

# DAVID W. HOBILL

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## POST-SECONDARY EDUCATION

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<b>University of Victoria</b> Ph.D. in Physics (Gravitational Waves from Two-Body Collisions)	<i>June 1980</i>
<b>University of Calgary</b> M.Sc. in Physics (Electromagnetic Radiation Recoil)	<i>June 1974</i>
<b>Worcester Polytechnic Institute</b> B.S. in Physics (Cosmic Ray Spallations in Nuclear Emulsions)	<i>June 1971</i>
<b>Bridgewater State College (MA)</b> Diploma in Biology	<i>June 1967</i>

## WORK EXPERIENCE

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<b>University of Calgary</b> <i>Professor Emeritus, Physics and Astronomy</i>	<i>July 2022 - Present</i>
<b>University of Calgary</b> <i>Professor, Physics and Astronomy</i>	<i>July 2019 - June 2022</i>
<b>Middle Eastern Technical University, Ankara, Turkey</b> <i>Visiting Research Professor, Mathematical Physics</i>	<i>Jan 2007 - May 2007</i>
<b>Observatoire de Paris, Meudon, France</b> <i>CNRS Poste Orange (Visiting Scientist), Gravitation</i>	<i>July 2000-July 2001</i>
<b>University of Calgary</b> <i>Associate Professor, Physics and Astronomy</i>	<i>July 1999 - June 2019</i>
<b>University of Calgary</b> <i>Assistant Professor, Physics and Astronomy</i>	<i>July 1994 - July 1999</i>
<b>University of Calgary</b> <i>Instructor II, Physics and Astronomy</i>	<i>July 1991 - July 1994</i>
<b>National Center for Supercomputing Applications, Univ. of Illinois</b> <i>Senior Research Scientist, Head, Numerical Relativity Division</i>	<i>June 1989 - June 1991</i>
<b>National Center for Supercomputing Applications, Univ. of Illinois</b> <i>Research Associate, Numerical Relativity Division</i>	<i>Jan 1987 - June 1989</i>
<b>Stevens Institute of Technology, Hoboken NJ</b> <i>Instructor, Physics</i>	<i>Jan 1986 - June 1986</i>
<b>Stevens Institute of Technology, Hoboken NJ</b> <i>NSF Postdoctoral Fellow, Physics</i>	<i>Sept 1983 - Dec 1986</i>
<b>Institut Henri Poincaré, Paris, France</b> <i>NATO-NSERC Postdoctoral Fellow, Physics</i>	<i>Sept 1980 - Aug 1983</i>

**Cariboo College, Kamloops, BC**  
*Sessional Instructor, Physics*

*Sept 1975 - Aug 1976*

**University of Calgary**  
*Research Assistant, International Hydrological Decade*

*Sept 1974 - Aug 1975*

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## PROFESSIONAL SERVICE: NATIONAL AND INTERNATIONAL

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**Canadian Association of Physicists** *2022 - Present*  
*CAP Governance Committee, Councillor-at-Large*

**Canadian Association of Physicists** *2018 - 2022*  
*CAP Council, Alberta NWT Regional Representative*

**Canadian Association of Physicists** *2009 - 2022*  
*Friends of CAP, UofC representative*

**WestGrid** *1998 - 2008*  
*Member, Advisory Council*

**Canadian Journal of Physics** *1996 - 2007*  
*Member, Editorial Board*

**US National Science Foundation, Gravitational Physics Division** *2000 - 2001*  
*Member, Grant Selection Committee*

**European Research Network** *2000 - 2001*  
*Member, "Sources of Gravitational Waves", Advisory Committee*

**Canadian Association of Physicists** *1998 - 2000*  
*Chair, Division of Theoretical Physics*

**NSERC-CAP** *1997 - 1999*  
*Member, NSERC-CAP Liaison Committee*

**NSERC** *1997 - 1999*  
*Member, Grant Selection Committee #17, (Chair - 1999)*

**Canadian Committee on Gen. Rel. and Rel. Astrophysics** *1995 - 2000*  
*Member, (Chair 1997-99)*

**US National Science Foundation, Gravitational Physics Division** *1990 - 1991*  
*Member, Grant Selection Committee*

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## PROFESSIONAL SERVICE: UNIVERSITY OF CALGARY

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**Faculty of Science: Executive Committee** *2016 - 2018*  
*PHAS Representative*

