Walter Craig

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Spouse: Deirdre Haskell, Professor of Mathematics, McMaster University, Hamilton Ontario L8S 4K1, Canada

Date of Birth: November 28, 1953

Fields of Research:

nonlinear partial differential equations, Hamiltonian dynamical systems, fluid dynamics, quantum mechanics

Education:

A.B. in Mathematics, June 1977
University of California, Berkeley

M.S. in Mathematics, June 1979
Ph.D. in Mathematics, June 1981
Courant Institute of Mathematical Sciences, New York University

Employment:

07/2000 – present: McMaster University, Department of Mathematics and Statistics
Hamilton, Ontario, Canada
Professor and
Canada Research Chair of
Mathematical Analysis and its Applications

09/1988 – 06/2000: Brown University, Department of Mathematics
Providence, Rhode Island 02912
Associate Professor, Sept. 1988 – June 1991
Professor, July 1991 – June 2000
Lefschetz Center for Dynamical Systems, Sept. 1988 – June 1999
Department Chair, July 1997 – June 2000

09/1984 – 08/1988: Stanford University, Department of Mathematics
Stanford, California 94305
Assistant Professor

09/1981 – 08/1984: California Institute of Technology, Department of Mathematics
Pasadena, California 91125
Bantrell Fellow Sept. 1983 – Aug. 1984
Bateman Research Instructor Sept. 1981 – Aug. 1983

09/1978 – 06/1981: Courant Institute, New York University
New York 10012
Teaching Assistant
Research Assistant in numerical analysis

Honors:

1983: Bantrell Fellowship
1988: Alfred P. Sloan Fellowship
1988 – 1993: NSF Presidential Young Investigator
2005: Fellow, Fields Institute
2007: Fellow, Royal Society of Canada
2008: Fellow, American Association for the Advancement of Science
2009-2011: Killam Research Fellowship

Professional service:

Editorial Boards (current):

Communications in Contemporary Mathematics; 2006 - present.
Electronic Research Announcements in Mathematical Sciences; February 15 2007 - February 14 2016
Fields Institute, Editorial Board; 2001 - present.
Journal of Dynamics and Differential Equations; 2006 - present.
Mathematical Physics Electronic Journal; 2002 - present.
Mathematical Reports of the Royal Society of Canada; 2008 - present.
Nonlinear Differential Equations and Applications; 2008 - present.
Philosophical Transactions of the Royal Society - A: 2009 - 2014.
Proceedings of the AMS; Feb. 2005 - Jan. 2013.

Editorial Boards (past):

AMS, Graduate Studies in Mathematics; Feb. 2002 - Jan. 2008.
Canadian Mathematical Society, Journal and Bulletin; 2002 - 2007.
London Mathematical Society Monographs; 2004 - 2008.
Proceedings of the Royal Society - A; 2002 - 2008.
SIAM: Mathematical Analysis; 1998 - 2004.

American Mathematical Society:

Member of the Executive Committee; 2003 - 2006.
Member at Large of Council; 2000 - 2003.
Member of the Committee on the Profession; 2001 - 2004, (chair, 2003 - 2004).
Member of the Committee on Committees; 2003 - 2005.

American Association for the Advancement of Science:

Member 1985 - present
Member of the Steering Group, AAAS Section on Mathematics (A); 2004 - 2008.

Fields Institute, Toronto:

Scientific Advisory Panel; 2000 - 2005.
Nominations Committee; 2001 - 2005.
Board of Directors; 2009-2012.

Centre de Recherches Mathématiques, Montréal:

Comité Consultatif; 2001 - 2005.

Pacific Institute for the Mathematical Sciences, Vancouver:

Scientific Review Panel; 2007 - 2013.

Origins Institute: member, Steering Committee; 2004 - present.

Canada Research Chairs Program: member, College of Reviewers.

EPSRC (Great Britain): member, Peer Review College, 2006-2012.

