

Professor Edgar Knobloch
University of California at Berkeley

Education

B.A. (1974) and M.A. (1978) in Mathematics, University of Cambridge, UK
A.M. (1975) and Ph.D. (1978) in Astronomy, Harvard University, Cambridge MA, USA
Sc.D. (1994), University of Cambridge, UK

Professional Appointments

Junior Fellow, Harvard Society of Fellows (1978-80)
Research Fellow, St John's College, Cambridge (1978-80)
Assistant Professor of Physics, University of California, Berkeley (1978-1984)
Associate Professor of Physics, University of California, Berkeley (1984-1987)
Professor of Physics, University of California, Berkeley (1987-2022)
Distinguished Professor of Physics, University of California, Berkeley (2022-present)
Professor of Applied Mathematics, University of Leeds, UK (2000-2004)

Honors

Baylis Scholar, St John's College, Cambridge (1971-1974)
Larmor Prize, St John's College, Cambridge (1974)
J.F. Kennedy Scholar, Harvard University (1974-1976)
Junior Fellow, Harvard Society of Fellows (1978-1980)
Research Fellow, St. John's College, Cambridge (1978-1980)
McCormick Fellow, University of Chicago (1978, declined)
Miller Fellow, University of California, Berkeley (1978, declined)
Alfred P Sloan Research Fellow (1980-1984)
Fellowship, Japan Society for the Promotion of Science (1988-1989)
Rosenbaum Fellow, Isaac Newton Institute, Cambridge (1992)
Fellow of the American Physical Society (2001)
NZIMA Maclaurin Fellow, University of Auckland, New Zealand (2008)
Docteur Honoris Causa, Université Paul Sabatier, Toulouse, France (2012)
Chaire d'Excellence Pierre de Fermat, Region Midi-Pyrénées, France (2012-2014)
Fellow of the Society of Industrial and Applied Mathematics (2013)
Faculty Award for Excellence in Postdoctoral Mentoring, UC Berkeley (2014)
Doctor Honoris Causa, Universidad Politécnica de Madrid, Madrid, Spain (2018)
Perspectives on Nonlinear Science, an international conference for my 65th birthday, Cargèse, France, March 2018

Visiting Appointments

JSPS Fellow, Department of Physics, Kyoto University (1988)
Visiting Professor, Observatoire du Pic du Midi et de Toulouse (1991)
Dynamo Theory, Isaac Newton Institute, Cambridge (1992)
JILA Visiting Fellow, University of Colorado, Boulder (1996)
Astrophysical Fluid Dynamics, Institute for Theoretical Physics, Santa Barbara (2000)
Magnetohydrodynamics of the Solar Interior, Isaac Newton Institute, Cambridge (2004)
Pattern Formation in Fluid Mechanics, Isaac Newton Institute, Cambridge (2005)
Magnetic Field Generation in Experiments, Geophysics and Astrophysics, KITP (2008)
EPSCI/PMMH, Paris (2008)
IFISC, Palma de Mallorca (2008)
Department of Mathematics, University of Auckland, New Zealand (2008)
Visiting Research Fellow, School of Mathematics, University of Sydney, Australia (2008)
Visiting Professor, School of Mathematics, Loughborough University, UK (2010–2019)
Chaire d'Excellence Pierre de Fermat, IMFT, Toulouse (2012–2014)
London Mathematical Society Lecturer, Loughborough University (2016)
Nelder Fellow, Imperial College, London (May–June 2016)
Visiting Professor, School of Mathematics, University of Leeds, UK (2016–2019)
Erceg Fellow, School of Mathematics, University of Auckland (2018)

In 1999–2017 Knobloch spent approximately one month each year visiting Université Paul Sabatier and/or IMFT (Toulouse) as Professeur Invité.