**Department of Physics and Astronomy: Head's Advisory Committee** *2016 - 2017*  
*Member*

**Faculty of Science: UofC 50th Anniversary Planning Committee** *2015 - 2016*  
*PHAS representative*

**Faculty of Science: Equity and Diversity Working committee** *2014 - 2015*  
*PHAS representative*

<b>Faculty of Science: Academic Appeals Committee</b> <i>PHAS representative, Co-Chair 2017-2018</i>	<i>2013 - 2018</i>
<b>Department of Physics and Astronomy: Outreach Committee</b> <i>Chair 2010-2015</i>	<i>2010 - 2020</i>
<b>Inst. for Quantum Science &amp; Technology Advisory Council</b> <i>Member</i>	<i>2008 - Present</i>
<b>Faculty of Science: IT Committee</b> <i>Chair</i>	<i>2005 - 2007</i>
<b>Faculty of Graduate Studies: Policy Committee</b> <i>FOS Representative</i>	<i>2003 - 2006</i>
<b>UofC Pacific Institute of Mathematical Sciences Steering Committee</b> <i>Member</i>	<i>2003 - 2006</i>
<b>UofC Research Grants Committee</b> <i>Member</i>	<i>2001 - 2005</i>
<b>Faculty of Graduate Studies: Council</b> <i>PHAS Representative</i>	<i>1999 - 2006</i>
<b>Department of Physics and Astronomy: Graduate Affairs Committee</b> <i>Chair 1999-2006</i>	<i>1997 - 2006</i>
<b>Department of Physics and Astronomy: IT Committee</b> <i>Chair 1998-2002</i>	<i>1996 - 2002</i>

## NATIONAL AND INTERNATIONAL CONFERENCE ORGANIZATION

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<b>Canadian Association of Physicists Congress, Calgary</b> <i>Member, Organizing Committee</i>	<i>June 2012</i>
<b>13th Can. Conf. on General Relativity and Relativistic Astrophysics, Calgary</b> <i>Co-Chair, Organizing Committee</i>	<i>May 2009</i>
<b>American Astron. Soc. Symposium, "Short Period Binary Stars", Calgary</b> <i>Member, Organizing Committee</i>	<i>June 2006</i>
<b>Canadian Association of Physicists Congress, Victoria, BC</b> <i>Member, Technical Program Committee</i>	<i>June 2001</i>
<b>PIMS Research Workshop "Invariants on 3-Manifolds", Morley, AB</b> <i>Co-Chair, Organizing Committee</i>	<i>July 1999</i>
<b>7th Can. Conf. on General Relativity and Relativistic Astrophysics, Calgary</b> <i>Chair, Organizing Committee</i>	<i>June 1997</i>
<b>Canadian Association of Physicists Congress, Calgary</b> <i>Member, Organizing Committee</i>	<i>June 1997</i>
<b>NATO ARW "Deterministic Chaos in General Relativity", Kananaskis</b> <i>Director and Chair, Organizing Committee</i>	<i>July 1994</i>
<b>High Performance Computing Symposium, Calgary</b> <i>Member, Technical Committee, Opening of Calgary High Performance Computing Centre</i>	<i>June 1993</i>

## CONSULTING

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<b>Parks Canada, Ottawa</b> <i>Banff Cosmic Ray Station: Directory of Federal Heritage Designations</i>	2022
<b>Parks Canada, Banff National Park</b> <i>Sulphur Mt. Signage: History of the Banff Cosmic Ray Station</i>	2015 - 2016
<b>Calgary High Performance Computing Consortium</b> <i>Vectorization Methods for Fujitsu VPX240/10 Supercomputer</i>	1991 - 1993
<b>Symbolics Inc. Boston</b> <i>Tensor Analysis Programming for MACSYMA software</i>	1988 - 1991
<b>Myrias Research Corp. Edmonton</b> <i>Parallelization of Large Scale Dynamical Systems Codes</i>	1988 - 1990

## RESEARCH INTERESTS

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- General Relativity: Black Holes, Gravitational Lensing, Gravitational Radiation, Cosmological Models
- Dynamics of Complex Systems: Self-Similarity, Scaling Behaviour, Spatio-Temporal Chaos
- Modelling Biological Systems: Growth of Leaves and Petals, Fractal Structure, Evolutionary Processes
- Computational Physics: Time dependent Systems, Ordinary and Partial Differential Equations
- Quantum Information Science: Quantum Communication, Information Dynamics, Relations to Gravity
- Geometry and Topology: Riemannian Geometry, Ricci Flow, Kähler Geometries
- Plasma Physics: Auroral Structure Formation, Magnetohydrodynamics

## GRANTS AND CONTRACTS

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- NSERC Discovery Grant “Dynamical Riemannian Geometries” (5 yr @ \$21,000/yr) (2017 - 2022)
- NSERC Discovery Grant “Dynamics of Riemannian Geometries” (5 yr @ \$18,000/yr) (2011 - 2016)
- iCORE Graduate Grant, w/J Pulwiczki “Computational Botany” (4 yr @ \$41,000/yr) (2009 - 2013)
- NSERC Discovery Grant “Computational Geometrodynamics” (3 yr @ \$23,100/yr) (2006 - 2009)
- NSERC Discovery Grant “Numerical Studies in Relativity” (4 yr @ \$26,500/yr) (2002 - 2006)
- iCORE Recruitment Grant, w/R Cleve “Quantum Information” (\$10,000) (2001)
- iCORE Recruitment Grant, w/E Couch “Financial Mathematics” (\$10,000) (2000)
- PIMS Conference Grant, w/J Bryden P Zvengrowski, “Invariants on 3-Manifolds” (\$19,000) (1999)
- NSERC Discovery Grant “Computational General Relativity” (4 yr @ \$33,000/yr) (1997 - 2001)
- NATO Conference Grant “Deterministic Chaos in General Relativity” (\$23,500) (1994)
- NSERC Discovery Grant “Numerical Relativity” (3 yr @ \$18,000/yr) (1993 - 1996)