Visiting professorships:

09/09 - 06/10: Université de Paris 7, France.
02/10: Ecole Normale Supérieure - Paris, France.
06/09: Université Cergy - Pontoise, France.
08/07: Jilin University, Changchun, China
05/07: Université Paul Sabatier - Toulouse, visiting professor
03/03 - 07/03: Université de Paris - Sud, Orsay, CNRS poste rouge
01/03 - 03/03: CEREMADE, Université de Paris - Dauphine, CNRS poste rouge
07/02 - 12/02: Mathematical Sciences Research Institute - Berkeley, member
07/00 - present: Fields Institute, visiting member
12/99 – 01/00: Institute of Mathematical Sciences, Chennai, India
05/99 – 06/99: International Centre for Mathematical Sciences, Edinburgh Scotland
06/98 – 07/98: ETH - Forschungsinstitut für Mathematik, Zürich, Switzerland
01/96 – 07/96: Institut des Hautes Etudes Scientifiques – Bures sur Yvette, France
08/95 – 12/95: CMLA, Ecole Normale Supérieure – Cachan, France
06/93: Department of Mathematics, Imperial College, London
01/91 – 12/91: Mathematical Institute, Oxford University
06/90: Département de Mathématique, Université de Paris 6, France
06/89: Laboratoire d'Analyse Numerique, Université de Paris–Sud, Orsay, France
03/88 – 08/88: Sonderforschungsbereich 256, Universität Bonn, West Germany
12/85: Department of Physics, Technion - Israel Institute of Technology, Haifa, Israel
08/84 – 10/84: Ecole Normale Supérieure – rue d'Ulm, Paris, France
10/84 – 12/84: ETH - Forschungsinstitut für Mathematik, Zürich, Switzerland
08/1981: Universidad Technica F. Santa Maria, Valparaiso, Chile

General Activities and Interests:

musician (contrabassist); mountaineering; molecular biology

Publications:

[1] "A bifurcation theory for periodic solutions of nonlinear dissipative hyperbolic equations," *Annali della Scuola Norm. Sup.-Pisa serie IV, Vol X,1*, pp. 125-167 (1983).

[2] "Pure point spectrum for discrete almost periodic Schrödinger operators," *Commun. Math. Phys.* **88** pp. 113-131 (1983).

[3] "Subharmonicity of the Lyaponov index," (with Simon, B.) *Duke Math. J.* **50** pp. 551-560 (1983).

[4] "Log Hölder continuity of the integrated density of states for stochastic Jacobi matrices," (with Simon, B.) *Commun. Math. Phys.* **90** pp. 207-218 (1983).

[5] "Large coupling behavior of the Lyaponov exponent for tight binding one-dimensional random systems," (with Avron, J. and Simon, B.) *J. Phys. A: Gen 16* pp. L209-211 (1983).

[6] "On water waves in the Boussinesq and Korteweg-de Vries limits," MSRI Berkeley report 056-84-5 (1984).

[7] "On the Lyapounov index and the integrated density of states for stochastic Schrodinger operators," *Infinite dimensional analysis and stochastic processes*, S. Albeverio ed. Research notes in mathematics **124**, Pitman (1985).

[8] "An existence theory for water waves, and the Boussinesq and Korteweg-deVries scaling limits," *Commun. PDE* **10**, no 8, pp 787-1004 (1985).

[9] "The Lyapounov index, the density of states and their regularity for general stochastic potentials," L. Arnold and V. Wihstutz, eds., *Lyapounov Exponents; proceedings Bremen 1984*, Springer Lecture Notes in Mathematics Vol 1186, pp. 252–257, 1986.

[10] "An introduction to bifurcation theory," Proceedings of the Stanford summer workshop on mathematical modelling, (1985), lecture notes.

[11] "Nonstrictly hyperbolic nonlinear systems," *Math. Annalen*, **277**, pp. 213-232 (1987).

[12] "On water waves as Hamiltonian system," manuscript 1987.

[13] "Symmetry of solitary waves," (with Sternberg, P.), *Commun. P.D.E.*, **13**, pp. 603-633 (1988).