Selected invited conference lectures (since 2000)

Colston Research Society Workshop: “Nonlinear Dynamics and Chaos: Where should we go from here”, Bristol, UK (2000, invited talk)
Symposium in honor of Professors M Golubitsky and I Stewart, Porto, Portugal (2000, invited talk)
Dynamo and Dynamics: A Mathematical Challenge, Cargèse, Corsica, France (2000, invited talk)
MIMMIII, Ann Arbor (2000, invited talk)
John David Crawford Memorial Lectures (3), U. Pittsburgh, Pittsburgh PA (2002)
Durham Symposium on Astrophysical Fluid Dynamics, Durham, UK (2002, invited talk)
Symposium in honor of Professor Jerrold Marsden, Fields Institute, Toronto, Canada (2002, invited talk)
First Rocky Mountains Workshop on Dynamics and Bifurcation of Patterns in Dissipative Systems, Ft Collins CO (2003, invited talk)
13th International Couette-Taylor Workshop, Barcelona, Spain (2003, invited talk)
Trends in Pattern Formation: From Amplitude Equations to Applications, Dresden, Germany (2003, invited talk)
Symposium in honor of Professor William Langford, Fields Institute, Toronto, Canada (2003, invited talk)
Hysteresis and Multiscale Analysis, Cork, Ireland (2004, invited talk)
5th AIMS Conference, Pomona CA (2004)
NZIMA Workshop, Raglan, New Zealand (2004, invited talk)
Patterns and Dynamics in Thin Films, Dresden, Germany (2004, invited talk)
OCNN: Symposium in honor of Professor Yoshiki Kuramoto, Kyoto, Japan (2004, invited talk)
Summer School in Astrophysical Fluid Dynamics, in honor of 70th birthday of Professor Jean-

Paul Zahn, Cargèse, Corsica, France (2005, invited talk)
 6th AIMS Conference, Poitiers, France (2006, invited talk)
 CAIMS Conference, Banff, Canada (2007, invited talk)
 Festival de Théorie, Aix-en-Provence, France (2007, invited talk)
 Turbulent Mixing and Beyond, Trieste, Italy (2007, invited talk)
 MHD Laboratory Experiments for Geophysics and Astrophysics, Catania, Italy (2007, invited talk)
 Dynamical Systems and Continuum Physics, Montreal, Canada (2007, invited talk)
 Theme of the Year Workshop, NCAR, Boulder CO (2008, invited talk)
 7th AIMS Conference, Arlington TX (2008)
 Focused Workshop on Localized States, Santiago de Chile, Chile (2008, invited talk)
 IAM-PICS-MITACS Distinguished Colloquium, U British Columbia, Vancouver, Canada (2009)
 Dynamo Program, Inst Henri Poincaré, Paris, France (2009, invited talk)
 Confluence Lecture, IMFT, Toulouse, France (2009)
 Gordon Conference on Nonlinear Science, Mt Holyoke MA (2009, invited talk)
 SIAM Conference on Dynamical Systems and Differential Equations, Barcelona, Spain (2010, invited talk)
 APS March Meeting, Portland, OR (2010, invited talk)
 Dynamics Days 2011, Chapel Hill, NC (2011, invited talk)
 Theme of the Year IMAGE workshop, NCAR, Boulder (2012, invited talk)
 Turing Symposium on Morphogenesis, Sendai, Japan (2012, invited talk)
 Medyfinol 2012, Santiago de Chile, Chile (2012, invited talk)
 Confluence Lecture, IMFT, Toulouse, France (2013)
 Conference de Physique Non-lineaire 2013, ENS, Paris (2013, plenary talk)
 den Hartog Lecture, MIT (2013)
 Joint US-Japan workshop on Interactions among Localized Patterns in Dissipative Systems, Minneapolis (2013, invited talk)
 Complex Media in Evolving Domains, Leeds (2013, invited talk)
 E.L. Reiss Distinguished Lectures, Northwestern University (2014)
 PIMS Lecture, University of Alberta, Edmonton (2015)
 Nonlinear Waves: Theory and Applications, Beijing, China (2016, plenary talk)
 Patterns and Waves, Sapporo, Japan (2016, invited talk)
 Analysis and Applications of Localized Structures in Nonlinear Media, Lorentz Center, Leiden (2016, plenary talk)
 The future of Singular Perturbation Theory and the Analysis of Multiscale problems, Lorentz Center, Leiden (2017, plenary talk)
 Turbulent Mixing and Beyond, ICTP, Trieste (2017, plenary talk)
 Rotating Convection-from the Lab to the Stars (Euromech Colloquium 599, Leiden 2018, invited talk)
 Quasicrystals: pattern formation and aperiodic order, ICMS Edinburgh (June 2018, invited talk)
 IIT Kanpur: Spatially Localized Structures in Driven Dissipative Systems: Experiments, Theory and Numerics (11 July 2018, Institute Lecture)
 Mathematics of Wave Phenomena, Karlsruhe: Front Propagation in Bistable Pattern-forming Systems (26 July 2018, invited talk)
 CRITICS Workshop, University College Cork: Pinning and Depinning in Nonautonomous Systems (27 August 2018, invited talk)
 Dynamics Days Europe, Loughborough University: Spatially Localized Structures in Driven Dis-