## PUBLICATIONS (student contributions in sans serif font)

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### A. Papers in refereed journals

- A Ragoonundun and D Hobill, “Stability Analysis of Tolman-VII Type Solutions for Compact Stars” submitted to *Journal of General Relativity and Gravitation* (Sept 2020)
- J Pulwiczki and D Hobill, “*Acetabularia* Growth, A Geometric Model”, submitted to *Journal of Mathematical Biology* (July 2020)

- A Masterson and D Hobill, “Critical Parameterization of Brill Wave Initial Data” re-submitted *Physical Reviews, D* (Feb 2020) (arXiv:1809.05179)
- MS Bryant and D Hobill, “Bianchi IX cosmologies and the golden ratio” *Classical and Quantum Gravity*, **34** (12), 125010, (2017)
- M Bryant and D Hobill, “Golden-Ratio-Based Rectangular tilings” *The Fibonacci Quarterly* **55**, 137-146 (2017) (arXiv:1611.01182)
- J Pulwiczki and D Hobill, “The dynamics of root growth: a geometric model” *Bulletin of Mathematical Biology* **79** (8), 1820-1845 (2017)
- AM Ragoonundun and DW Hobill, “Possible physical realizations of the Tolman VII solution” *Physical Review D* **92** (12), 124005, (2015)
- H Dale, A Runions, D Hobill and P Prusinkiewicz, “Modelling biomechanics of bark patterning in grass trees” *Annals of Botany*, **114** (4), 629-641 (2014)
- Z Horváth, LA Gergely, D Hobill, S Capozziello, and M De Laurentis, “Weak gravitational lensing by fourth order gravity black holes” *Physical Review D* **88** (6), 063009 (2013) (arXiv:1207.1823)
- Z Horváth, LA Gergely, and D Hobill, “Image formation in weak gravitational lensing by tidal charged black holes” *Classical and Quantum Gravity* **27** (23), 235006, (2010)
- W Guo and D Hobill “Cosmology without dark energy: Weyl curvature solutions” *Canadian Journal of Physics* **86** (4), 571-577 (2008)
- S Kauffman, RK Logan, R Este, R Goebel, D Hobill and Shmulevich, “Propagating organization: An enquiry” *Biology & Philosophy* **23** (1), 27-45 (2008)
- P Anninos, D Hobill, E Seidel, L Smarr, WM Suen “3+1 Methods for Colliding Black Holes” *Fields Inst. Comm.* **15**, 151 (1997)
- D Hobill, M Szydlowski, “Deterministic Chaos in General Relativity” *Classical and Quantum Gravity* **12** (4), 1113-1118, (1995)
- P Anninos, D Hobill, E Seidel, L Smarr, WM Suen “Head-on collision of two equal mass black holes” *Physical Review D* **52**, (4), 2044, (1995)
- P Anninos, D Bernstein, S Brandt, D Hobill, E Seidel, L Smarr “Oscillating apparent horizons in numerically generated spacetimes” *Australian Journal of Physics* **48**, (6), 1027-1044 (1995)
- D Bernstein, D Hobill, E Seidel, L Smarr “Initial data for the black hole plus Brill wave spacetime” *Physical Review D* **50** (6), 3760 (1994)
- P Anninos, D Bernstein, SR Brandt, D Hobill, E Seidel, L Smarr “Dynamics of black hole apparent horizons” *Physical Review D* **50** (6), 3801 (1994)
- D Bernstein, D Hobill, E Seidel, L Smarr, J Towns “Numerically generated axisymmetric black hole spacetimes: Numerical methods and code tests” *Physical Review D*, **50** (8), 5000 (1994)
- R d’Inverno, D Hobill “Approaches to numerical relativity” *Classical and Quantum Gravity* **11** (10), 2615 (1994)
- P Anninos, D Hobill, E Seidel, L Smarr, WM Suen, “Collision of two black holes” *Physical Review Letters* **71** (18), 2851 (1993)
- P Anninos, M Bajuk, E Seidel, L Smarr, D Hobill, “Visualizing black hole space-times” *IEEE Computer Graphics and Applications*, **13** (1), 13-18 (1993)
- A Abrahams, D Bernstein, D Hobill, E Seidel, L Smarr, “Numerically generated black-hole spacetimes: Interaction with gravitational waves” *Physical Review D* **45** (10), 3544 (1992)
- D Hobill, “Sources of chaos in mixmaster cosmologies” *Annals of the New York Academy of Sciences* **631**, 15-30 (1991)
- D Hobill, D Bernstein, M Welge, D Simkins “The Mixmaster cosmology as a dynamical system” *Classical and Quantum Gravity* **8** (6), 1155 (1991)
- CR Evans, LS Finn, DW Hobill, JP Muckey, “Recent Advances in Numerical Relativity” *Astronomische Nachrichten* **31**, 350 (1990)
- CR Evans, DW Hobill “Computational Physics: Numerical Relativity” *Science* **247**, 1128-1129, (1990)