[14] "Floquet exponents for Jacobi fields", Univ. Bonn–SFB 256 preprint 37, 1988. *Ergodic Theory and Dynamical Systems* **11**, pp. 41-63, (1991).

[15] "Symmetry of free surface flows", (with P. Sternberg) Univ. Bonn–SFB 256 preprint 86, 1989. *Archives for Rational Mechanics and Analysis* **118**, pp. 1-36, (1992).

[16] "The trace formula for Schrödinger operators on the line", Univ. Bonn–SFB 256 preprint 57, 1988. *Commun. Math. Physics* **126**, no. 2 pp. 379-407 (1989).

[17] "Symmetry of solitary waves", Proc. of the Analysis Oberseminar 1988, Univ. Bonn. Vorlesungreihe SFB 256.

[18] "Trace formulae and singular spectra for the Schrödinger operator", Integrable Systems and Applications: Proceedings, Ile d'Oléron, France, June 1988. M. Balaban, P. Lochak, C. Sulem (eds.) *Springer Lecture Notes in Physics,* **342**, (1989).

[19] "Linear dispersive equations of Airy type" (with J. Goodman) *Journal Differential Equations* **87**, vol. 1, pp. 38-61 (1990).

[20] "Infinite gain of regularity for dispersive evolution equations" (with T. Kappeler and W. Strauss), Microlocal Analysis and Nonlinear Waves, May 1989, M. Beals, R. Melrose and J. Rauch, ed's. IMA vol. 30, *Springer*, (1991).

[21] "Water waves, Hamiltonian systems and Cauchy integrals", *Microlocal Analysis and Nonlinear Waves (Minnesota, May 1989)*, M. Beals, R. Melrose and J. Rauch, ed's. IMA Vol. Math. Appl. 30, *Springer*, (1991).

[22] "Nonlinear waves and the KAM theorem: nonlinear degeneracies", (with C.E. Wayne), *Large Scale structures in nonlinear physics, (Villefrache-sur-Mer, 1991)*, pp. 37-49, J.-D. Fourier and P.-L. Sulem, ed's. Lecture Notes in Physics 392, *Springer* (1991).

[23] "Periodic solutions to the nonlinear wave equation and localization theory", (with C.E. Wayne), *Mathematical Physics X, (Leipzig, 1991)*, pp. 256-261, *Springer* (1992).

[24] "Comparison principles for free surface flows with gravity" (with P. Sternberg) *Journal of Fluid Mechanics* **230**, pp. 231-243, (1991).

[25] "Infinite gain of regularity for equations of KdV type" (with T. Kappeler and W. Strauss), *Annales de l'IHP, ≪ Analyse Nonlinéaire ≫* **9**, vol. 2, pp. 147-186, (1992).

[26] "Nonlinear modulation of gravity waves: a rigorous approach", (with C. Sulem and P.L. Sulem), *Nonlinearity* **5**, pp. 497-552, (1992).

[27] "Numerical simulation of gravity waves", (with C. Sulem), *Journal Comp. Physics* **108**, pp. 73-83, (1993).

[28] "Newton's method and periodic solutions of nonlinear wave equations" (with C.E. Wayne), *Commun. Pure Applied Math.* **XLVI** pp. 1409-1501, (1993).

[29] "Nonlinear waves and the 1 : 1 : 2 resonance", (with C.E. Wayne), *Singular limits of dispersive waves (Lyon, 1991)*, pp. 297-313, N. Ercolani, D. Levermore and D. Serre ed's., NATO Adv. Sci. Inst. Ser. B Phys. 320, Plenum, N.Y. (1994).

[30] "Hamiltonian long-wave scaling limits of the water-wave problem", (with M. Groves), *Wave Motion* **19** pp. 367-389, (1994).

[31] "Periodic solutions of nonlinear Schrödinger equations and the Nash Moser method", (with C.E. Wayne), ETH preprint (1993); *Hamiltonian Mechanics (Torún, 1993)*, pp. 103-122, J. Semanis ed. NATO Adv. Sci. Inst. Ser. B Phys. 331, Plenum N.Y. (1994) pp. 103-122.

