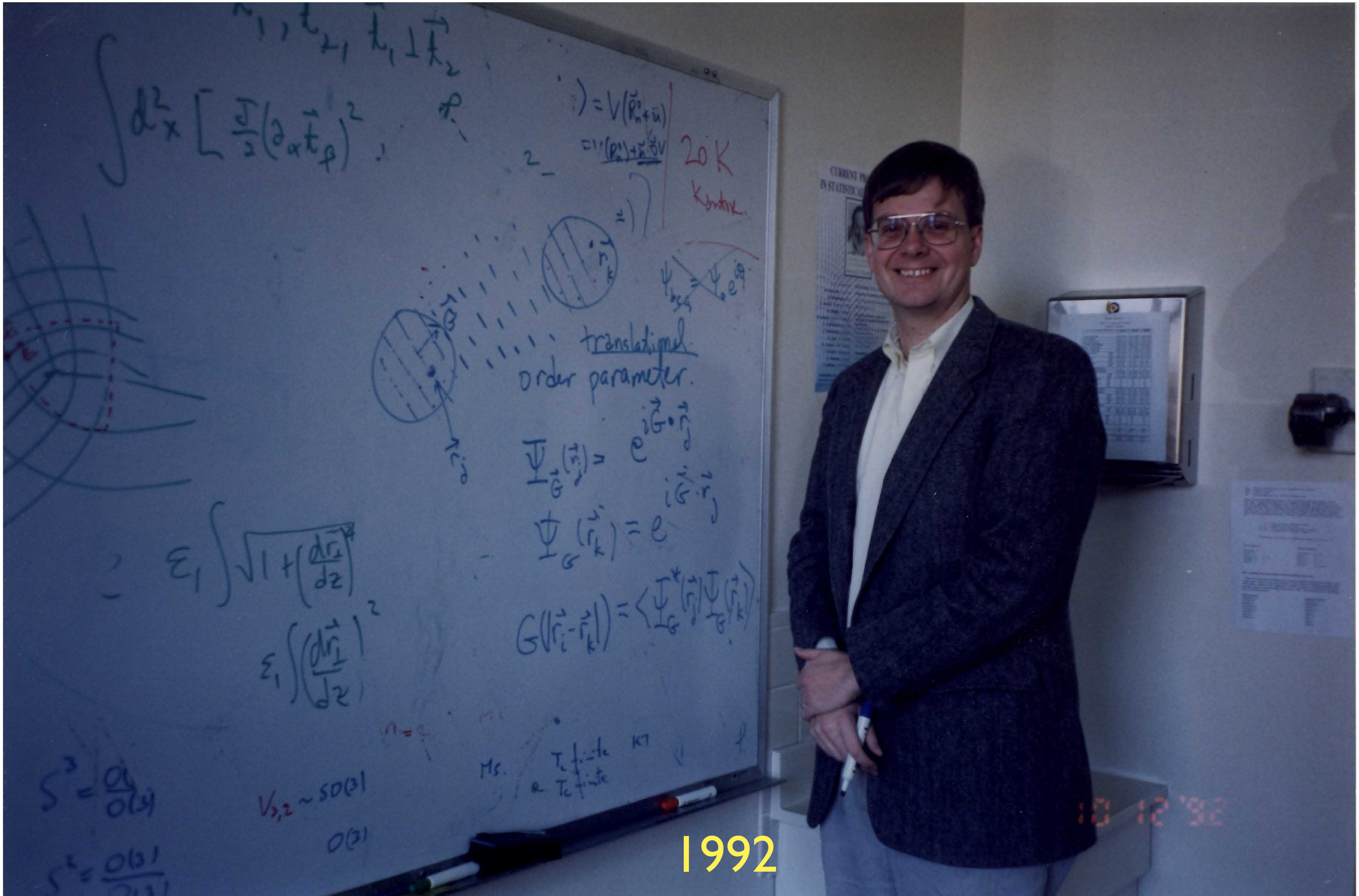
Laudatio for David Nelson



1992

1972

Holland 1974

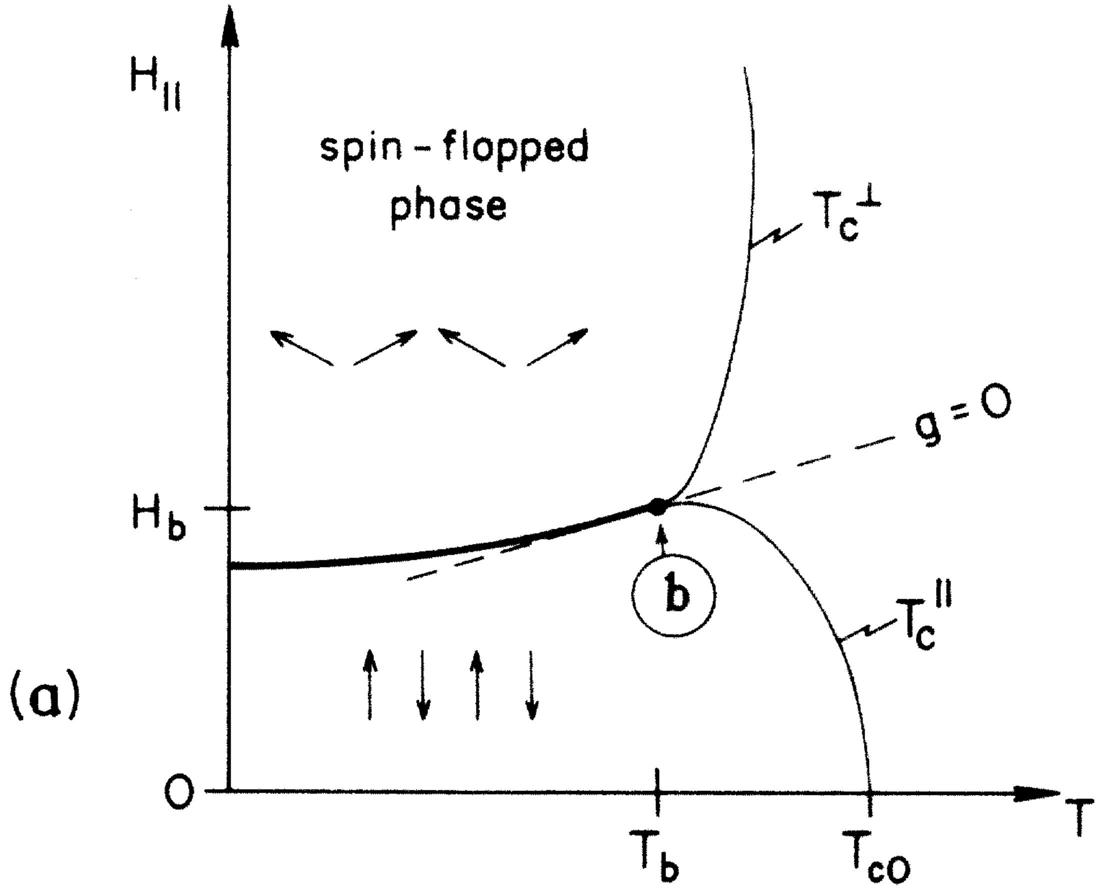
Ph.D., Cornell University, January 1975
Thesis: Applications of the Renormalization Group to Critical Phenomena
Supervisor: Michael E. Fisher

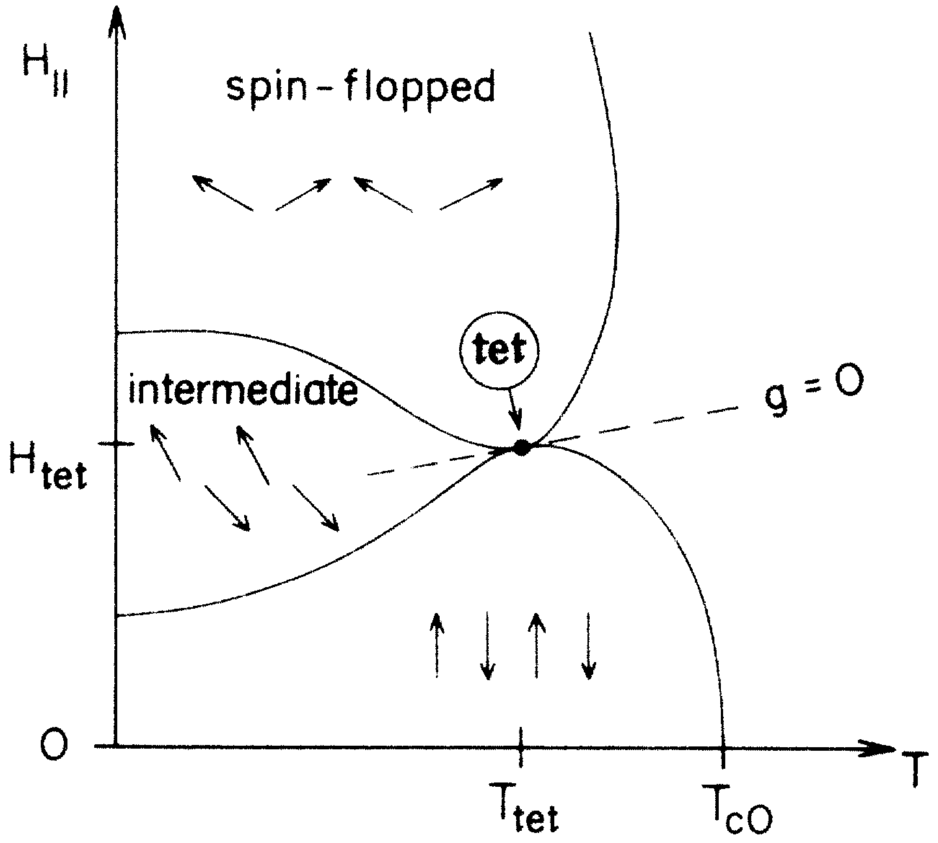
VOLUME 32, NUMBER 24 PHYSICAL REVIEW LETTERS 17 JUNE 1974

Spin Flop, Supersolids, and Bicritical and Tetracritical Points

Michael E. Fisher and David R. Nelson
Baker Laboratory of Chemistry and the Materials Science Center,
Cornell University, Ithaca, New York 14850

(Received 15 April 1974)





Harvard Society of Fellows ~1977

Harvard Society of Fellows ~1977

PHYSICAL REVIEW A VOLUME 16, NUMBER 2 AUGUST 1977

Large-distance and long-time properties of a randomly stirred fluid

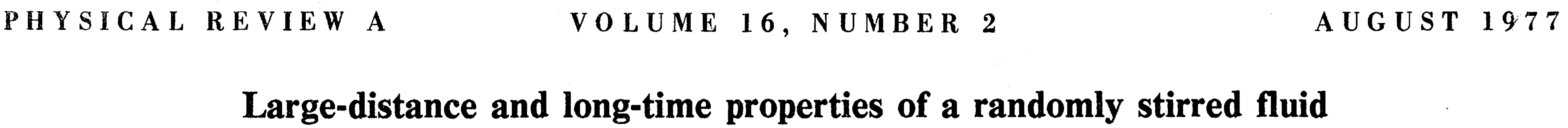
Dieter Forster*
Department of Physics, Temple University, Philadelphia, Pennsylvania 19122

David R. Nelson†
Department of Physics, Harvard University, Cambridge, Massachusetts 02138

Michael J. Stephen‡
Physics Department, Rutgers University, New Brunswick, New Jersey 08903

(Received 14 February 1977)