sipative Systems: Theory and Applications (3 September 2018, plenary talk)
 Michael Erceg Public Lecture, University of Auckland: Spatially Localized Structures: What are they and how do we understand them? (22 November 2018)
 ANZIAM Lecture, New Zealand Mathematical Society Colloquium, Dunedin: Spatially Localized Structures in Driven Dissipative Systems: Theory and Applications (6 Dec 2018, plenary talk)
 Advances in Pattern Formation (Beersheva, February 2019, invited talk)
 Patterns of Synchrony: Chimera States and Beyond (ICTP, Trieste, May 2019, invited talk)
 From Pattern Formation to Turbulence (Kloster Banz, June 2019, invited talk)
 Dynamics Days USA, Hartford CT: Crystallization from a supercooled melt (3 January 2020, plenary talk)
 KITP Program on Layering in Atmospheres, Oceans and Plasmas (3 invited lectures, January-March 2021)
 PIMS Workshop on Localized Patterns: The conserved Swift-Hohenberg equation and crystallization (Vancouver, 12 May 2021, invited talk)
 Annual Meeting of SIAM-Mexico, CIMAT, Guanajuato: Geostrophic turbulence and the formation of large scale structure (23 June 2021, plenary talk)

Lecture series:

Ten lectures on Chaos and Turbulence, Technical University, Vienna (1992)
 Ten lectures, Equivariant Bifurcation Theory and Pattern Formation, Polytechnic University of Catalunya, Barcelona (2002)
 Three lectures, Workshop on Multidimensional Localized Structures, Rome (2008)
 Six lectures, Dynamo Program, Inst. Henri Poincaré, Paris (2009)
 Ten lectures, Spatially Localized Structures: Theory and Experiment, Polytechnic University of Catalunya, Barcelona (2009)
 Ten lectures, Advanced Bifurcation Theory, Polytechnic University of Catalunya, Barcelona (2010)
 Five lectures, MULTIFLOW Summer School, El Escorial (2010)
 Principal Lecturer, Summer Program in Geophysical Fluid Dynamics, Woods Hole Oceanographic Institution (10 lectures, June 2012)
 Mathematical Approaches to Complex Fluids, Isaac Newton Institute, Cambridge (3 lectures, July 2013)
 Spatially localized structures, IMFT, Toulouse (12 lectures, February 2014)
 Ten lectures on Dynamics, Patterns and Spatially Localized Structures, Loughborough University, March 2016
 Ten lectures on Spatially Localized Structures, Imperial College, May 2016

Professional responsibilities

Societies: American Physical Society (APS):

Fellow, 2001: “For innovative applications of modern mathematical tools such as bifurcation and group theory to the analysis of nonlinear structures in fluid flows and for the elucidation of fundamental dynamical mechanisms”

Society of Industrial and Applied Mathematics (SIAM):

Fellow, 2013: “For contributions to pattern formation and nonlinear dynamics, bifurcation theory and fluid dynamics”