[32] "Microlocal dispersive smoothing for the Schrödinger equation", (with T. Kappeler and W. Strauss), *Commun. Pure Applied Math.* **48** (1995) pp. 769-860.

[33] "KAM theory in infinite dimensions", *Dynamical systems and probabilistic methods in partial differential equations (Berkeley, CA, 1994)*, p. 31-46, Lectures in Applied Mathematics 31, American Mathematical Society, (1996).

[34] "An integrable normal form for water waves in infinite depth", (with P. Worfolk), *Physica D* **84** (1995) pp. 513-531.

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[39] "Birkhoff normal forms for water waves", Mathematical problems in Water Waves, *Contemporary Math.* **200** AMS (1996), pp. 57-74.

[40] "On the microlocal regularity of the Schrödinger kernel", CRM Workshop on partial differential equations, Univ. Toronto June 1995. *Proceedings CRM* **12** AMS (1997), pp. 71-90.

[41] "Les moments microlocaux et la régularité des solutions de l'équation de Schrödinger", IHES preprint M/96/48; Publications du séminaire: équations aux dérivées partielles, 1995 - 1996, Ecole Polytechnique, Palaiseau, no. XX.
- (english version) "Microlocal moments and regularity of solutions of Schrödinger's equation", *Math. Physics Electronic Journal* **97-2** (1997), `mpej@math.utexas.edu` .

[42] "Reheating in the presence of noise", (with V. Zanchin, A. Maia and R. Brandenberger), preprint hep-ph 97 09, *Physical Review D* **57** (1998), pp. 4651-4662.

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[45] "Traveling two and three dimensional capillary gravity waves", (with D. Nicholls), *SIAM: Math. Analysis* **32** (2000), pp. 323-359.

[46] "Problèmes de petits diviseurs dans les équations aux dérivées partielles", *Panaromas et Synthèses* **9**, Société Mathématiques de France (2000).

[47] "Normal forms for wave motion in fluid interfaces", (with M. Groves), *Wave Motion* **31** pp. 21 - 41, (2000).

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[58] "Hamiltonian long wave expansions for water waves over a rough bottom", (with P. Guyenne, D. Nicholls and C. Sulem), *Proc. Royal Society A* **461** (2005), pp, 839 - 873.

[59] "Thermal Diffusion Shock Waves", (with S. Danworaphong, V. Gusev and G. Diebold) *Physical Review Letters* **94** 095901 (2005); and *Virtual Journal of Nanoscale Science & Technology* vol. 11, issue 11, March 21, 2005.

[60] "Hamiltonian long wave expansions for free surfaces and interfaces", (with P. Guyenne and H. Kalisch), *Commun. Pure Applied Math.* **LVIII** (2005), pp. 1587-1641.

[61] "Invariant tori for Hamiltonian PDE", *Nonlinear Dynamics and Evolution Equations*, editors: Hermann Brunner, Xiao-Qiang Zhao and Xingfu Zou, Fields Institute Communications 28, AMS (2005), pp. 53 -66.

[62] "The mathematical analysis of thermal diffusion shocks", (with V. Gusev, R. LiVoti, S. Danworaphong and G. Diebold), *Phys. Rev E (3)* **72**, 041205 (2005).

[63] "KAM theory for PDE", *Oberwolfach Reports* **31** (2005), pp. 18-21.

[64] "Solitary water wave interactions", (with P. Guyenne, J. Hammack, D. Henderson and C. Sulem), *Physics of Fluids* **18** (2006), 057106.

[65] "On the regularity of the Neumann problem for free surfaces with surface tension", (with A.-M. Matei), *Proc. AMS* **135** (2006), pp. 2497-2504.

[66] "Strong solutions of the Boltzmann equation in one spatial dimension", (with A. Biryuk and V. Panferov), *C. R. Acad. Sci. Paris - Mathématiques, Ser. I* **342** (2006), pp. 843-848.

[67] "Surface water waves and tsunamis", *JDDE* **18** (2006), pp. 525-549.