Lexington ~1985



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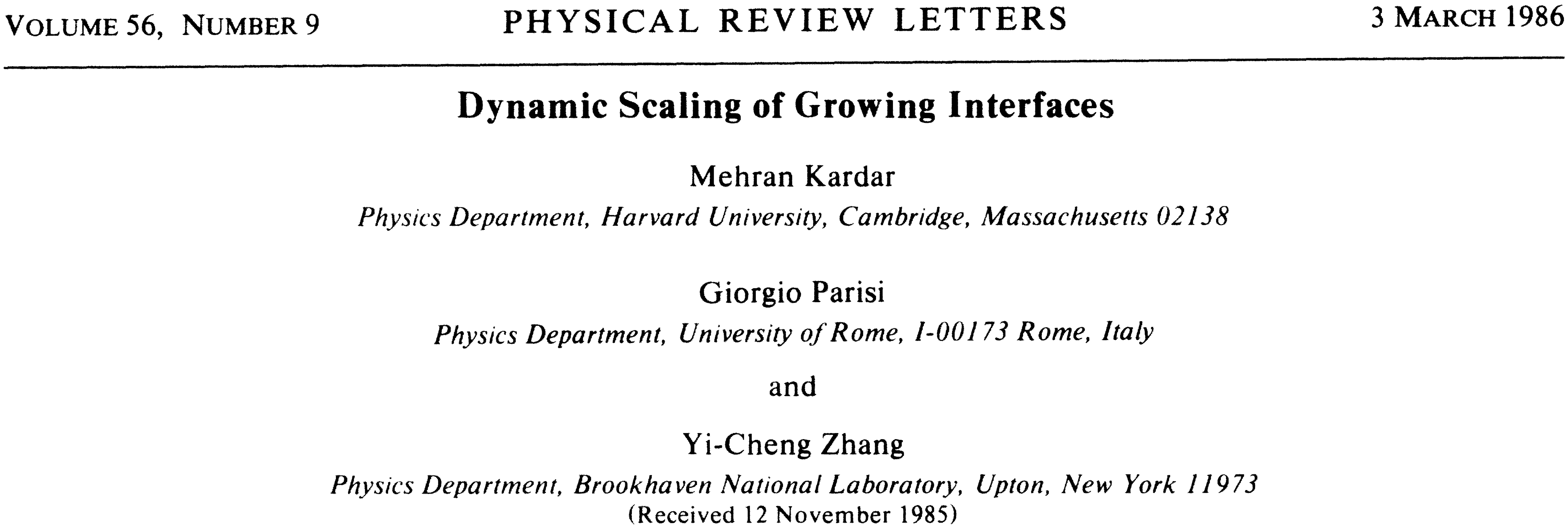

VOLUME 56, NUMBER 9 PHYSICAL REVIEW LETTERS 3 MARCH 1986

Dynamic Scaling of Growing Interfaces

Mehran Kardar
Physics Department, Harvard University, Cambridge, Massachusetts 02138

Giorgio Parisi
Physics Department, University of Rome, I-00173 Rome, Italy

and

Yi-Cheng Zhang
Physics Department, Brookhaven National Laboratory, Upton, New York 11973
(Received 12 November 1985)

PHYSICAL REVIEW A VOLUME 16, NUMBER 2 AUGUST 1977

Large-distance and long-time properties of a randomly stirred fluid

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VOLUME 56, NUMBER 9 PHYSICAL REVIEW LETTERS 3 MARCH 1986

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Yi-Cheng Zhang
Physics Department, Brookhaven National Laboratory, Upton, New York 11973
(Received 12 November 1985)

Renormalization Group Analysis of Turbulence. I. Basic Theory

Victor Yakhot[1] **and Steven A. Orszag**[1]

Journal of Scientific Computing, Vol. 1, No. 1, 1986

PHYSICAL REVIEW B VOLUME 16, NUMBER 3 1 AUGUST 1977

Renormalization, vortices, and symmetry-breaking perturbations in the two-dimensional planar model

Jorge V. José*† and Leo P. Kadanoff*
Department of Physics, Brown University, Providence, Rhode Island 02912

Scott Kirkpatrick
Department of Physics, State University of New York at Stony Brook, Stony Brook, New York 11794
and IBM Thomas J. Watson Research Center,‡ Yorktown Heights, New York 10598

David R. Nelson§
Department of Physics, Harvard University, Cambridge, Massachusetts 12138

(Received 7 March 1977)

Universal Jump in the Superfluid Density of Two-Dimensional Superfluids

David R. Nelson[(a)]
Department of Physics, Harvard University, Cambridge, Massachusetts 02138

and

J. M. Kosterlitz
Department of Mathematical Physics, University of Birmingham, Birmingham B15 2TT, England

(Received 16 September 1977)

VOLUME 39, NUMBER 19 PHYSICAL REVIEW LETTERS 7 NOVEMBER 1977

PHYSICAL REVIEW B VOLUME 16, NUMBER 3 1 AUGUST 1977

Renormalization, vortices, and symmetry-breaking perturbations in the two-dimensional planar model

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VOLUME 39, NUMBER 19 PHYSICAL REVIEW LETTERS 7 NOVEMBER 1977

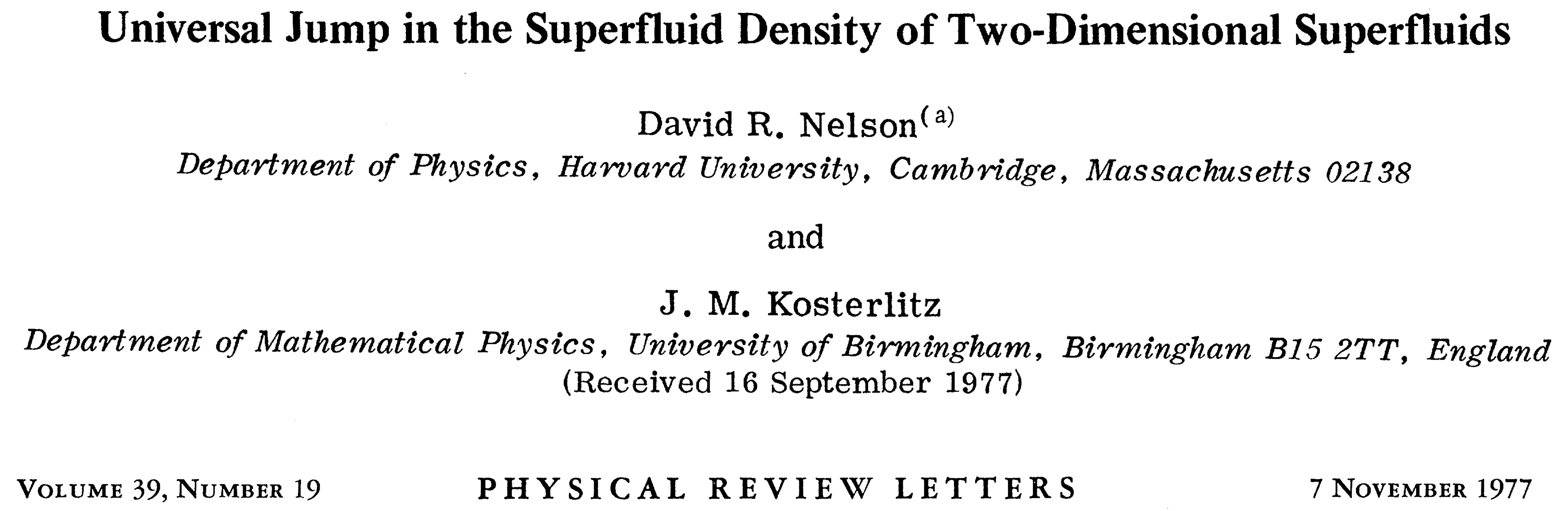
VOLUME 40, NUMBER 26 PHYSICAL REVIEW LETTERS 26 JUNE 1978

Study of the Superfluid Transition in Two-Dimensional ^{4}He Films

D. J. Bishop and J. D. Reppy
Laboratory of Atomic and Solid State Physics, and Materials Science Center,
Cornell University, Ithaca, New York 14853

(Received 20 April 1978)

$$\rho_s(T_c^-) = 8\pi k_B (m/h)^2 T_c$$



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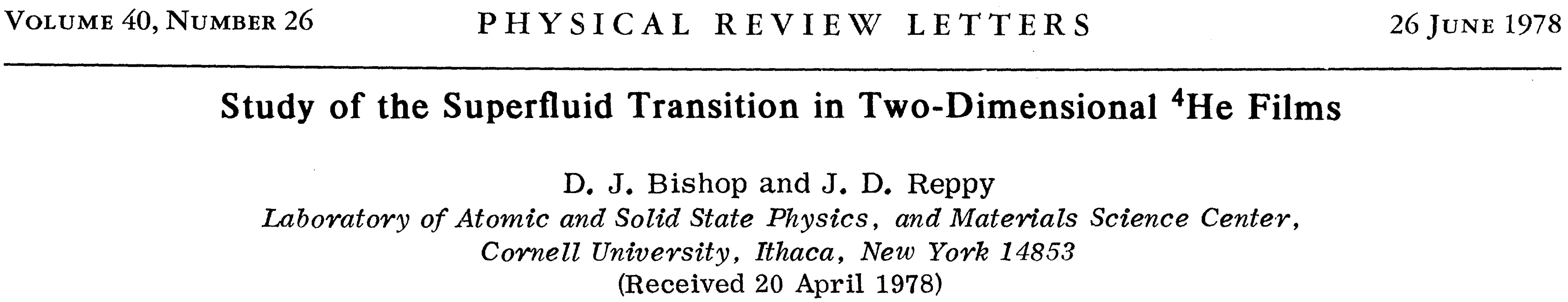
VOLUME 39, NUMBER 19 PHYSICAL REVIEW LETTERS 7 NOVEMBER 1977



VOLUME 40, NUMBER 26 PHYSICAL REVIEW LETTERS 26 JUNE 1978

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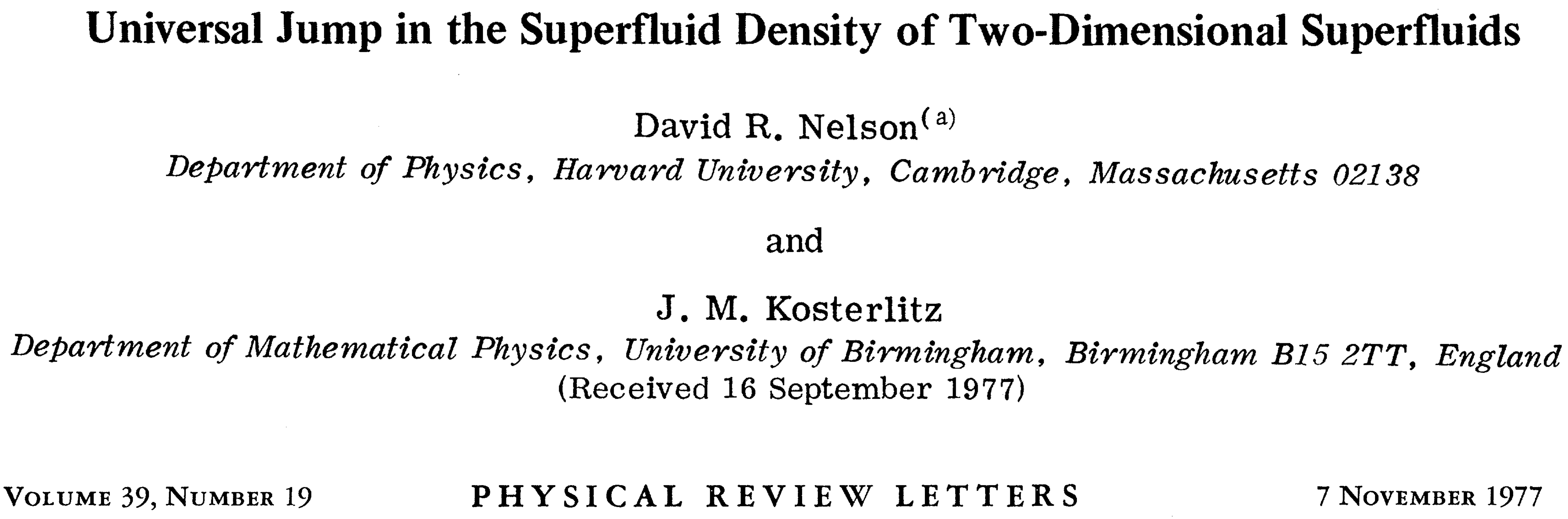
K.v. Klitzing, Integer Quantum Hall effect, 1980



Universal Jump in the Superfluid Density of Two-Dimensional Superfluids

David R. Nelson(a)
Department of Physics, Harvard University, Cambridge, Massachusetts 02138

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J. M. Kosterlitz
Department of Mathematical Physics, University of Birmingham, Birmingham B15 2TT, England

(Received 16 September 1977)

VOLUME 39, NUMBER 19 PHYSICAL REVIEW LETTERS 7 NOVEMBER 1977

Observation of first and second sound in a BKT superfluid

Nature | Vol 594 | 10 June 2021 | **191**

https://doi.org/10.1038/s41586-021-03537-9

Received: 24 August 2020

Panagiotis Christodoulou[1]✉, Maciej Gałka[1], Nishant Dogra[1], Raphael Lopes[2], Julian Schmitt[1,3] & Zoran Hadzibabic[1]

Our results agree with the predictions of BKT theory, including the prediction of a universal jump in the superfluid density at the critical temperature.