Advisory Board, SIAM Dynamical Systems Activity Group (2005–2006)
Chair, Crawford Prize, SIAM Dynamical Systems Activity Group (2005)
Committee Member, Crawford Prize, SIAM Dynamical Systems Activity Group (2007)
Vice-Chair of the SIAM Activity Group on Nonlinear Waves and Coherent Structures (2007–2008)
Chair of the SIAM Activity Group on Nonlinear Waves and Coherent Structures (2013–2014)
Nominating Committee, APS Division of Fluid Dynamics (2013–2014)
Organizing Committee, SIAM Conference on Dynamical Systems, Snowbird 21–25 May, 2017
Moser Prize Committee, SIAM Activity group on Dynamical Systems (2020)

Editorial: Editor-in-Chief of *Nonlinearity* (2013–2017); Editor of *Fluid Dynamics Research* (1995–2018), *Journal of Nonlinear Science* (1998–2015), *SIAM Journal on Applied Dynamical Systems* (2009–2015) and *Nonlinearity* (1992–1997).

Knobloch is a sought-after reviewer of books, articles and research proposals (about 50 annually).

Conferences organized or co-organized:

Isaac Newton Institute Conference on Pattern Formation in Fluid Mechanics (2005)
Dynamical Systems with Emphasis on Extended Systems, MSRI, Berkeley (2007)
Co-organizer of SIAM Conference on Nonlinear Waves and Coherent Structures, Rome (2008)
Co-organizer, MULTIFLOW Summer School, El Escorial (21 June–2 July, 2010)
Co-organizer, MULTIFLOW 2010 Conference, Brussels (November 2010)
International Workshop on Localized Multi-dimensional Patterns in Dissipative Systems: Theory, Modeling and Experiments, Banff, Alberta, 24–29 July, 2011
Co-organizer, SIAM Conference on Nonlinear Waves and Coherent Structures, Cambridge (UK), 10–14 August 2014
Organizing Committee, SIAM Conference on Dynamical Systems, Snowbird, 21–25 May 2017

Knobloch has also organized numerous minisymposia at SIAM conferences, and presents approximately 10 seminars and colloquia each year at institutions around the world.

Research Interests

Fluid Dynamics: Pattern selection in fluid systems and other continuum systems, particularly in convection and surface gravity-capillary waves, geophysical and astrophysical fluid dynamics and magnetohydrodynamics and dynamo theory. Reduced models of strongly nonlinear convection with restraints (due to fast rotation or strong magnetic fields), the magnetorotational instability, origin of burst-like behavior in hydrodynamic systems, convective and absolute instabilities in finite and infinite systems, origin and properties of spatially localized states in fluid mechanics, turbulence in anisotropic systems, formation of large scale coherent structures in turbulent flows, dynamics of drops and thin films on homogeneous and heterogeneous substrates.

Nonlinear Dynamics: Generic bifurcations with symmetry, dynamical behavior due to global bifurcations, spontaneous symmetry breaking and pattern formation, forced symmetry breaking, dynamics of nonlinear waves in bounded and unbounded systems. Spatial dynamics of forced dissipative systems, and homoclinic snaking in one or more spatial dimensions. Global bifurcations and relaxation oscillations in excitable systems. Turing instability. Coupled nonlinear oscillators, synchronization, chimera states. Oscillons. Nonlinear optics.

Former students: Prof. K. A. Wiesenfeld, Prof. J. W. Swift, Dr. J. D. Lerner, Prof. J. B. Weiss, Prof. M. Silber, Dr. T. L. Clune, Dr. H. F. Goldstein, Dr. R. D. Pierce, Dr. P. C. Hirschberg, Prof. A. S. Landsberg, Dr. T. K. Callahan, Prof. J. Moehlis, Dr. J. Porter, Dr. J. Burke, Dr. Y.-P. Ma, Dr. H.-C. Kao, Dr. Jianbo Xie, Dr. P. Gandhi, Dr. B. C. Ponedel, B. Foster (current)

Former postdocs: Prof. J.-P. Nadal, Dr. P. C. Hirschberg, Prof. U. Thiele, Dr. O. Batiste, Dr. J. Porter, Prof. A. Yochelis, Prof. C. Beaume, Prof. Jin-Han Xie, Dr. N. Verschueren, Dr. C. Liu (current), Dr. A. van Kan (current)

