1(225)5787677.

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E. Seidel, Director, Office of Cyberinfrastructure at the National Science Foundation, The National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia 22230, USA, E-mail: [hseidel@nsf.gov](mailto:hseidel@nsf.gov), Phone: +1(703)292-8970, Fax: +1(703)292-9060.

## HORST R BEYER, PUBLICATIONS (TOTAL: 2186 PP)

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### Books (1502 pp)

5. Horst R. Beyer, 2018, Hector Francisco Ruiz P., Russell-Aarón Quiñones-E., *Cálculo Diferencial para Docentes*, 211pp, SEE Michoacán: Instituto Tecnológico Superior de Ciudad Hidalgo, México, ISBN-13: 978-6079829506.
4. Horst R Beyer, Maricela de Beyer, Jesus Castañeda R, Abdiel Espinosa, 2018, *Fundamentos de Matemáticas para Docentes*, 84pp, SEE Michoacán: Dirección de Formación Continua de Actualización y Desarrollo Profesional de Maestros, México, ISBN-13: 978-6072911932.
3. Horst R Beyer, Héctor R Paredes, Maricela H Beyer, 2014, *Matemáticas Para Todos: La Historia*, 248pp, Secretaría de Cultura de Michoacán, Morelia, México, ISBN-13: 978-6078201792.
2. Beyer H. R., 2010, *Calculus and Analysis: A Combined Approach*, 671pp, Wiley: New York, ISBN-13: 978-0470617953.
1. Beyer H. R., 2007, *Beyond partial differential equations: A course on linear and quasi-linear abstract hyperbolic evolution equations*, Springer Lecture Notes in Mathematics 1898, 288pp, Springer: Berlin, ISBN-13: 978-3540711285.

### Peer Reviewed Articles (684 pp)

39. Schmidt, A. , Beyer, H. R., Hinze, M., Vadoros, E. N., 2020, *Finite Element Approach for the Solution of First-Order Differential Equations*, Journal of Applied Mathematics and Physics, **8**, pp. 2072-2090, doi: 10.4236/jamp.2020.810155.
38. Beyer H. R., Beyer M., 2018, *El Método Genético en la Didáctica de las Matemáticas*, Administración para el desarrollo, **14**, Enero-junio, pp. 43-58, ISSN 2007-2910.
37. Aksoylu B., Beyer H. R., Celiker F., 2017, *Theoretical foundations of incorporating local boundary conditions into nonlocal problems*, Reports on Mathematical Physics, **80**, Issue 1, 39-71, [https://doi.org/10.1016/S0034-4877\(17\)30061-7](https://doi.org/10.1016/S0034-4877(17)30061-7)
36. Aksoylu B., Beyer H. R., Celiker F., 2017, *Application and Implementation of Incorporating Local Boundary Conditions into Nonlocal Problems*, Numerical Functional Analysis and Optimization, **38**, Issue 9, 1077-1114, <https://doi.org/10.1080/01630563.2017.1320674>
35. Beyer H. R., Aksoylu B., Celiker F., 2016, *On a Class of Nonlocal Wave Equations from Applications*, J. Math. Phys., **57**, 062902, 1-28, doi:10.1063/1.4953252.
34. Beyer H. R., Alcubierre M., Megevand M., Carlos Degollado J. C. 2013, *Stability study of a model for the Klein-Gordon equation in Kerr space-time*, Gen Relativ Gravit, **45**, 203-227, doi:10.1007/s10714-012-1470-0.
33. Beyer H. R., 2011, *On the stability of the massive scalar field in Kerr space-time*, J. Math. Phys., **52**, 102502, 1-21.
32. Beyer, H. R., 2010, *On the stability of the scalar field in the gravitational field of a rotating (Kerr) black hole*, AIP Conf. Proc., **1256**, 139-153.
31. Aksoylu B., Beyer H. R., 2010, *Results on the diffusion equation with rough coefficients*, SIAM J. Math. Anal., **42**:1, 406-426.
30. Aksoylu, B. and Beyer, H. R., 2009, *On the Characterization of Asymptotic Cases of the Diffusion Equation with Rough Coefficients and Applications to Preconditioning*, Numer. Funct. Anal. Optim., **30**:5, 405-420.
29. Colaiuda, A., Beyer, H., Kokkotas, K. D., 2009, *On the quasi-periodic oscillations in magnetars*, Mon. Not. R. Astron. Soc., **396**, 1441-1448.