VOLUME 41, NUMBER 2 PHYSICAL REVIEW LETTERS 10 JULY 1978

Theory of Two-Dimensional Melting

B. I. Halperin and David R. Nelson
Department of Physics, Harvard University, Cambridge, Massachusetts 02138
(Received 17 May 1978)

KTHNY theory of 2D melting

Prediction of a new phase of matter: the hexatic
Orientational order but no translational order

Volume 41, Number 2 PHYSICAL REVIEW LETTERS 10 July 1978

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B. I. Halperin and David R. Nelson
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Prediction of a new phase of matter: the hexatic
Orientational order but no translational order

Volume 46, Number 17 PHYSICAL REVIEW LETTERS 27 April 1981

X-Ray Observation of a Stacked Hexatic Liquid-Crystal *B* Phase

R. Pindak, D. E. Moncton, S. C. Davey, and J. W. Goodby
Bell Laboratories, Murray Hill, New Jersey 07974
(Received 28 January 1981)

X-ray studies have been performed on a new liquid-crystal material which exhibits a noncrystalline *B* phase. Using free-standing liquid-crystal film techniques, we find that this *B* phase has short-range in-plane positional correlations but long-range, three-dimensional, sixfold bond-orientational order. We interpret our results in terms of a system of interacting two-dimensional hexatic layers.

VOLUME 41, NUMBER 2 PHYSICAL REVIEW LETTERS 10 JULY 1978

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B. I. Halperin and David R. Nelson
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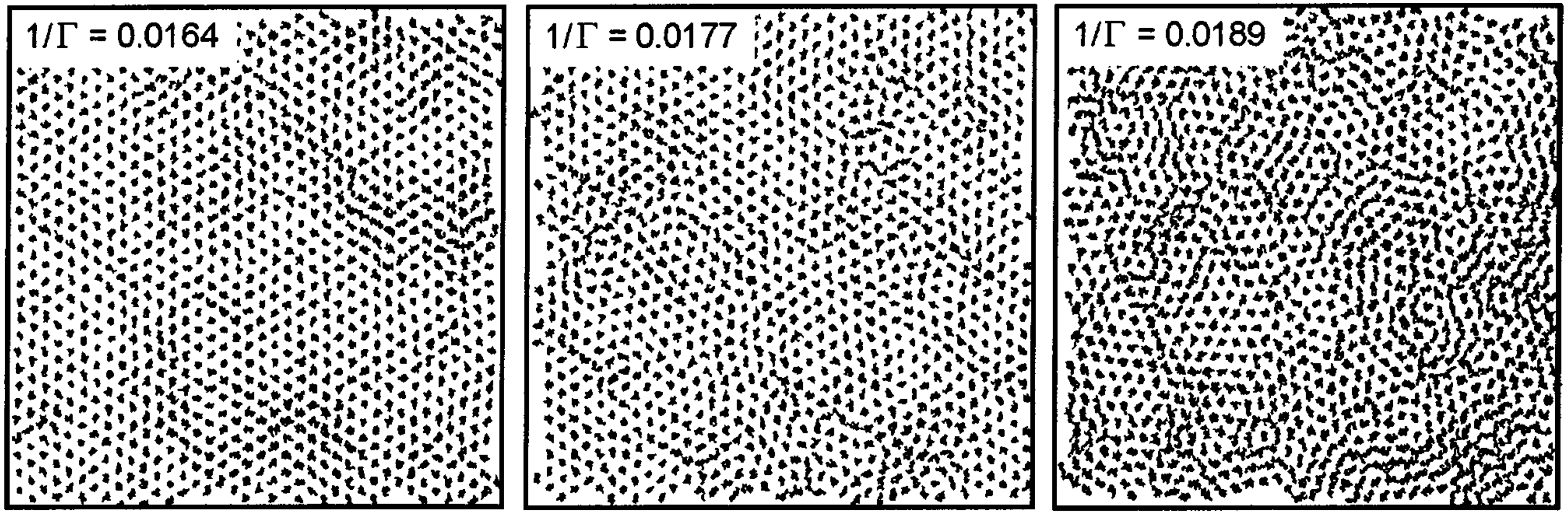
VOLUME 82, NUMBER 13 PHYSICAL REVIEW LETTERS 29 MARCH 1999

Two-Stage Melting of Paramagnetic Colloidal Crystals in Two Dimensions

K. Zahn,[1] R. Lenke,[1,2] and G. Maret[1]



VOLUME 41, NUMBER 2 PHYSICAL REVIEW LETTERS 10 JULY 1978

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B. I. Halperin and David R. Nelson
Department of Physics, Harvard University, Cambridge, Massachusetts 02138

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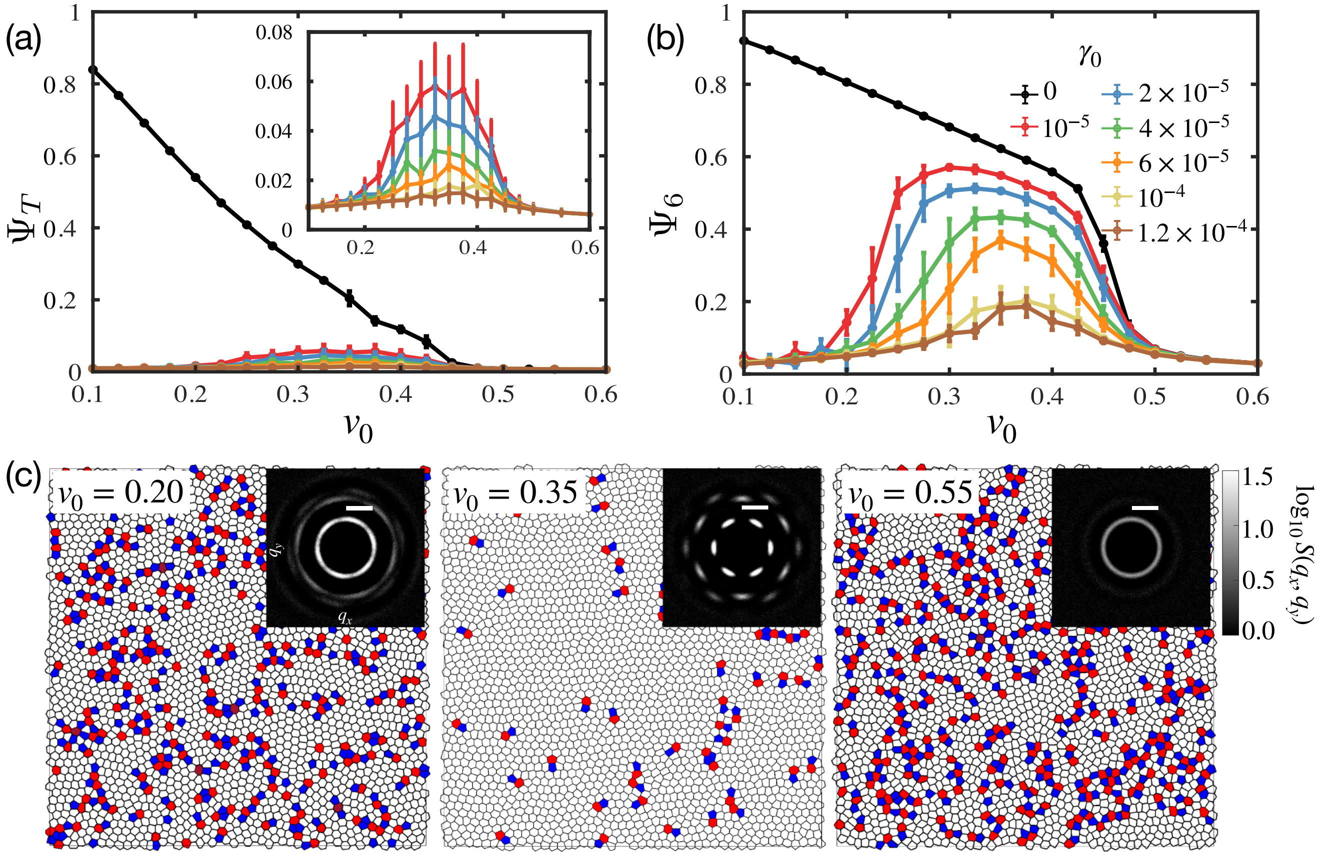
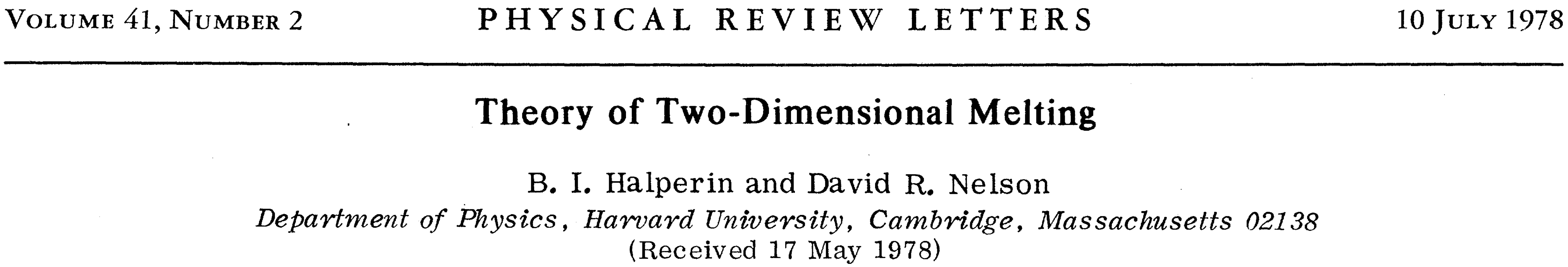
Cell Division and Motility Enable Hexatic Order in Biological Tissues

Yiwen Tang[1,4] Siyuan Chen,[2] Mark J. Bowick[2,3] and Dapeng Bi[1,4]

PHYSICAL REVIEW LETTERS **132,** 218402 (2024)





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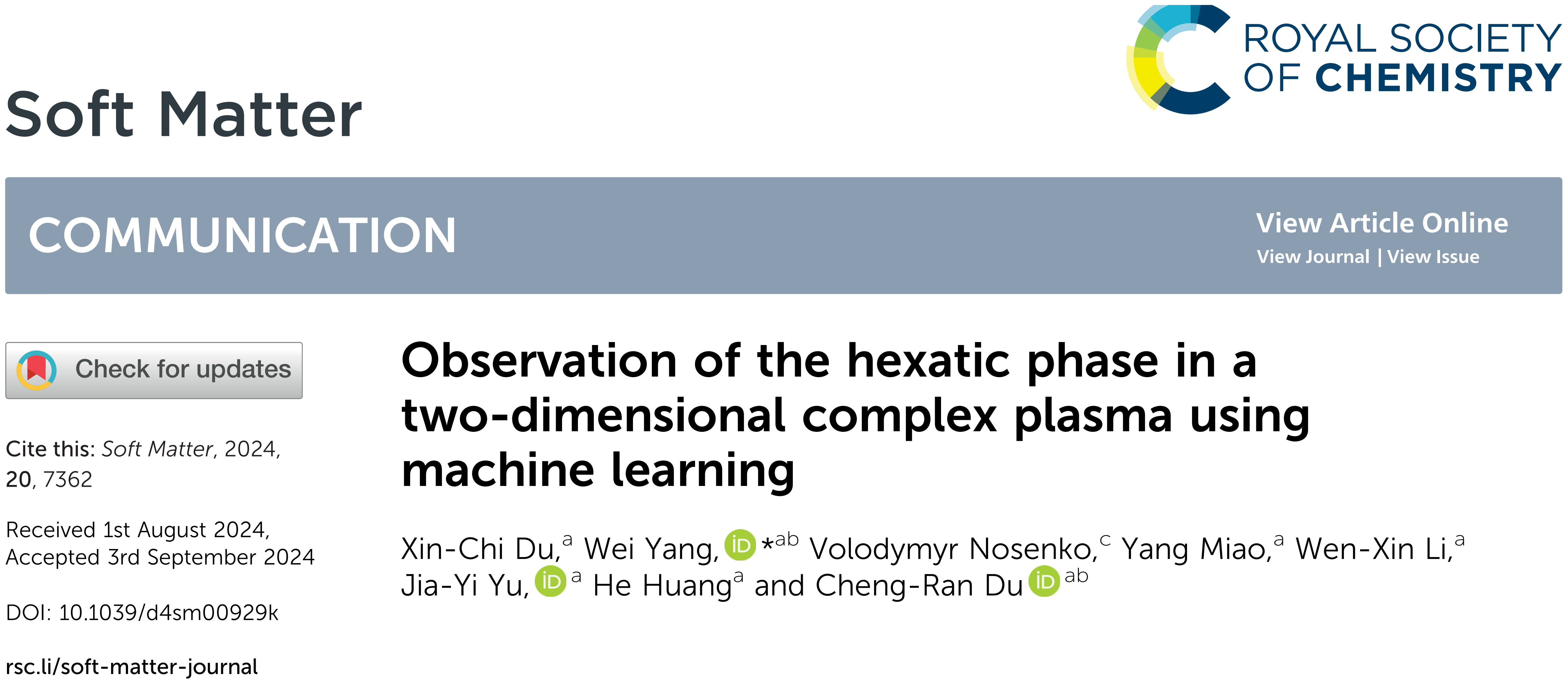