Publications

Knobloch is the author of approximately 390 refereed papers, with h-index = 54 (web of science) and h-index = 67 (Google scholar)

1. E. Knobloch. Tidal disruption of clusters. *Astrophys. J.* 209, 411-417 (1976).
2. E. Knobloch. Stochastic tidal disruption of clusters. *Astrophys. J.* 218, 406-414 (1977).
3. E. Knobloch. The diffusion of scalar and vector fields by homogeneous stationary turbulence. *J. Fluid Mech.* 83, 129-140 (1977).
4. E. Knobloch. The root-mean-square magnetic field in turbulent diffusion. *Astrophys. J.* 220, 330-333 (1978).
5. E. Knobloch. On the decay of cosmic turbulence. *Astrophys. J.* 221, 395-398 (1978).
6. E. Knobloch. The evolution of mass and tidal radius of cluster galaxies. *Astrophys. J.* 222, 779-783 (1978).
7. E. Knobloch. Turbulent diffusion of magnetic fields. *Astrophys. J.* 225, 1050-1057 (1978).
8. E. Knobloch. Tidal interaction of galaxies. *Astrophys. J. Suppl.* 38, 253-266 (1978).
9. L.N. Da Costa and E. Knobloch. Evolution of galaxies in clusters. *Astrophys. J.* 230, 639-647 (1979).
10. E. Knobloch. On the statistical dynamics of the Lorenz model. *J. Stat. Phys.* 20, 695-709 (1979).
11. E. Knobloch. Stochastic phenomena in astrophysics. *Vistas in Astronomy* 24, 39-58 (1980).
12. E. Knobloch. On the relationship between Eulerian and Lagrangian turbulent diffusivities. *Phys. Lett.* 78A, 307-308 (1980).
13. E. Knobloch. Convection in binary fluids. *Phys. Fluids* 23, 1918-1920 (1980).
14. S.H. Margolis and E. Knobloch. Solutions of the equation of heat flow. *Mon. Not. R. astr. Soc.* 193, 345-351 (1980).
15. E. Knobloch. Chaos in the segmented disc dynamo. *Phys. Lett. A* 82, 439-440 (1981).
16. E. Knobloch and R. Rosner. On the spectrum of turbulent magnetic fields. *Astrophys. J.* 247, 300-311 (1981).
17. E. Knobloch and M.R.E. Proctor. Nonlinear periodic convection in double-diffusive systems. *J. Fluid Mech.* 108, 291-316 (1981).
18. E. Knobloch. Solar surface magnetic fields: A model. *Astrophys. J.* 247, L93-L96 (1981).
19. L.N. Da Costa, E. Knobloch and N.O. Weiss. Oscillations in double-diffusive convection. *J. Fluid Mech.* 109, 25-43 (1981).
20. E. Knobloch. Flux tubes and the solar magnetic field spectrum. *Astrophys. J.* 248, 1126-1131 (1981).
21. E. Knobloch and N.O. Weiss. Bifurcations in a model of double-diffusive convection. *Phys. Lett. A* 85, 127-130 (1981).