[68] "Hamiltonian expansions for water waves over a random bottom", (with C. Sulem), *Oberwolfach Reports* **50** (2006).

[69] "On suitable weak solutions of the Navier – Stokes equation", (with A. Biryuk and S. Ibrahim), *Contemporary Math.***429** (2007), pp. 1-18.

[70] "Workshop on Mathematical Hydrodynamics" June 2006, Dedicated issue, (W. Craig, A. V. Fursikov, P. Gérard, S. B. Kuksin, A. G. Sergeev, C. E. Wayne, editors), *Russian Math. Surveys* **62:3** pp. 407-408 (2007).

[71] "Stable three-dimensional waves of nearly permanent form on deep water", (with D. Henderson, M. Oscamou and H. Segur), *Mathematics and Computers in Simulation* **74**, March (2007), pp. 135-144 .

[72] "Mathematical aspects of surface water waves", (with C. E. Wayne), *Russian Math. Surveys* **62:3** pp. 453-473 (2007).

[73] "Hamiltonian formulation and long wave models for internal waves", (with P. Guyenne and H. Kalisch), *Proceedings of the 26th International Conference on Offshore Mechanics and Artic Engineering*, OMAE2007-29314 (2007).

[74] "Electron screening in nanostructures", (with A. Achoyan, S. Petrosian, H. E. Ruda and A. Shik) *Journal Appl. Phys.***101** 104308 (2007), and *Virtual Journal of Nanoscale Science & Technology*, June 4, 2007.

[75] *Hamiltonian dynamical systems and applications* (W. Craig, editor), Proceedings of the Advanced Study Institute on Hamiltonian Dynamical Systems and Applications, NATO Science for Peace and Security Series B: Springer - Verlag, (2008) XVI, 441 pp.

[76] "Transformation theory of Hamiltonian PDE and the problem of water waves", Proceedings of the Advanced Study Institute on Hamiltonian Dynamical Systems and Applications, NATO Science for Peace and Security Series B: Springer - Verlag, (2008), pp. 67-83.

[77] "Long wave expansions for water waves over random topography", (with A. deBouard, O. Diaz-Espinosa, P. Guyenne and C. Sulem) *Nonlinearity* 21 (2008) 2143-2178.

[78] *Laser induced thermal diffusion shock waves*, (w. S. Danworaphong and G. Diebold) VDM Verlag, Saarbrücken (2008), 84 pp.

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[81] "Water waves over a random bottom", (with P. Guyenne and C. Sulem), *Journal of Fluid Mechanics* **640** (2009), pp. 79-107.

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[83] "Asymptotics of surface water waves over random bathymetry"(with C. Sulem), *Quarterly of Applied Math.***68** no.1, (2010) pp. 91-112.

[84] "Global regular solutions to the Boltzmann equation in one space dimension" (with A. Biryuk and V. Panferov), manuscript for *Inventiones Math.* (2008).

[85] "Lagrangian invariant tori for infinite dimensional lattice Schrödinger equations" (with J. Geng), manuscript (second revision) for *Inventiones Math.* (2009).

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[87] "A Hamiltonian approach to nonlinear modulation of surface waves" (with P. Guyenne and C. Sulem), *Wave Motion* **42** (2010) pp. 552-563.

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[92] "Water waves over a rough bottom in the shallow water regime" (with D. Lannes and C. Sulem), (2011), Annales IHP - Analyse Nonlinéaire, 10.1016/j.anihpc.2011.10.004.

[93] "Hamiltonian higher-order nonlinear Schrödinger equations for broad-banded waves on deep water", (with P. Guyenne and C. Sulem), European J. Mech. B - Fluids (2011) in press.

[94] "Hamiltonian modulation theory for water waves on arbitrary depth" (w. P. Guyenne and C. Sulem), Proceedings of the 21^{st} ISOPE Conference, Maui Hawaii, (2011).

[95] "Birkhoff normal form and nonlinear scattering for PDEs", *Oberwolfach Reports* **34** (2011).

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