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Cite this: *Soft Matter*, 2024, **20**, 7362

Received 1st August 2024,
Accepted 3rd September 2024

DOI: 10.1039/d4sm00929k

rsc.li/soft-matter-journal

Observation of the hexatic phase in a two-dimensional complex plasma using machine learning

Xin-Chi Du,[a] Wei Yang, *[ab] Volodymyr Nosenko,[c] Yang Miao,[a] Wen-Xin Li,[a] Jia-Yi Yu,[a] He Huang[a] and Cheng-Ran Du[ab]

VOLUME 41, NUMBER 2 PHYSICAL REVIEW LETTERS 10 JULY 1978

Theory of Two-Dimensional Melting

B. I. Halperin and David R. Nelson
Department of Physics, Harvard University, Cambridge, Massachusetts 02138

(Received 17 May 1978)

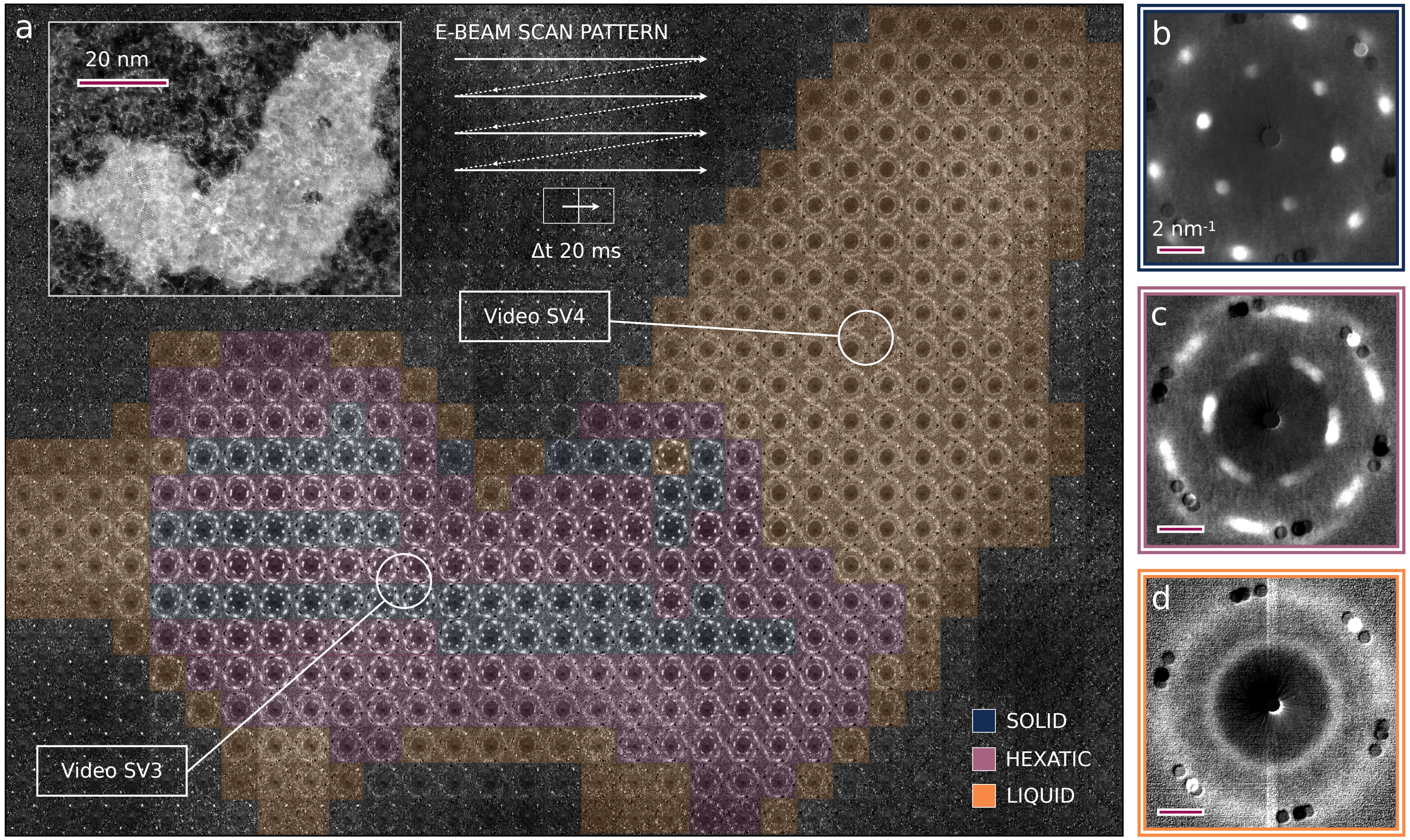
KTHNY theory of 2D melting

Prediction of a new phase of matter: the hexatic
Orientational order but no translational order

Hexatic Phase in Covalent Two-Dimensional
Silver Iodide

Thuy An Bui [1†], David Lamprecht [1,2†], Jacob Madsen [1], Marcin Kurpas,[3]
Peter Kotrusz,[4,7] Alexander Markevich,[1] Clemens Mangler,[1]
Jani Kotakoski, [1] Lado Filipovic,[2] Jannik C. Meyer,[5]
Timothy J. Pennycook,[6] Viera Skákalová,[1,4,7] Kimmo Mustonen[1*]

arXiv:2501.05759



Group of members of the Physics Dept. - photograph taken spring 1980

Group of members of the Physics Dept. - photograph taken spring 1980

PHYSICAL REVIEW B VOLUME 28, NUMBER 2 15 JULY 1983

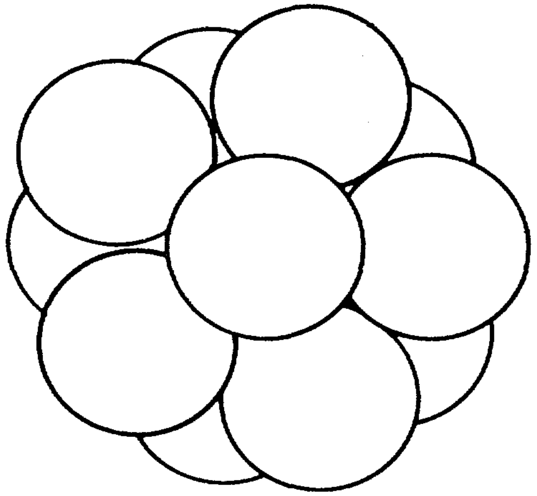
Bond-orientational order in liquids and glasses

Paul J. Steinhardt*
IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598

David R. Nelson
Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138

Marco Ronchetti†
IBM Thomas J. Watson Research Center, Yorktown Heights, New York 10598

(Received 27 December 1982)



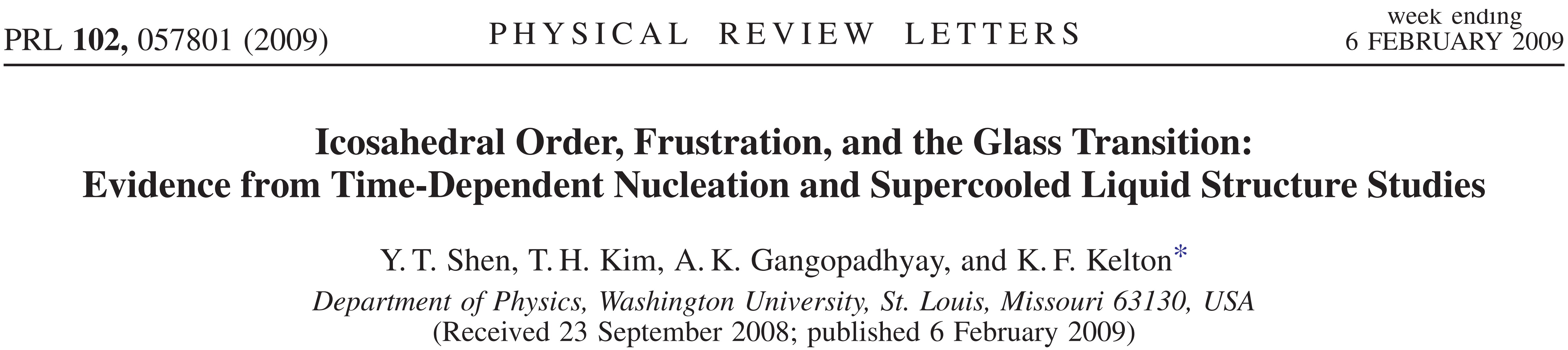
PHYSICAL REVIEW B VOLUME 28, NUMBER 10 15 NOV

Order, frustration, and defects in liquids and glasses

David R. Nelson
Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138

(Received 19 May 1983)

A defect description of liquids and metallic glasses is developed. In two dimensions, surfaces of constant negative curvature contain an irreducible density of point disclinations in a hexatic order parameter. Analogous defect lines in an icosahedral order parameter appear in three-dimensional flat space. Frustration in tetrahedral particle packings forces disclination lines into the medium in a way reminiscent of Abrikosov flux lines in a type-II superconductor and of uniformly frustrated spin-glasses. The defect density is determined by an isotropic curvature mismatch, and the resulting singular lines run in all directions. The Frank-Kasper phases of transition-metal alloys are ordered networks of these lines, which, when disordered, provide an appealing model for structure in metallic glasses.

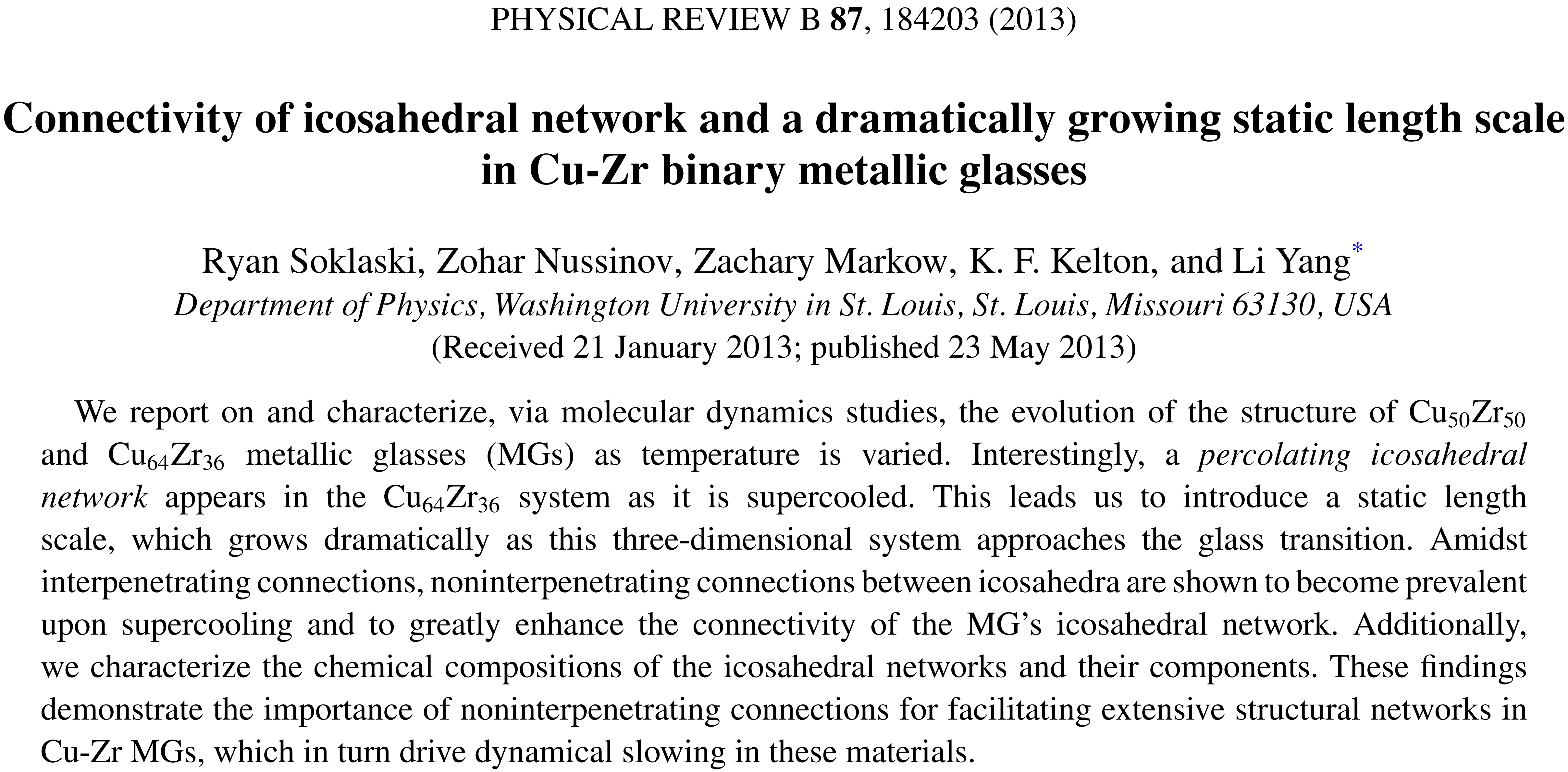


PRL **102,** 057801 (2009) PHYSICAL REVIEW LETTERS week ending 6 FEBRUARY 2009

Icosahedral Order, Frustration, and the Glass Transition: Evidence from Time-Dependent Nucleation and Supercooled Liquid Structure Studies