22. E. Knobloch, N.O. Weiss and L.N. Da Costa. Oscillatory and steady convection in a magnetic field. *J. Fluid Mech.* 113, 153-186 (1981).
23. E. Knobloch, R. Rosner and N.O. Weiss. Magnetic fields in late-type stars. *Mon. Not. R. Astr. Soc.* 197, 45P-49P (1981).
24. E. Knobloch and H.C. Spruit. Stability of differential rotation in stars. *Astron. Astrophys.* 113, 261-268 (1982).
25. R. Rosner and E. Knobloch. On perturbations of magnetic field configurations. *Astrophys. J.* 262, 349-357 (1982).
26. K.A. Wiesenfeld and E. Knobloch. Effect of noise on the dynamics of a nonlinear oscillator. *Phys. Rev. A* 26, 2946-2953 (1982).
27. E. Knobloch. Nonlinear diffusive instabilities in differentially rotating stars. *Geophys. Astrophys. Fluid Dyn.* 22, 133-158 (1982).
28. E. Knobloch and J. Guckenheimer. Convective transitions induced by a varying aspect ratio. *Phys. Rev. A* 27, 408-417 (1983).
29. J. Guckenheimer and E. Knobloch. Nonlinear convection in a rotating layer: Amplitude expansions and normal forms. *Geophys. Astrophys. Fluid Dyn.* 23, 247-272 (1983).
30. D.R. Moore, J. Toomre, E. Knobloch and N.O. Weiss. Chaos in thermosolutal convection: Period doubling for partial differential equations. *Nature* 303, 663-667 (1983).
31. E. Knobloch and N.O. Weiss. Bifurcations in a model of magnetoconvection. *Physica D* 9, 379-407 (1983).
32. H.C. Spruit, E. Knobloch and I.W. Roxburgh. The internal rotation of the sun. *Nature* 304, 320-324 (1983).
33. E. Knobloch and K.A. Wiesenfeld. Bifurcations in fluctuating systems: The center manifold approach. *J. Stat. Phys.* 33, 611-637 (1983).
34. E. Knobloch and H.C. Spruit. The molecular weight barrier and angular momentum transport in radiative stellar interiors. *Astron. Astrophys.* 125, 59-68 (1983).
35. M. Golubitsky, J.W. Swift and E. Knobloch. Symmetries and pattern selection in Rayleigh-Bénard convection. *Physica D* 10, 249-276 (1984).
36. E. Knobloch and N.O. Weiss. Convection in sunspots and the origin of umbral dots. *Mon. Not. R. astr. Soc.* 207, 203-214 (1984).
37. K. Wiesenfeld, E. Knobloch, R.F. Miracky and J. Clarke. Calculation of period-doubling in a Josephson circuit. *Phys. Rev. A* 29, 2102-2109 (1984).
38. H.C. Spruit and E. Knobloch. Baroclinic instability in stars. *Astron. Astrophys.* 132, 89-96 (1984).
39. E. Knobloch. On the stability of stratified plane Couette flow. *Geophys. Astrophys. Fluid Dyn.* 29, 105-116 (1984).
40. E. Knobloch. Bifurcations in doubly diffusive convection, in *Chaos and Statistical Methods*, Y. Kuramoto (ed), Springer-Verlag, pp. 143-160 (1984).