- D Hobill “ADM: A MACSYMA Package for Deriving the Equations of Numerical Relativity”, *MACSYMA Newsletter* **7** (1) 1-14 (1990)
- L Smarr, D Hobill, D Bernstein “Shedding light on black holes” *Future Generation Computer Systems* **5**, (2-3), 225-242, (1989)
- D Bernstein, D Hobill, L Smarr “Slicing the Schwarzschild Spacetime” *General relativity and gravitation* **21** (9), 304-311 (1989)
- JL Anderson and DW Hobill “A Study of nonlinear radiation damping by matching analytic and numerical solutions” *Journal of Computational Physics* **75** (2), 283 (1988)
- JL Anderson, DW Hobill “Numerical methods for radiating particles in general relativity” *Journal of Computational Physics* [**74**, (5) 498 (1987)
- JL Anderson, DW Hobill “Mixed analytic-numerical solutions for a simple radiating system” *General relativity and gravitation* **19** (6), 563-580 (1987)
- DW Hobill “ On integrating Einstein’s equations using the Bondi metric ” *General relativity and gravitation* **19** (2), 121-133 (1987)
- DW Hobill “Axially symmetric gravitational radiation from isolated sources” *Journal of mathematical physics* **25** (12), 3527-3537 (1984)
- FI Cooperstock, DW Hobill “Gravitational radiation and the motion of bodies in general relativity” *General Relativity and Gravitation* **14** (4), 361-378 (1982)
- FI Cooperstock, DW Hobill “ Gravitational radiation from the propulsion of bodies in a line” *Physics Letters A* **84** (6), 297-300 (1981)
- FI Cooperstock, DW Hobill “Free-fall sources of gravitational radiation and the failure of the quadrupole formula” *The Astrophysical Journal* **235**, L55 (1980)
- FI Cooperstock, DW Hobill “Axially symmetric two-body problem in general relativity. III. Bondi mass loss and the failure of the quadrupole formula” *Physical Review D*, **20**, (12), 2995 (1979)
- FI Cooperstock, DW Hobill “ Detection of relative motion in a gravitational field” *Physics Letters A* **72** (2), 69-70 (1979)
- FI Cooperstock, DW Hobill “Enhanced electromagnetic radiation recoil” *Physics Letters A* **60** (3), 168-170 (1977)

## **B. Published Proceedings of Conferences and Workshops**

- J Hanan, HJ Dale, A Runions, D Hobill, P Prusinkiewicz, “Functional-structural modelling with L-systems: Where from and where to” in *Proc. of 7th Conf. on Functional-Structural Plant Models*, (Sievanen, R., Nikinmaa, E., Godin, C., Lintunen, A., and Nygren, P., editors), PKP Pub., Saariselkä, Finland (2013)
- H Dale, A Runions, D Hobill and P Prusinkiewicz, “A theory of of grasstree bark patterning” in *Proc. of 7th Conf. on Functional-Structural Plant Models*, (Sievanen, R., Nikinmaa, E., Godin, C., Lintunen, A., and Nygren, P., editors), PKP Pub., Saariselkä, Finland (2013)
- J Kollar, J Pulwiczki, and D Hobill, “Gravitational Lensing in Compact Binary Systems”, in *Short-Period Binary Stars: Observations, Analyses, and Results*, (E. Milone, D. Leahy, and D. Hobill, editors), Springer-Verlag, Berlin (2008)
- D Hobill and P Webster “The Brill wave initial-value problem” *AIP Conference Proceedings* (C. Burgess and R. Myers, editors) **493** (1), 306-310, (1999)
- P Webster and D Hobill, “Dynamic Brill wave spacetimes”, *AIP Conference Proceedings* (C. Burgess and R. Myers, editors) **493** (1), 311-316 (1999)
- D Hobill, “Deterministic Chaos and Bianchi Cosmologies” in *Dynamical Dynamical Systems in Cosmology* (Wainwright, J., and Ellis, G.F.R., editors), Cambridge U Press, Cambridge UK, (1997)
- P Anninos, D Hobill, E Seidel, L Smarr, and WM Suen, “When Black Holes Collide”, in *Proc. Sixth Canadian Conference on General Relativity and Relativistic Astrophysics*, (S. Braham, J. Gegenberg, and R. McKellar, editors, American Mathematical Society, Providence, RI, (1997)