Y. T. Shen, T. H. Kim, A. K. Gangopadhyay, and K. F. Kelton*
Department of Physics, Washington University, St. Louis, Missouri 63130, USA

(Received 23 September 2008; published 6 February 2009)



PHYSICAL REVIEW B **87**, 184203 (2013)

Connectivity of icosahedral network and a dramatically growing static length scale in Cu-Zr binary metallic glasses

Ryan Soklaski, Zohar Nussinov, Zachary Markow, K. F. Kelton, and Li Yang*
Department of Physics, Washington University in St. Louis, St. Louis, Missouri 63130, USA

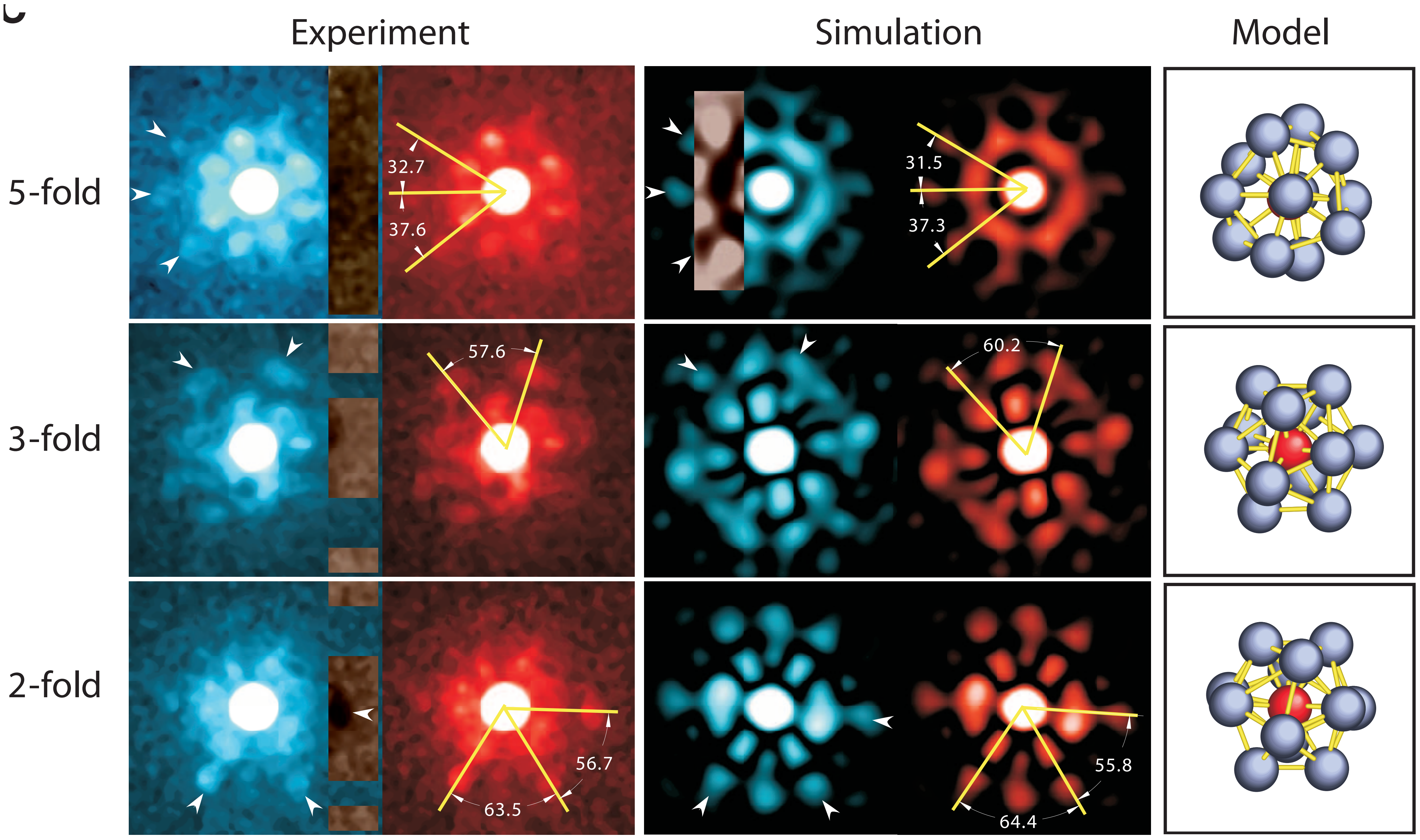
(Received 21 January 2013; published 23 May 2013)

We report on and characterize, via molecular dynamics studies, the evolution of the structure of $Cu_{50}Zr_{50}$ and $Cu_{64}Zr_{36}$ metallic glasses (MGs) as temperature is varied. Interestingly, a *percolating icosahedral network* appears in the $Cu_{64}Zr_{36}$ system as it is supercooled. This leads us to introduce a static length scale, which grows dramatically as this three-dimensional system approaches the glass transition. Amidst interpenetrating connections, noninterpenetrating connections between icosahedra are shown to become prevalent upon supercooling and to greatly enhance the connectivity of the MG's icosahedral network. Additionally, we characterize the chemical compositions of the icosahedral networks and their components. These findings demonstrate the importance of noninterpenetrating connections for facilitating extensive structural networks in Cu-Zr MGs, which in turn drive dynamical slowing in these materials.

Geometric Frustration of Icosahedron in Metallic Glasses

A. Hirata,[1] L. J. Kang,[1] T. Fujita,[1] B. Klumov,[2] K. Matsue,[3] M. Kotani,[1,3]
A. R. Yavari,[4,1] M. W. Chen[1,5]*

376 26 JULY 2013 VOL 341 SCIENCE



Theory of the Structure Factor of Metallic Glasses

Subir Sachdev and David R. Nelson
Department of Physics, Harvard University, Cambridge, Massachusetts 02138

(Received 27 July 1984)

A recently developed Landau description of short-range icosahedral order in supercooled liquids and metallic glasses is used to calculate density correlation functions in these systems. The theory predicts frustration-broadened peaks in the structure factor, at positions determined by the symmetries of an ideal, curved-space icosahedral crystal. The results provide a good fit to experiments on vapor-deposited metal films.

VOLUME 53, NUMBER 20 PHYSICAL REVIEW LETTERS 12 NOVEMBER 1984

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VOLUME 53, NUMBER 20 PHYSICAL REVIEW LETTERS 12 NOVEMBER 1984

Metallic Phase with Long-Range Orientational Order and No Translational Symmetry

D. Shechtman and I. Blech
Department of Materials Engineering, Israel Institute of Technology–Technion, 3200 Haifa, Israel

and

D. Gratias
Centre d'Etudes de Chimie Métallurgique, Centre National de la Recherche Scientifique, F-94400 Vitry, France

and

J. W. Cahn
Center for Materials Science, National Bureau of Standards, Gaithersburg, Maryland 20760

(Received 9 October 1984)

The icosahedral phase has symmetries intermediate between those of a crystal and a liquid. It differs from other intermediate phases in that it is both solid, like a metallic glass, and that it has long-range orientational order. Many intermediate phases do have orientational order, but usually it is only local, and the transition to such phases is continuous.[8, 9] The possibility of an icosahedral phase with long range order was inferred from a computer simulation,[10, 11] and a first-order liquid-to-icosahedral phase transition has been predicted from a mean-field theory.[11, 12]

---

[10] P. J. Steinhardt, D. R. Nelson and M. Rouchetti, Phys. Rev. Lett. **47**, 1297 (1981).

[11] P. J. Steinhardt, D. R. Nelson and M. Rouchetti, Phys. Rev. B **28**, 784 (1983).

VOLUME 53, NUMBER 20 PHYSICAL REVIEW LETTERS 12 NOVEMBER 1984

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D. Shechtman and I. Blech
Department of Materials Engineering, Israel Institute of Technology–Technion, 3200 Haifa, Israel

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Centre d'Etudes de Chimie Métallurgique, Centre National de la Recherche Scientifique, F-94400 Vitry, France

and

J. W. Cahn
Center for Materials Science, National Bureau of Standards, Gaithersburg, Maryland 20760

(Received 9 October 1984)

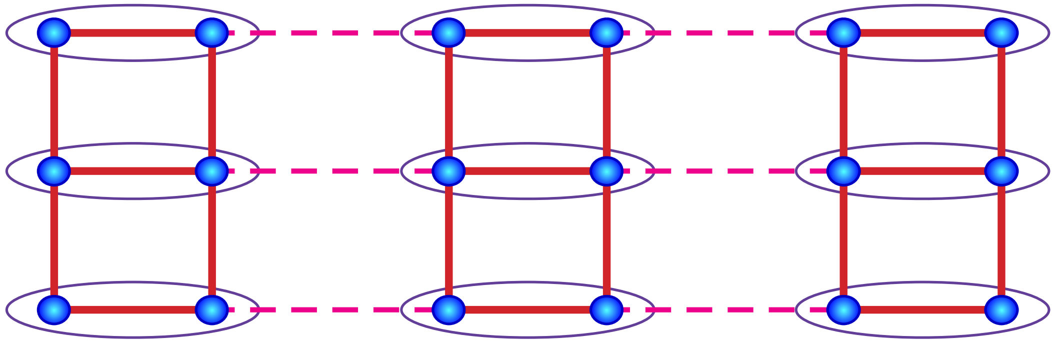
VOLUME 60, NUMBER 11 PHYSICAL REVIEW LETTERS 14 MARCH 1988

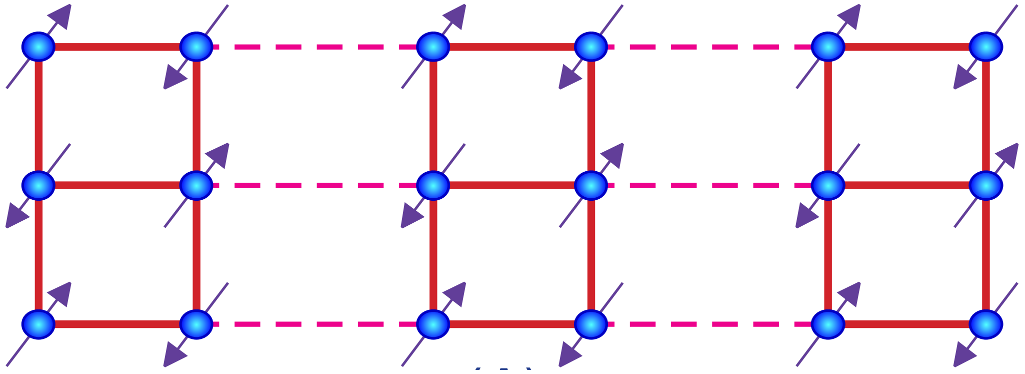
Low-Temperature Behavior of Two-Dimensional Quantum Antiferromagnets