41. E. Knobloch. Transition to chaos in doubly-diffusive convection, in *Turbulence and Chaotic Phenomena in Fluids*, T. Tatsumi (ed), Elsevier (North Holland), pp. 157-166 (1984).
42. W.-Y. Law, E. Knobloch and H.C. Spruit. Evolution of the sun with mixing by hydrodynamic instabilities, in *Observational Tests of the Stellar Evolution Theory*, A. Maeder and A. Renzini (eds), International Astronomical Union, pp. 523-524 (1984).
43. E. Knobloch. Doubly diffusive waves, in *Double Diffusive Motions*, N.E. Bixler and E. Spiegel (eds), The American Society of Mechanical Engineers, New York, FED 24, 17-22 (1985).
44. E. Knobloch and H.C. Spruit. Baroclinic instability in the presence of a strong horizontal shear. *Geophys. Astrophys. Fluid Dyn.* 32, 197-216 (1985).
45. J. Lerner and E. Knobloch. The stability of dissipative MHD shear flow in a parallel magnetic field. *Geophys. Astrophys. Fluid Dyn.* 33, 295-314 (1985).
46. E. Knobloch. The stability of non-separable barotropic and baroclinic shear flows. *Astrophys. Sp. Sci.* 116, 149-163 (1985).
47. E. Knobloch. Normal forms for bifurcations at a double zero eigenvalue. *Phys. Lett. A* 115, 199-201 (1986).
48. E. Knobloch, D.R. Moore, J. Toomre and N.O. Weiss. Transitions to chaos in two-dimensional double-diffusive convection. *J. Fluid Mech.* 166, 409-448 (1986).
49. E. Knobloch. On the degenerate Hopf bifurcation with $O(2)$ symmetry, in *Multiparameter Bifurcation Theory*, M. Golubitsky and J. Guckenheimer (eds), American Mathematical Society, Providence, R.I. *Contemp. Math.* 56, 193-201 (1986).
50. E. Knobloch, A. Deane, J. Toomre and D.R. Moore. Doubly diffusive waves, in *Multiparameter Bifurcation Theory*, M. Golubitsky and J. Guckenheimer (eds), American Mathematical Society, Providence, R.I. *Contemp. Math.* 56, 203-216 (1986).
51. E. Knobloch. Normal form coefficients for the nonresonant double Hopf bifurcation. *Phys. Lett. A* 116, 365-369 (1986).
52. E. Knobloch. Oscillatory convection in binary mixtures. *Phys. Rev. A* 34, 1538-1549 (1986).
53. E. Knobloch. On convection in a horizontal magnetic field with periodic boundary conditions. *Geophys. Astrophys. Fluid Dyn.* 36, 161-177 (1986).
54. G. Dangelmayr and E. Knobloch. Interaction between standing and travelling waves and steady states in magnetoconvection. *Phys. Lett. A* 117, 394-398 (1986).
55. E. Knobloch and H.C. Spruit. Baroclinic waves in a vertically stratified thin accretion disk. *Astron. Astrophys.* 166, 359-367 (1986).
56. G. Dangelmayr and E. Knobloch. The Takens–Bogdanov bifurcation with $O(2)$ symmetry. *Phil. Trans. Roy. Soc. London A* 322, 243-279 (1987).
57. E. Knobloch and J.B. Weiss. Mass transport by wave motion, in *Proceedings National Solar Observatory Workshop on the Internal Solar Angular Velocity: Theory and Observations*, B.R. Durney and S. Sofia (eds), Reidel, Dordrecht, pp. 221-228 (1987).
58. A.E. Deane, E. Knobloch and J. Toomre. Doubly diffusive waves, in *Proceedings of the*

International Conference on Fluid Mechanics, Beijing 1987, Peking University Press, Beijing, pp. 713-718 (1987).

59. E. Knobloch and J.B. Weiss. Chaotic advection by modulated travelling waves. *Phys. Rev. A* 36, 1522-1524 (1987).

60. A. E. Deane, E. Knobloch and J. Toomre. Travelling waves and chaos in thermosolutal convection. *Phys. Rev. A* 36, 2862-2869 (1987).

61. E. Knobloch, A. Deane and J. Toomre. Oscillatory doubly diffusive convection: Theory and experiment, in *The Physics of Structure Formation: Theory and Simulation*, W. Güttinger and G. Dangelmayr (eds), Springer-Verlag, Berlin, pp. 117-129 (1987).

62. G. Dangelmayr and E. Knobloch. On the Hopf bifurcation with broken $O(2)$ symmetry, in *The Physics of Structure Formation: Theory and Simulation*, W. Güttinger and G. Dangelmayr (eds), Springer-Verlag, Berlin, pp. 387-393 (1987).

63. E. Knobloch and M.R.E. Proctor. The double Hopf bifurcation with 2:1 resonance. *Proc. R. Soc. London A* 415, 61-90 (1988).

64. E. Knobloch and D.R. Moore. Linear stability of experimental Soret convection. *Phys. Rev. A* 37, 860-870 (1988).

65. A.E. Deane, E. Knobloch and J. Toomre. Travelling waves in large-aspect-ratio thermosolutal convection. *Phys. Rev. A* 37, 1817-1820 (1988).

66. J.D. Lerner and E. Knobloch. The long wave instability of a defect in a uniform parallel shear. *J. Fluid Mech.* 189, 117-134 (1988).

67. M. Silber and E. Knobloch. Pattern selection in ferrofluids. *Physica D* 30, 83-98 (1988).

68. J.D. Crawford and E. Knobloch. Symmetry-breaking bifurcations in $O(2)$ maps. *Phys. Lett. A* 128, 327-331 (1988).

69. J.D. Crawford and E. Knobloch. Classification and unfolding of degenerate Hopf bifurcations with $O(2)$ symmetry: no distinguished parameter. *Physica D* 31, 1-48 (1988).