- P Anninos, DW Hobill, HE Seidel, LL Smarr, and WM Suen “Head-on Collisions of Two Black Holes” *Computational Astrophysics; 12th Kingston Meeting on Theoretical Astrophysics* (D. Clarke, and M. West, editors) Astronomical Soc. Pacific Conf. Ser. Vol. 123), (1997)
- TD Creighton and DW Hobill “Continuous Time Dynamics and Iterative Maps of Expansion Normalized Variables for Mixmaster Cosmologies” in *Proceedings of the Seventh Marcel Grossman Meeting* (R. Janson, G.M. Keiser and R. Ruffini editors), World Scientific Pub, Singapore, (1996)
- DW Hobill, “Numerical Simulations of Strong Gravitational Fields” *AIP Conference Proceedings* (G. Gonzales, editor) **342** (1), 499-505, (1995)
- D Bernstein, D Hobill, E Seidel, L Smarr, J Towns “Gravitational Waves from Dynamic Black Hole Spacetimes” in *Proceedings of the 5th Canadian Conference on General Relativity and Relativistic Astrophysics*, (R. Mann and R. McLenaghan, editors) World Scientific Pub, Singapore, 98-112 (1993)
- D Bernstein, D Hobill, E Seidel, L Smarr, “Dynamical Black Hole spacetimes” in *Proceedings of the 6th Marcel Grossmann Meeting on General Relativity*, (H. Sato, T. Nakamura and R. Ruffini, editors), World Scientific Pub, Singapore (1992)
- D Bernstein, D Hobill, E Seidel, L Smarr, J Towns “Computing Dynamical Black Hole Spacetimes” in *Proceedings of Supercomputing Symposium '92*, (M. Dansereau, editor) Environment Canada, Ottawa, (1992)
- D Hobill “Chaotic behaviour in Mixmaster cosmologies.” in *Proceedings of the 6th Marcel Grossmann Meeting on General Relativity*, (H. Sato, T. Nakamura and R. Ruffini, editors), World Scientific Pub, Singapore (1992)
- D Hobill “Computational methods for vacuum spacetimes” *Banff Summer Institute on Gravitation*, (R. Mann and P. Wesson, editors) World Scientific Pub, Singapore, 98-112 (1991)
- D Bernstein, D Hobill, L Smarr “Numerical Methods for Computing Black Holes spacetimes” *Proceedings of the 12th International Conference on General Relativity and Gravitation* (N. Ashby, D. Bartlett, and W. Wyss, editors), Cambridge University Press, Cambridge, (1990)
- JL Anderson, D Hobill “Matched analytic-numerical solutions of wave equations” in *Dynamical Spacetimes and Numerical Relativity*, (J. Centrella editor), Cambridge University Press, Cambridge 389-410 (1986)
- D Hobill “Rayonnement gravitationnel des sources bornées”, in *Journées Relativistes: 1981*, Institut Fourier, Grenoble, (1981)

### C. Full Chapters in Edited Volumes

- DW Hobill “Deterministic Chaos and Bianchi Cosmologies” in *Dynamical systems in cosmology*, (J. Wainwright and G.F.R. Ellis, editors), Cambridge University Press, Cambridge, (1997).
- P Anninos, D Bernstein, D Hobill, E Seidel, L Smarr, J Towns “Numerical methods for black hole collisions”, in *Computational Astrophysics: Gas Dynamics and Particle Methods*, (W. Benz, J. Barnes, E. Muller and M. Norman, editors) Springer-Verlag, New York (1994)
- D Hobill “A brief review of deterministic chaos in general relativity” in *Deterministic Chaos in General Relativity*, (edited by D. Hobill, A. Burd, A. Coley), Plenum Press, New York, (1994)
- TD Creighton, DW Hobill “Continuous Time Dynamics and Iterative Maps of Ellis-MacCallum-Wainwright Variables” in *Deterministic Chaos in General Relativity*, (edited by D. Hobill, A. Burd, A. Coley), Plenum Press, New York, (1994)
- DW Hobill, LL Smarr “Supercomputing and numerical relativity: A look at the past, present and future” in *Frontiers in Numerical Relativity*, (C. Evans, L.S Finn, D. Hobill, editors), Cambridge University Press, Cambridge, 1-17 (1989)
- D Bernstein, D Hobill, L Smarr “Black hole spacetimes: Testing numerical relativity” in *Frontiers in Numerical Relativity*, (C. Evans, L.S Finn, D. Hobill, editors), Cambridge University Press, Cambridge, 57-73 (1989)

## D. Books edited

- EF Milone, DA Leahy, DW Hobill *Astrophys. Space Sci. Libr. Vol. 352, Short-Period Binary Stars: Observations, Analyses, and Results* Springer, Berlin (2008)
- D Hobill, A Burd, AA Coley *NATO Advanced Study Institute series. Series B, Physics, Deterministic chaos in general relativity* Plenum Press, New York, (1994) Re-issued by Springer Science & Business Media New York (2013)
- CR Evans, LS Finn, DW Hobill *Frontiers in numerical relativity* Cambridge University Press, Cambridge (1989) Re-issued by Cambridge University Press (2011)

## E. Scientific Visualization Videos

- DW Hobill, DS Phillips, “Normalized Curvature Oscillations in Bianchi-IX Cosmologies”, University of Calgary (1993) (unpublished)
- D Hobill, D Bernstein, L Smarr, D Cox, R Idaszak, “Numerical Relativity: Black Hole Spacetimes” (5:26), *ACM SIGGRAPH Video Review* **49** (7), (1989).  
D Hobill, D Simkins, M Welge, J Yost, “The Lorenz Attractor” (17:43), *ACM SIGGRAPH Video Review* **49** (8), (1989).