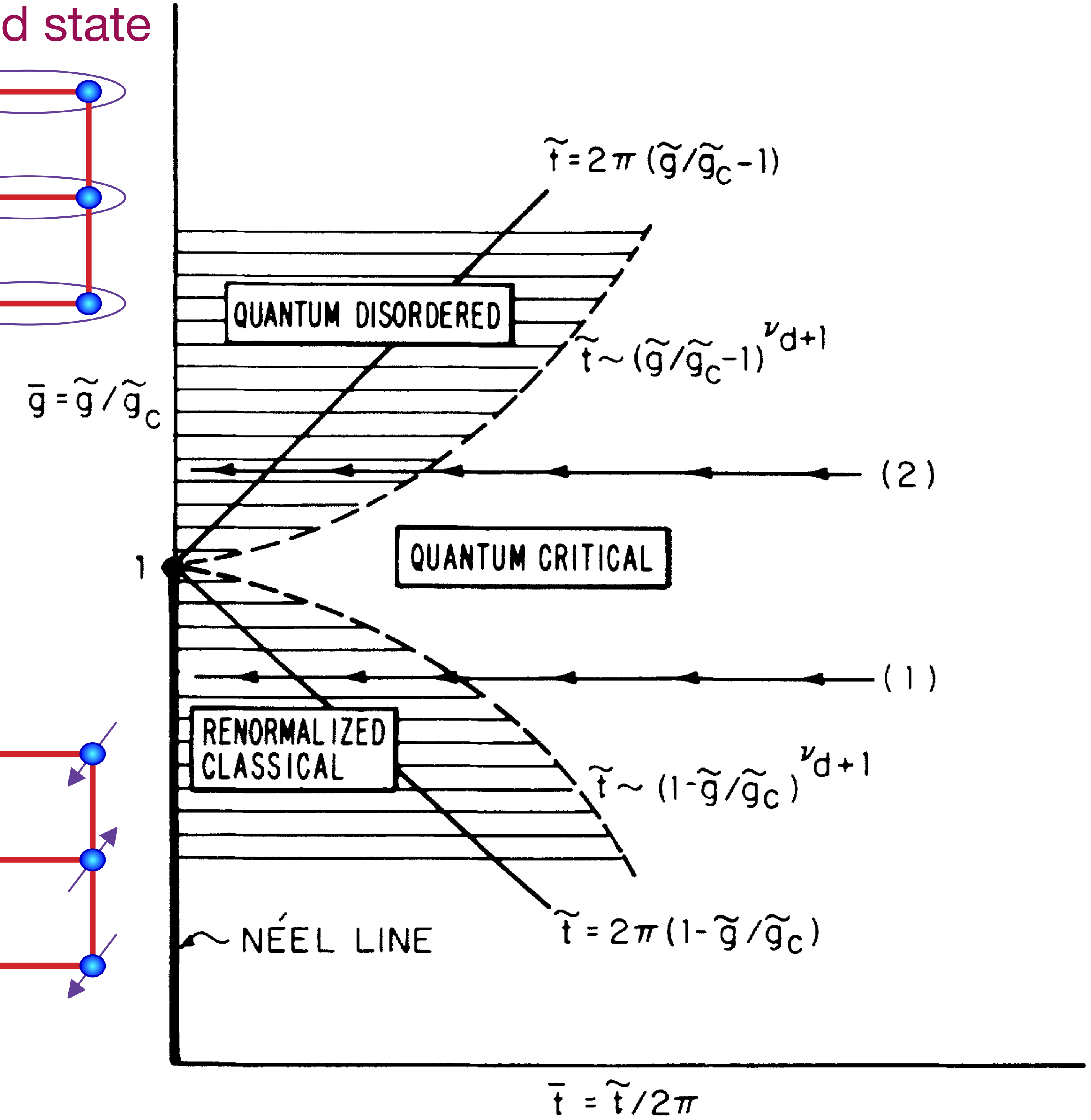
Sudip Chakravarty,(a) Bertrand I. Halperin, and David R. Nelson
Department of Physics, Harvard University, Cambridge, Massachusetts 02138

(Received 24 December 1987)

No LSM anomaly: “trivial” ground state







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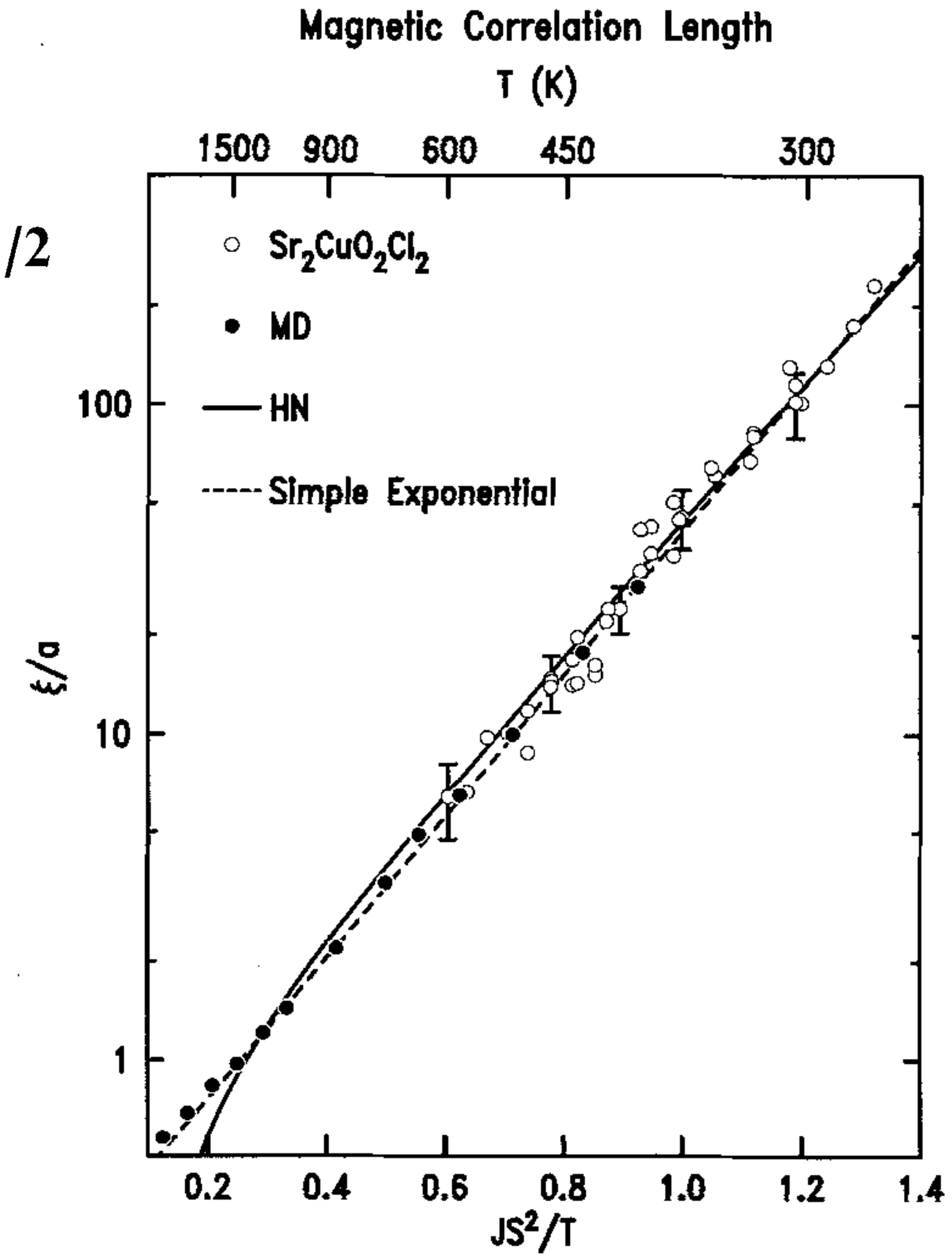
Sudip Chakravarty,[(a)] Bertrand I. Halperin, and David R. Nelson
Department of Physics, Harvard University, Cambridge, Massachusetts 02138

(Received 24 December 1987)

Neutron scattering study of the two-dimensional spin $S=1/2$ square-lattice Heisenberg antiferromagnet $Sr_2CuO_2Cl_2$

M. Greven[1,2], R.J. Birgeneau[1], Y. Endoh[3], M.A. Kastner[1], M. Matsuda[2,*], G. Shirane[2]

Z. Phys. B 96, 465–477 (1995)



Fisher Festschrift 1991

VOLUME 77, NUMBER 3 PHYSICAL REVIEW LETTERS 15 JULY 1996

Localization Transitions in Non-Hermitian Quantum Mechanics

Naomichi Hatano* and David R. Nelson
Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138

(Received 15 March 1996)

We study the localization transitions which arise in both one and two dimensions when quantum mechanical particles described by a random Schrödinger equation are subjected to a constant imaginary vector potential. A path-integral formulation relates the transition to flux lines depinned from columnar defects by a transverse magnetic field in superconductors. The theory predicts that, close to the depinning transition, the transverse Meissner effect is accompanied by stretched exponential relaxation of the field into the bulk and a diverging penetration depth. [S0031-9007(96)00677-1]

PHYSICAL REVIEW B VOLUME 56, NUMBER 14 1 OCTOBER 1997-II

Vortex pinning and non-Hermitian quantum mechanics

Naomichi Hatano*
Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138
and Department of Physics, University of Tokyo, Hongo, Bunkyo, Tokyo 113, Japan

David R. Nelson
Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138

(Received 16 May 1997)

A delocalization phenomenon is studied in a class of non-Hermitian random quantum-mechanical problems. Delocalization arises in response to a sufficiently large constant imaginary vector potential. The transition is related to depinning of flux lines from extended defects in type-II superconductors subject to a tilted external magnetic field. The physical meaning of the complex eigenvalues and currents of the non-Hermitian system is elucidated in terms of properties of tilted vortex lines. The singular behavior of the penetration length describing stretched exponential screening of a perpendicular magnetic field (transverse Meissner effect), the surface transverse magnetization, and the trapping length is determined near the flux-line depinning point. [S0163-1829(97)03438-3]

VOLUME 77, NUMBER 3 PHYSICAL REVIEW LETTERS 15 JULY 1996

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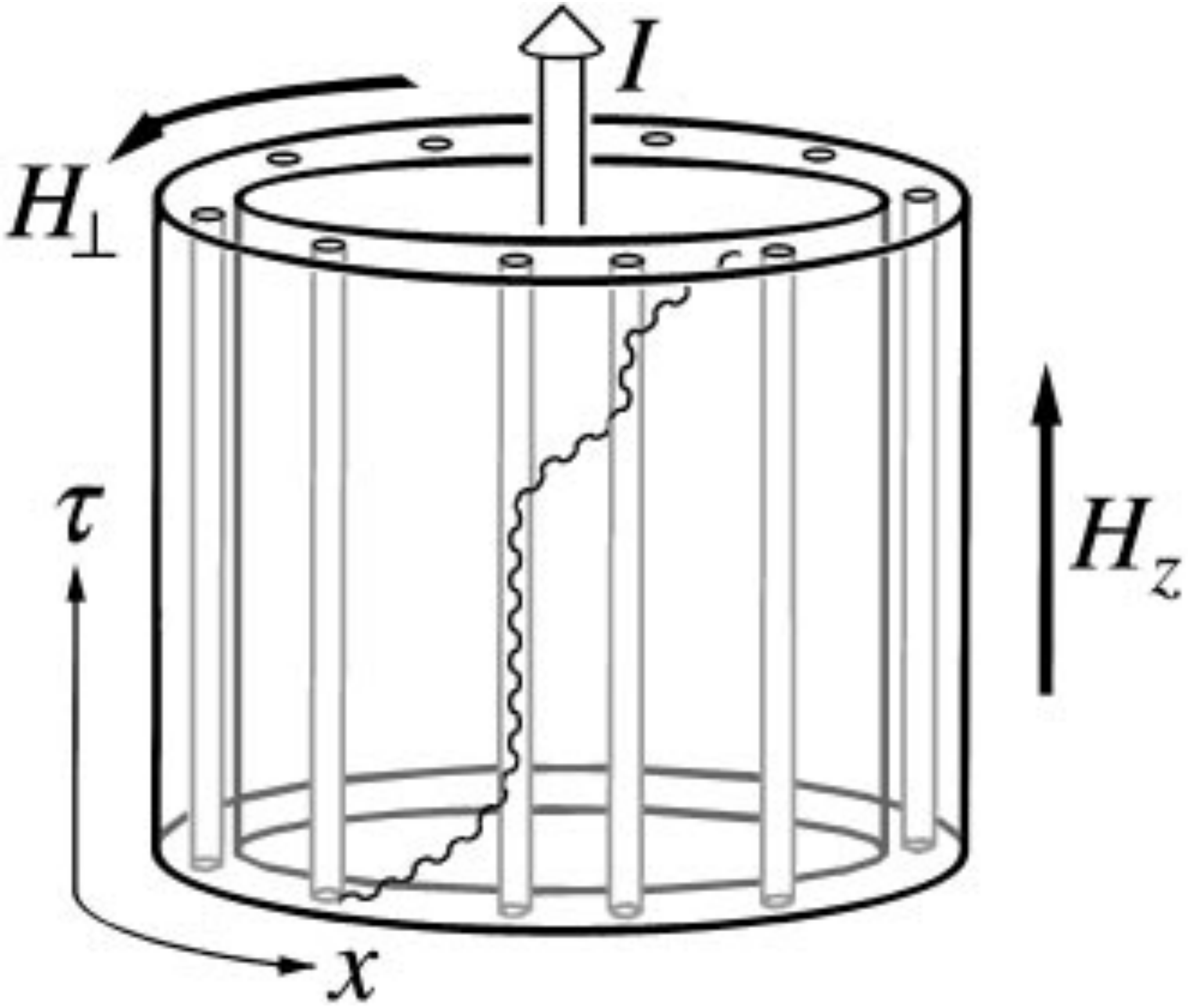