28. Beyer H. R., 2009, *A note on the Klein-Gordon equation in the background of a rotating black hole*, J. Math. Phys., **50**, 012502, 1-9.
27. Beyer H. R., Craciun I., 2008, *On a new symmetry of the solutions of the wave equation in the background of a Kerr black hole*, Class. Quantum Grav., **25**, 135014, 1-13.
26. Vavoulidis M., Stavridis A., Kokkotas K. D., Beyer H., 2007, *Torsional oscillations of slowly rotating relativistic stars*, Mon. Not. R. Astron. Soc., **377**, 1553-1556.
25. Beyer H. R., 2006, *Results on the spectrum of R-Modes of slowly rotating, relativistic stars*, Class. Quantum Grav., **23**, 2409-2425.
24. Beyer H. R., Sarbach O., 2004, *On the well posedness of the Baumgarte - Shapiro - Shibata - Nakamura formulation of Einstein's field equations*, Phys. Rev. D, 104004,1-11.
23. Kempfle S., Beyer H., 2003, *The Scope of a Functional Calculus Approach to Fractional Differential Equations*, in: Begehr H. G. W., Gilbert R. P., Wong M. W. (eds.), Progress in Analysis, Proceedings of 3rd International ISAAC Congress 2001 in Berlin, World Scientific, Singapore, 69-81.
22. Beyer H., 2003, *On the Stability of the Kerr Black Hole*, in: Tsagas Gr., Spyrou N., Papadopoulos D. (eds.), Proc. of the conference on Applied Differential Geometry, Lie Algebras - General Relativity, Thessaloniki 2000, 69-80.
21. Watts A. L., Andersson N., Beyer H., Schutz B. F., 2003, *The oscillation and stability of differentially rotating spherical shells: The normal-mode problem*, Mon. Not. R. Astron. Soc., **342**, 1156-1168.
20. Kempfle S., Schaefer I., Beyer H., 2002, *Fractional Calculus via Functional Calculus: Theory and Applications*, Nonlinear Dynamics, **29**, 99-127.
19. Kempfle S., Schaefer I., Beyer H., 2002, *Functional calculus and a link to fractional calculus*, Fractional Calculus and Applied Analysis, **5**, 411-426.
18. Beyer H. R., 2002, *A framework for perturbations and stability of differentially rotating stars*, Proc. Roy. Soc. Lond. A, **458**, 359-380.
17. Kempfle S., Schaefer I., Beyer H., 2001, *Fractional differential equations and viscoelastic damping*, Proc. of the European Control Conference 2001, 1744-1751.
16. Beyer H. R., 2001, *On the stability of the Kerr metric*, Commun. Math. Phys., **221**, 659-676.
15. Beyer H. R., 2000, *On some vector analogues of Sturm-Liouville operators*, in: T. M. Rassias (ed.), Mathematical analysis and applications, Hadronic Press, Palm Harbor, 11-35.
14. Beyer H. R., Kokkotas K. D., 1999, *On the r-mode spectrum of relativistic stars*, Mon. Not. R. Astron. Soc., **308**, 745-750.
13. Beyer H. R., 1999, *On the completeness of the quasinormal modes of the Pöschl-Teller potential*, Commun. Math. Phys., **204**, 397-423.
12. Kempfle S., Beyer H. R., 1998, *Global and causal solutions of fractional differential equations*, in: Rusev P., Dimovski I., Kiryakova V. (eds.), Proceedings of the 2nd int. workshop on Transform methods & Special functions, Varna 1996, IMI-BAS, Sofia, 210-226.
11. Beyer H. R., 1995, *The spectrum of radial adiabatic stellar oscillations*, J. Math. Phys., **36**, 4815-4825.
10. Beyer H. R., 1995, *The spectrum of adiabatic stellar oscillations*, J. Math. Phys., **36**, 4792-4814.
09. Beyer H. R., Schmidt B. G., 1995, *Newtonian stellar oscillations*, Astronomy & Astrophysics, **296**, 722-726.

08. Beyer H. R., Kempfle S., 1995, *Definition of physically consistent damping laws with fractional derivatives*, Z. angew. Math. Mech. (ZAMM), **75**, 623-635.
07. Beyer H. R., Kempfle S., 1994, *Dämpfungsbeschreibung mittels gebrochener Ableitungen*, (Description of damping by means of fractional derivatives), Z. angew. Math. Mech. (ZAMM), **74**, 657-660.
06. Beyer H. R., 1991, *Zur kanonischen lokalen Quantisierung des freien neutralen Skalarfeldes auf einer statischen Raum-Zeit* (On the canonical local quantization of the free scalar field on a static spacetime), Dissertation (PhD thesis), Hamburg, 78pp.
05. Beyer H. R., 1991, *Remarks on Fulling's quantization*, Class. Quantum Grav., **8**, 1091-1112.
04. Beyer H. R., Nitsch J., 1990, *A note on a Casimir effect in a uniformly accelerated reference frame*, Found. Phys., **20**, 459-469.
03. Beyer H. R., Nitsch J., 1986, *The non-relativistic COW experiment in the uniformly accelerated reference frame*, Phys. Lett. B, **182**, 211-215.
02. Nitsch J., Beyer H. R., 1983, *The influence of gravity and inertia on neutron interference experiments*, Mitt. Astr. Ges., **58**, 166-172.
01. Beyer H. R., Nitsch J., 1983, *The COW experiment in the uniformly accelerated reference frame*, Phys. Lett. B, **127**, 336-340.



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Â About Horst. Born in Germany he studied History of Art and later on got specialized as a computer professional, always cultivating his passion for art and painting since he was a child. Home>Professors >Master of Science in Aerospace Engineering >Prof. Dr.-Ing. Horst Baier. Prof. Dr.-Ing. Horst Baier. Professor. PhD. Email: baier@tum.de. Research Interests. Adaptive and shape variable structures; hybrid materials structures; multidisciplinary model based design optimisation methods; precision dimensionally stable structures; cryogenic structures. Research Projects. Horst R. Beyer, PHD, is Professor of Mathematics at the Institute for Physics and Mathematics at the University of Michoacan (Mexico). Dr. Beyer has written numerous published articles in his areas of research interest, which include functional analysis, operator theory, partial differential equations, and semigroup theory. Country of Publication. United States. Author. Horst Reinhard Beyer. Topic. Mathematics & Sciences.Â Calculus and Analysis: A Combined Approach by Horst Reinhard Beyer (Hardback, 2010). Be the first to write a reviewAbout this product. Brand new: Lowest price.