## F. arXiv pre-prints not listed in journal publications

- AM Raghoonundun, DW Hobill “Self-gravitating charged fluid spheres with anisotropic pressures” arXiv preprint arXiv:1603.03373 (2016)
- AM Raghoonundun, DW Hobill “The geometrical structure of the Tolman VII solution arXiv preprint arXiv:1601.06337 (2016)
- T Wang, D Hobill “Is the Preferred Basis selected by the environment?” arXiv preprint arXiv:1412.2852 (2014)
- J Pulwiski, D Hobill “The Dynamical Riemannian Geometry of Plant Growth” arXiv preprint arXiv:1010.0475 (2010)
- J Burke, D Hobill “New Physically Realistic Solutions for Charged Fluid Spheres ” arXiv preprint arXiv:0910.3230 (2009)
- J Briet, D Hobill “Determining the dimensionality of spacetime by gravitational lensing” arXiv preprint arXiv:0801.3859 (2008)
- P Anninos, D Hobill, E Seidel, L Smarr, WM Suen “The head-on collision of two equal mass black holes: Numerical methods” arXiv preprint gr-qc/9408042 (1994)

## G. Technical Reports

- P Anninos, D Hobill, E Seidel, L Smarr, WM Suen “Numerical Methods for the 3+1 (ADM) Equations” *Technical Report No. 24* National Center for Supercomputing Applications (unpublished) (1993)

## SELECTED INVITED TALKS AND EXTERNAL COLLOQUIA

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### A. Invited Talks

- “Golden Ratio Solutions to the Einstein Equations” Theory Canada 10, Calgary (June 2015)
- “Ricci Flow and the Geometry of Plant Growth” PIMS Research Workshop: Geometric Flows: Recent Developments and Applications, Banff (May 2015)
- “Exploring the Properties of Black Holes in General Relativity and Alternative Theories”, Black Holes IX, Saskatoon (May 2013)
- “Exact Solutions for Neutron Star Structure” CAP Congress 2012, Calgary (June 2012)
- “Vacuum Gravity and Dark Energy” Theory Canada 3, Edmonton (June 2007)
- “Distributed Analysis of Large Data Sets in Astrophysics” High Performance Computing Symposium 2006, St Johns (May 2006)



- “Search for Higher Dimensions using Gravitational Lensing” PIMS Research Workshop: The Dark Side of Extra Dimensions, Banff (June 2005)
- “Gravitational Radiation from Dynamical Black Holes” Black Holes I, Banff (June 1997)
- “Numerical Simulations of Strong Gravitational Fields” 1st Joint Meeting of the Canadian, American, Mexican Physics Societies, Cancun, Mexico (Sept 1994)
- “Numerical Solutions for Bianchi-IX Cosmologies” Workshop on a Dynamical Systems Approach in Cosmology, Cape Town, SA (July 1994)
- “Symbolic Algebra Manipulation for Numerical Computation” Physics Computing, ‘91, San Jose CA (June 1991)

### **B. External Colloquia**

- “A Geometric Theory of Plant Growth” Theoretical Physics Institute, University of Alberta (June 2019)
- “New Interior Solutions for Compact Stars” Physics Dept., University of Alberta (June 2009)
- “Numerical Simulations of the Generation of Gravitational Waves” Astronomy Dept., University of Toronto (June 2008)
- “Deterministic Chaos in General Relativity” Physics Dept., University of Victoria (Dec 2006)
- “Is the Mixmaster Cosmology Chaotic? Physics Dept. University of Lethbridge June 2006)
- “Einstein Play Dice: Chaos in General Relativity” CAP Lecture Tour (Memorial, Dalhousie, St. Marys, Acadia, St. Francis Xavier Universities (March 2006)
- “Numerical Relativity and Black Hole Dynamics” Physics Dept. Worcester Polytechnic Institute (May 1990)

## **PUBLIC OUTREACH**

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### **A. Live Presentations**

- “Einstein was right after all: Black holes, gravitational waves and the true nature of gravity” Royal Astron. Soc. Canada Calgary Public Library (May 16, 2019)
- “Nucleosynthesis in the Cosmos From the Beginning of Time to the End of a Star” Nuclear Science Week - Canadian Nuclear Association, RAO Priddis (Oct. 22, 2016)
- “The Dark Side of the Universe: The 50th Anniversary of the first Star Trek broadcast” Telus Spark, Calgary (Sept. 8, 2016)
- “A Cosmological Question and Answer Session” as the opening act for a Chad van Gaalen Concert Festival Hall, Calgary (Sept. 11, 2015)
- “Gravitational Lensing as a Way to Explore the Universe”, An Evening Celebrating Einstein Telus Spark, Calgary (March 13, 2014)
- “Extracting the Physics from Simulations in General Relativity” PIMS-Shell Lunchbox Lecture (March 23, 2005)
- “The non-linear dynamics of gravitating systems in general relativity” PIMS Spotlight lecture, Calgary (April 11, 2002)

### **B. Recorded Presentations for Broadcast Media**

- “Seeing a Black Hole” CTV Calgary Broadcast on the Event Horizon Telescope Announcement (April 10, 2019)
- “Remembering Stephen Hawking” CBC and CTV Calgary Broadcasts on the death of Stephen Hawking (March 16, 2018)
- “The optics of the *Wishing Well* Public Sculpture” CTV Calgary on visitors being burned by the focusing of sunlight inside the sculpture, (also interview with Calgary Herald) (Oct. 11, 2014)
- “Are all planets the same age as the Earth?” CBC-Radio *Quirks and Quarks* Question and Answer Broadcast, recorded (June 7, 2012)