Review

Non-Hermitian Physics

Yuto Ashida[a*], Zongping Gong[b], and Masahito Ueda[b,c]

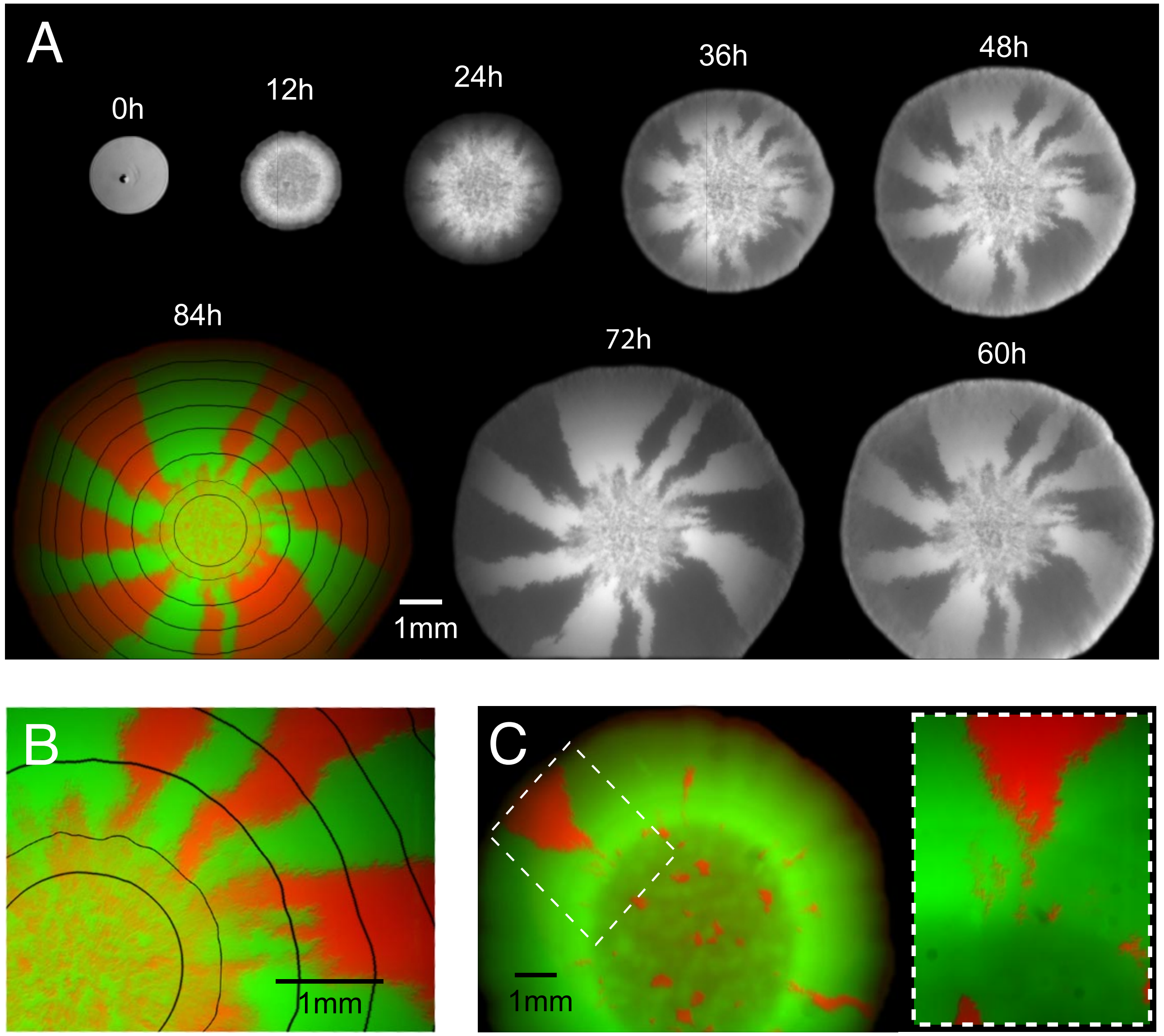
Advances in Physics, 2020

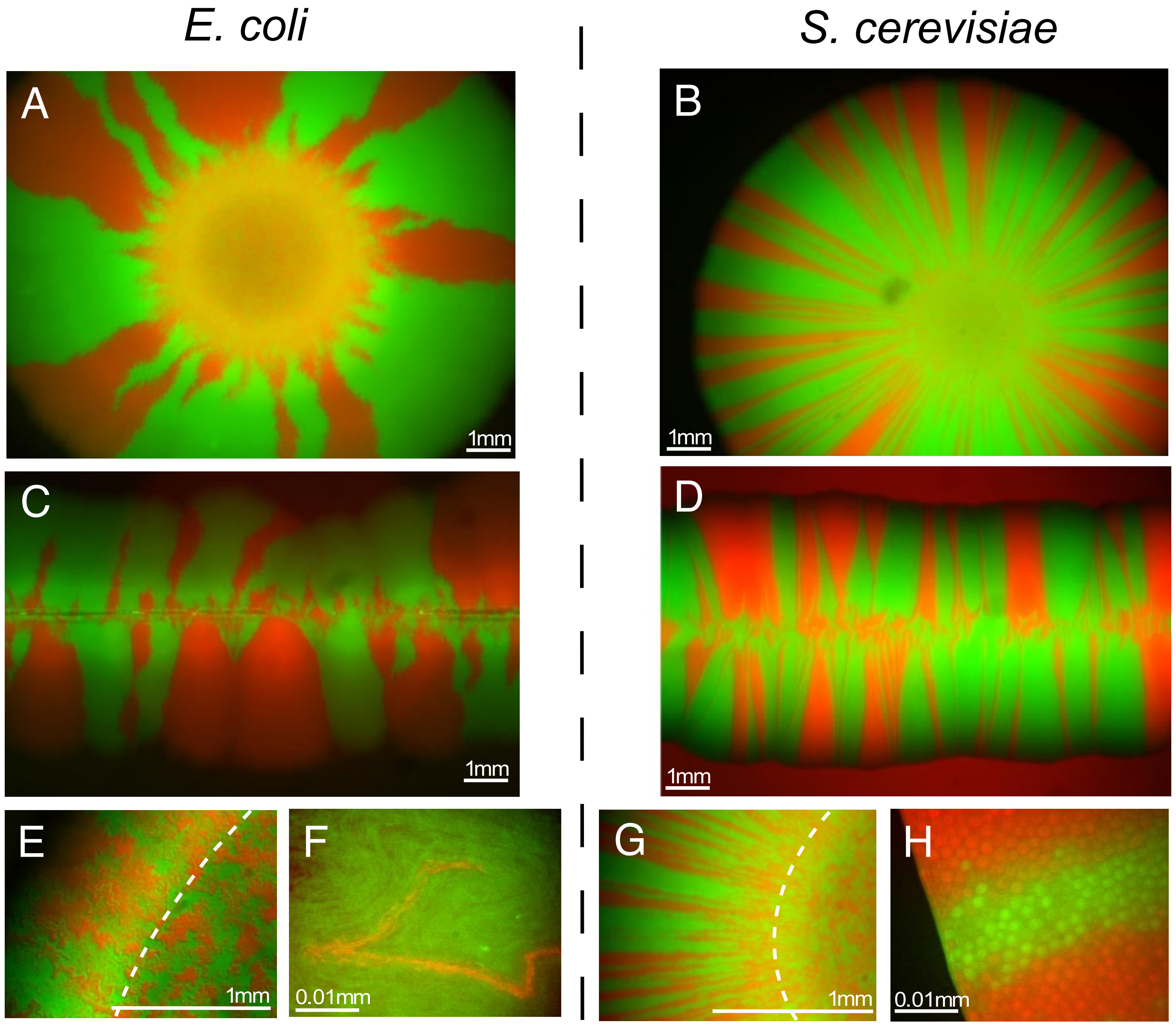
We discuss their applications to physical systems relevant to a variety of fields, including atomic, molecular and optical physics, mesoscopic physics, and nuclear physics with emphasis on prominent phenomena/subjects in quantum regimes, such as quantum resonances, superradiance, continuous quantum Zeno effect, quantum critical phenomena, Dirac spectra in quantum chromodynamics, and nonunitary conformal field theories.

Genetic drift at expanding frontiers promotes gene segregation

Oskar Hallatschek*†, Pascal Hersen†‡, Sharad Ramanathan†§, and David R. Nelson*†¶

19926–19930 | PNAS | **December 11, 2007** | vol. 104 |





Phys. Biol. **9** (2012) 026008 (15pp)

doi:10.1088/1478-39

Selective sweeps in growing microbial colonies

Kirill S Korolev[1,2,5,6], Melanie J I Müller[1,2,3,5], Nilay Karahan[3], Andrew W Murray[1,3], Oskar Hallatschek[4] and David R Nelson[1,2,3]

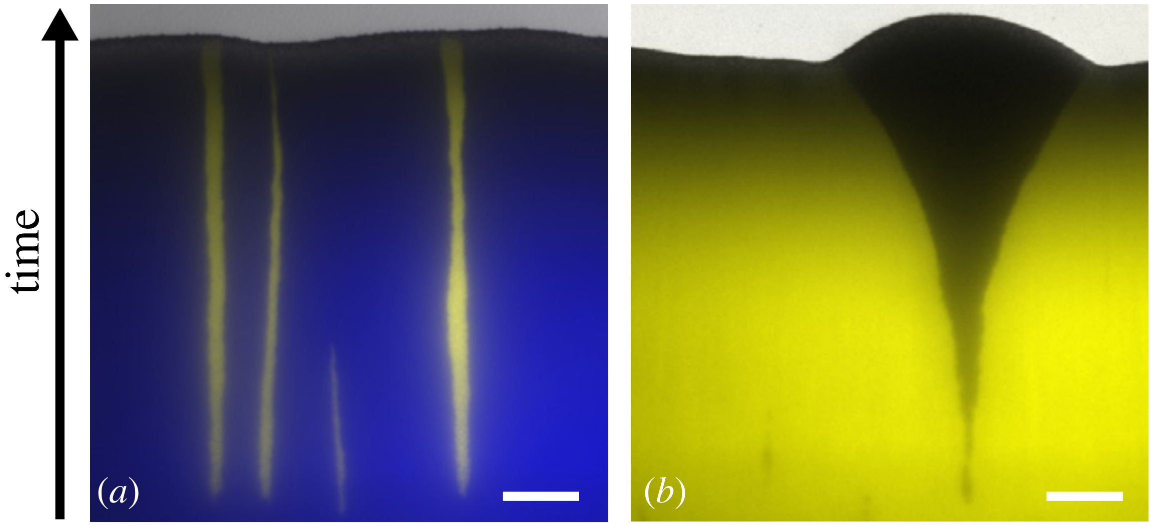


Figure 1. Comparison of spatial segregation during a range expansion of Baker's yeast, *Saccharomyces cerevisiae* with (*a*) equal and (*b*) different growth rates of the two competing strains. The Petri dishes were inoculated with a well-mixed population occupying a narrow horizontal linear region at the bottom of the images from which the sectors appear. As the populations expand, they segregate into well-defined domains. Different colors label different genotypes. (*a*) The two strains (yellow and blue) have the same fitness and the demixing is driven primarily by number fluctuations (genetic drift) [15, 6]. It is likely that the small variations with horizontal position in boundary slopes are related to undulations of linear fronts, which are difficult to suppress when the front is very long [26]. (*b*) The sector is formed by the fitter strain (black), and the sector expansion is caused by the difference in growth rates of the strains, or, in other words, by natural selection. In both (*a*) and (*b*), the scale bars are 500 μm.