70. M. Silber and E. Knobloch. Pattern selection in steady binary-fluid convection. *Phys. Rev. A* 38, 1468-1477 (1988).

71. H. Riecke, J.D. Crawford and E. Knobloch. Time-modulated oscillatory convection. *Phys. Rev. Lett.* 61, 1942-1945 (1988).

72. J.D. Crawford and E. Knobloch. On degenerate Hopf bifurcation with broken $O(2)$ symmetry. *Nonlinearity* 1, 617-652 (1988).

73. J.D. Crawford, E. Knobloch and H. Riecke. Competing parametric instabilities with circular symmetry. *Phys. Lett.* 135 A, 20-24 (1989).

74. E. Knobloch and J.B. Weiss. Effect of Noise on Discrete Dynamical Systems with Multiple Attractors, in *Noise in Nonlinear Dynamical Systems*, Vol. 2: Theory of noise induced processes in special applications, F. Moss and P.V.E. McClintock (eds), Cambridge University Press, pp. 65-86 (1989).

75. E. Knobloch. Nonlinear binary fluid convection at positive separation ratios, in *Cooperative*

Dynamics in Complex Physical Systems, H. Takayama (ed), Springer-Verlag, pp. 337-338 (1989).

76. M. Silber and E. Knobloch. Parametrically excited surface waves in square geometry. *Phys. Lett. A* 137, 349-354 (1989).

77. G. Bodo, R. Rosner, A. Ferrari and E. Knobloch. On the stability of magnetized rotating jets: the axisymmetric case. *Astrophys. J.* 341, 631-649 (1989).

78. J.D. Crawford, E. Knobloch and H. Riecke. Mode interactions and symmetry, in *Singular Behavior and Nonlinear Dynamics*, S. Pnevmatikos, T. Bountis and S. Pnevmatikos (eds), World Scientific, pp. 277-297 (1989).

79. E. Knobloch. Pattern selection in binary fluid convection at positive separation ratios. *Phys. Rev. A* 40, 1549-1559 (1989).

80. J.B. Weiss and E. Knobloch. Mass transport and mixing by modulated travelling waves. *Phys. Rev. A* 40, 2579-2589 (1989).

81. G. Dangelmayr and E. Knobloch. Hopf bifurcation in reaction-diffusion equations with broken translation symmetry, in *Proceedings of the International Conference on Bifurcation Theory and its Numerical Analysis*, Li Kaitai, J.E. Marsden, M. Golubitsky and G. Iooss (eds), Xi'an Jiaotong University Press, Xi'an, pp. 162-170 (1989).

82. E. Knobloch, A.E. Deane and J. Toomre. A model of double-diffusive convection, in *The Connection Between Infinite Dimensional and Finite Dimensional Dynamical Systems*, B. Nicolaenko, C. Foias and R. Temam (eds), American Mathematical Society, Providence, R.I. *Contemp. Math.* 99, 339-349 (1989).

83. E. Knobloch and M. Silber. Travelling wave convection in a rotating layer. *Geophys. Astrophys. Fluid Dyn.* 51, 195-209 (1990).

84. J.B. Weiss and E. Knobloch. A stochastic return map for stochastic differential equations. *J. Stat. Phys.* 58, 863-883 (1990).

85. H.F. Goldstein, E. Knobloch and M. Silber. Planform selection in rotating convection. *Phys. Fluids A* 2, 625-627 (1990).

86. E. Knobloch. Pattern selection in long-wavelength convection. *Physica D* 41, 450-479 (1990).

87. E. Knobloch and M. Silber. Pattern selection in rotating convection, in *Nonlinear Structures in Physical Systems—Pattern Formation, Chaos and Waves*, L. Lam and H.C. Morris (eds), Springer-Verlag, New York, pp. 173-180 (1990).

88. E. Knobloch. Mass transport and mixing by waves, in *Rotation and Mixing in Stellar Interiors*, M.-J. Goupil and J.-P. Zahn (eds), Springer-Verlag, New York, *Lecture Notes in Physics* 366, 109-118 (1990).

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