- “Phase Space Analysis of Dynamical Systems” CBC-TV *The Nature of Things* Presentation and Video (w/ Mark Bajuk) (Nov. 21, 1990)
- “The Lorenz Attractor” PBS-TV *NOVA: The New Science of Chaos*, (video w/ D. Simkins, M. Welge and J. Yost) (Jan 31, 1989)

### C. High School Outreach Organizational Activities

- Particle Physics Masterclass for High School Students Coordination with CERN International Particle Physics Outreach Group (May 14, 2017)
- PHAS-High School Teacher Professional Development Day - Organizer, Pedagogical and Research presentations by PHAS Faculty, PostDocs and Grad Students offered each May since 2010

## GRADUATE STUDENT SUPERVISION

Student	Degree	Dates	Research Topic	Current Position
R. Bell	M.Sc.	2018- 2022	Neutron Stars	Ph.D. Student
B. Al-Kabouri	M.Sc.	2016- 2018	Grav. Lens Analogues	HS Teacher (Oman)
M. Bryant	Ph.D	2015- DNF	Plasma Physics	Tutor
J. Weisert	M.Sc.	2011-DNF	Cosmology	Retired
A. Raghoonundun	Ph.D.	2010-2017	Exact Solutions in GR	Analyst (McGill U)
J. Pulwicki	Ph.D.	2009-2017	Plant Growth	PostDoc (France)
M. Bryant	M.Sc.	2012-2014	Cosmology	Tutor
A. Masterson	Ph.D.	2002-2014	Brill Wave Collapse	IT Admin
H. Dale	M.Sc.	2012-2014	Plant Growth	Comp. Graphics Artist (NZ)
A. Raghoonundun	M.Sc.	2008-2010	Exact Solutions in GR	Analyst (McGill U)
J. Koller	Ph.D.	2003-DNF	Gravitational Lensing	Med. Imaging Tech.
C. Johnson	Ph.D.	2000-DNF	Charged fluid collapse	
W. Guo	Ph.D.	1999-2006	Cosmology	Pipeline Engineer
P. Webster	Ph.D.	1996-2000	Grav. Wave Collapse	Geophysics
A. Masterson	M.Sc.	2000-2002	Brill Wave IVP	IT Admin
J. Gomez	M.Sc.	1997-1999	Gravitational Lensing	Geophysics (USA)
P. Anninos	Ph.D.	1989-1993	Black Hole Collisions	US DOE Physicist
D. Bernstein	Ph.D.	1986-1991	Black Hole Collisions	Consultant (USA)

## EXTERNAL EXAMINER PH.D. THESES

- University of Lethbridge, Physics, Pasquale Bosso; “The Generalized Uncertainty Principle” (2016)
- University of Alberta, Physics, Abdallah M. Al Zahrani; “Escape of Charged Particles Moving around Weakly Magnetized Black Holes” (2014)
- University of Alberta, Physics, Patrick Connell; “Particle Propagation in Higher Dimensional Black Hole Spacetimes” (2009)
- University of Toronto, Astronomy, Parandis Khavari; “Aspects of Causality in the Parallelisable Implicit Evolution Scheme” (2008)
- University of Lethbridge, Physics, Morteza Ahmadi; “Aspects of Black Hole Physics” (2006)
- Monash University, (Melbourne), Mathematics, Elizabeth Stark; “Gravitoelectromagnetism and the Question of Stability” (2004)
- University of Alberta, Physics, Jean-Pierre deVilliers; “The Dynamics of Cosmic Strings in Black Hole Spacetimes” (1998)
- Dalhousie University, Mathematics, Robert van den Hoogen; “Qualitative analysis of cosmological models” (1995)

## PROFESSIONAL SOCIETY AND ASSOCIATION MEMBERSHIPS

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- International Society on General Relativity and Gravitation (Life Member)
- Canadian Association of Physicists
- American Physical Society
- American Association for the Advancement of Science

## COURSES TAUGHT: UNIVERSITY OF CALGARY

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The number of courses taught at this institution is large and varied, from introductory courses for first year students to very specific topics at the graduate level. A detailed list is provided below along with the term(s) during which they were taught.

### **PHYS 141** Computational Physics Lab

A block week course that taught basic computational physics programming using the Macintosh computer lab established originally for PHYS 333. This extended the computational methods originally introduced in PHYS 333 and introduced students to document preparation using LaTeX.

Winter 2000 1999 1998 (Block Week)

### **PHYS 201** Classical Physics I

Algebra based course in Newtonian mechanics of particles, extended objects, and introduction to wave motion and sound.

Fall 1994 1993 1992 1991, Winter 1995 1994 1993 1992

### **PHYS 203** Classical Physics II

Algebra based course in electricity and magnetism, DC and AC circuits, geometric optics and modern physics..