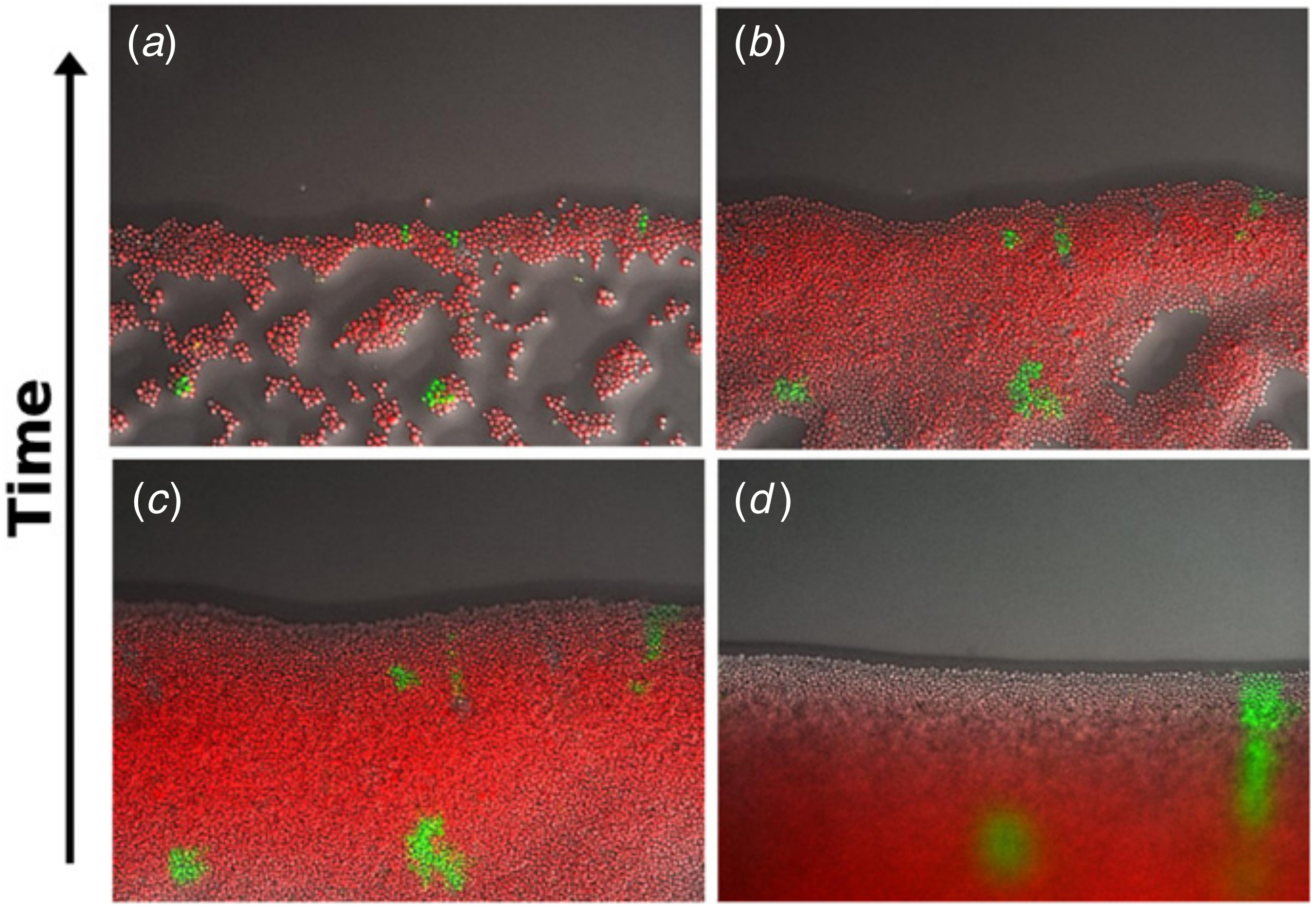
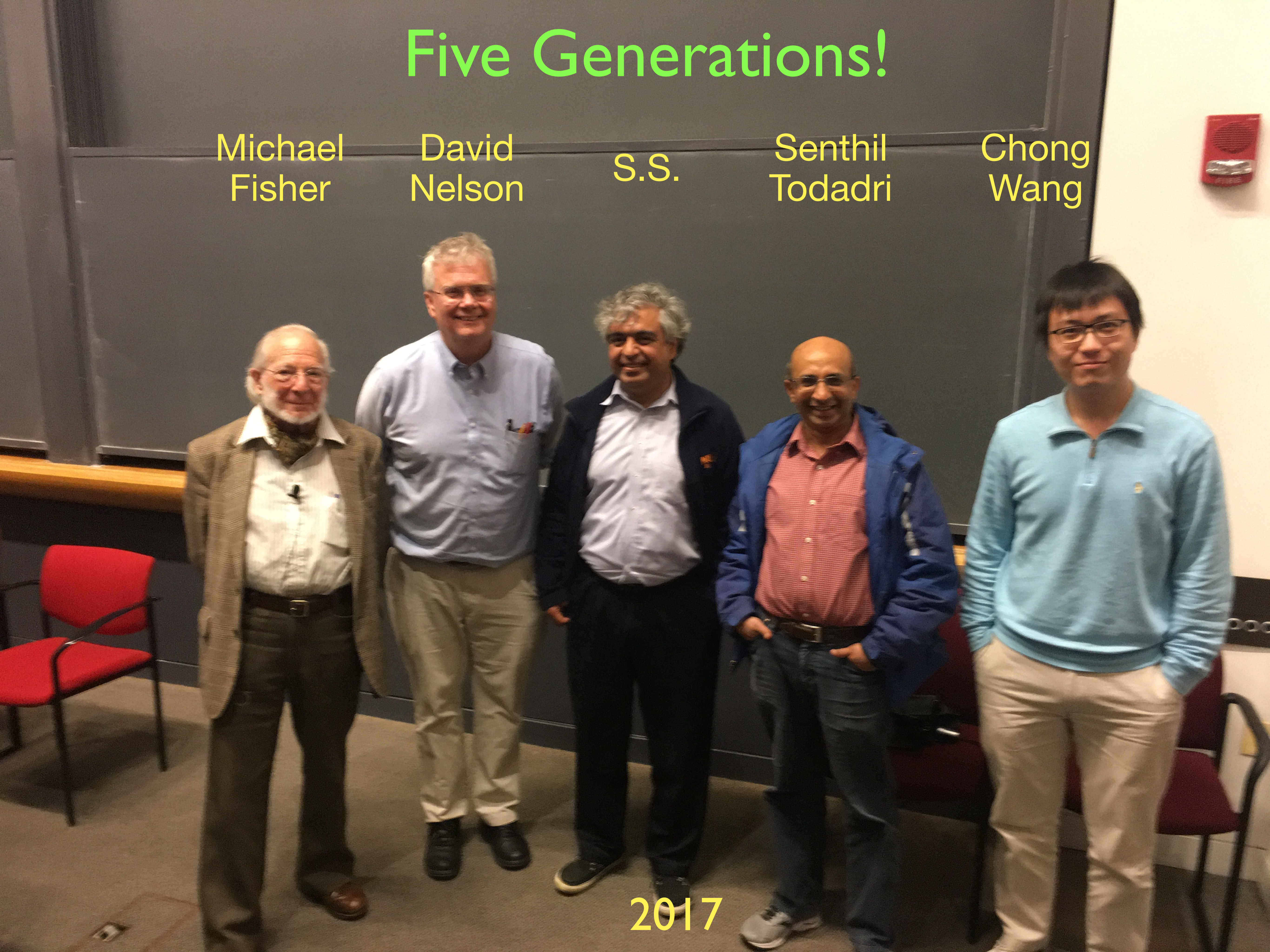


Figure 2. Colony edge at single-cell resolution (mature yeast cells are 5 μm in diameter). (*a*), (*b*), (*c*) and (*d*) Successive images (at 2 h intervals) of the same region near the edge of a growing *S. cerevisiae* colony inoculated with a razor blade. Note the formation of a green (light gray) sector on the lower right. The two strains have approximately the same fitness in this experiment.

Five Generations!



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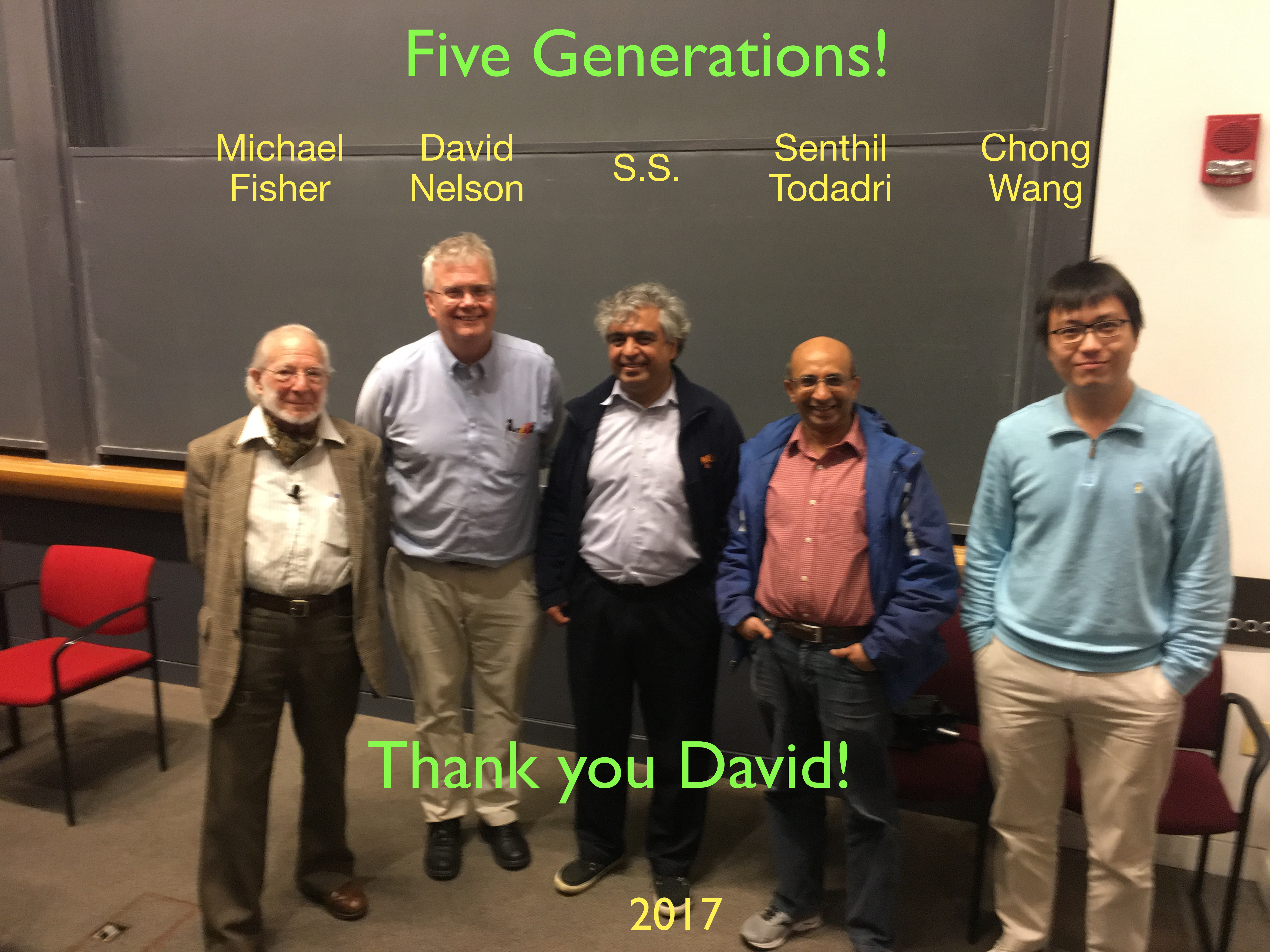

Thank you David!

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