Fall 1993 1992 1991, Winter 1994 1993 1992

### **PHYS 205** Classical Physics I (formerly PHYS 201)

Replaced PHYS 201

Winter 1995

### **PHYS 255** Electromagnetic Theory I

Electricity and Magnetism for designed specifically for Physics and Astronomy students, calculus based course with a more theoretical approach. Course also includes a laboratory component.

Winter 2014 2013

### **PHYS 259** Electricity and Magnetism (for Engineering students)

Calculus based course for first year engineering students, similar in content to PHYS 255 but with a "laboratorial" component

Winter 2015 2011

### **PHYS 315** Fluids and Thermal Physics

Algebra based course for students in the sciences, introduction to fluid statics and dynamics, introduction to thermodynamics

Fall 1999 1998

### **PHYS 323** Optics and Electromagnetism

Calculus based course on topics in electricity and magnetism, behaviour of waves, geometric and physical optics, applications to optical instruments

Fall 2018

### **PHYS 333** Mathematical Physics I

Introduction to methods using complex variables and functions, matrix methods in geometric optics, Ordinary differential equations of first and second order, Fourier analysis (computational methods

introduced in 1997)

Winter 1998 1997 1996 1995 1994

**PHYS 335** Introduction to Computational Physics

Introduction to Linux operating system, numerical differentiation, integration, solutions to ordinary differential equations, GNUplot graphics, LaTeX document preparation

Fall 2004, Winter 2002 2000 1999

**PHYS 341** Classical Mechanics I

Newtonian dynamics of single particle systems with constant, time dependent, velocity dependent and spatially dependent forces, Forced, damped harmonic oscillator, phase space analysis, central forces, accelerating reference frames

Fall 2017 2016 2015 2006 2005 2004 2003 2002 1998

**PHYS 343** Classical Mechanics II

Multiple particle interactions, rotational motions of extended rigid bodies, Lagrangian and Hamiltonian methods

Winter 2017 2016 2006 2005 2003 2002

**PHYS 381** Computational Physics I (formerly PHYS 335)

Replaces PHYS 355 with the same material but with both C++ and FORTRAN programming

Winter 2009

**PHYS 481** Computational Physics II

Computational methods for matrix manipulation, more advanced computer graphics methods, structured programming, introduction to Monte Carlo methods (formerly PHYS 499)

Fall 2010 2009

**PHYS 499** Computational Physics II

See PHYS 481 but FORTRAN programming only

Winter 2009

**PHYS 501** Relativity Theory

special relativity and Minkowski diagrams, applications to electromagnetic theory, tensor analysis, introduction to general relativity

Fall 2006 2005 2001 2000 1998 1996, Winter 2017 2004 1997

**PHYS 533** Mathematical Physics II

Various topics chosen by students: second order differential equations, Sturm-Liouville theory, Laplace transforms, group theory, tensor analysis, special functions, separable partial differential equations

Fall 2008 1996 Winter 2002 1998

**PHYS 581** Computational Physics III

solutions to partial differential equations, stability analysis, applications in potential theory, fluid mechanics, electrodynamics, graphical methods for scientific visualization

Winter 2012

**PHYS 609** Advanced Classical Mechanics

Lagrangian methods with Lagrangian multipliers, generalized forces, Hamiltonian methods, Hamilton-Jacobi theory, Poisson Bracket methods, relation to quantum mechanics

Fall 2019 2014 2013 2012 Winter 2017 2012 2007

**PHYS 613** Electrodynamics

Fully relativistic dynamics of charged particles, Classical Field Theory, Lagrangian densities, Electromagnetic waves, Electromagnetic radiation from charge particles, Radiation reaction, relation to quantum mechanics

Fall 2011 2010 2003 1999 1995 1994 1993, Winter 2020 2019 2018 2016 2015 2014 2013 2010

**PHYS 629 Gravitation**

Review of Newtonian gravitation and its geometry, differential geometry, Einstein equations, applications to black holes, cosmology, gravitational waves

Fall 2018 2008 1993, Winter 1996

**PHYS 691.02 Graduate Seminar**

Preparation of scientific papers, presentation of scientific results for graduate students

Winter 1998

**PHYS 699 Independent Study** Various topics in physics, in both cases here the students were visitors from outside of Canada

Fall 1997, Winter 2018

**NUMBERED COURSES TAUGHT ELSEWHERE**

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**PEP 112** Electricity and Magnetism

Jan - June 1986 (Stevens Institute of Technology, Hoboken NJ)

**PHYS 043** Relativity and the Quantum: Theories of Modern Physics (Cont. Ed.)

Jan - May 1976 (Cariboo College, Kamloops)

**PHYS 101** Newtonian Mechanics

Sept-Dec 1975 (Cariboo College, Kamloops)

**EXTENDED TRAINING COURSES TAUGHT**

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**Computer Algebra Methods for Scientists and Engineers** Training Programme

Feb. - March 1989, (10 lectures) (National Centre for Supercomputing Applications)

**AWARDS**

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**Faculty of Graduate Studies Award: "GREATSupervisor"**

(2019)

**UofC Student's Union Award for Teaching Excellence** *Honorable Mention*

(1995-1996) and (2016-2017)

**UofC Student's Union Award for Teaching Excellence** *Nominations*

(1994-1995) and (2015-2016)