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Feb. 6 1962
Iranian

Mark Rothko faces us with a simple question: where did such paintings come from? Never before had I come across such a question. I started my research by a problem assigned to me by my thesis advisor. It had to do with the phase diagram of a binary alloy. I finished the assignment. Then I wondered about the new problem he had started to consider. This one had to do with Josephson junctions. Before it is late, I should mention that the assignment was finished only due to my lack of knowledge in the process of doing research.

Rothko's early paintings have a character of their own, of course, still they are familiar in the usual sense. My thesis considered the question of the ground state of an array of Josephson junctions in a magnetic field. The magnetic field made the interaction frustrated, and now the potential well became a landscape with a rough terrain, the ground state lying at the bottom of the deepest well.

Rothko's early paintings are full of feelings, and we do not need any special training to sense it. I had no special training of anything beyond the graduate physics.

Rothko's later paintings of subway insist that the vertical confinement underground be extended to horizontal limits by putting people leaning to the station pillars. I got interested in complexity, as was known at the time, and with my first student, compared the Lempel-Ziv complexity in a dynamical system, to that of a quasi-periodic sequence.

Rothko's still later paintings become so abstract his description of them are indeed welcome. The paintings have to do with known myths of antiquity. Rothko talks about them in a radio broadcast, and I invite you to consider his thoughts.
`https://www.nga.gov`

Rothko goes from oil to watercolor, in a period, it is "the fluidity of the medium that he is exploring." (ibid) I go to various subjects, granular matter among them.

Rothko then applies diluted oil to canvas to get similar effects. I realize that Josephson junction can be applied to different topics. Dynamic effects of frustration can be studied.

Rothko approaches his last twenty years of works. There appear horizontal bands in the background, as if stages in the painting are described by them, according to me. Synchronization is the idea that suddenly appears in my studies. But this suddenly has to do with epilepsy.

Rothko uses the bands in a free style, not restricted to a geometric composition.

Sometimes the bands are vertical too, again in a free style, as if taking the place of the figures. I realize that studying a nonlinear dynamics, the Josephson junction can take on those various roles mathematically. Synchronized activity is important for the synaptic arrays too—learning and memory depend on it. Neuroscience is in. We even rediscover the Lisman switch.
Rothko's bands suddenly, as I see it, become geometric. It becomes the statistical mechanics of size colored bands on very large canvases. The synchronous dynamics takes on still new aspects with newly discovered effects of having both synchronous, and asynchronous bands living next to each other; in effect, supporting each other in making the whole.
Rothko's classic paintings consist of the bands on large canvases and stay that way for the last twenty years of his life. The question on 'where the bands came from,' remains mainly unanswered. In science, things are not so unpredictable, or are they?

• Visiting Researcher at the College of Science, Engineering and Technology, University of South Africa (UNISA), 1 July to 30 September 2014, and 14 July to 14 September 2019, Johannesburg, South Africa

• Department of Physics, University of South Africa, Pretoria, South Africa, Dec. 2 to Dec. 16, 2013 (as guest)

• Professor of Physics (2010)

• Sabbatical year at School of Physics and Astronomy, University of Nottingham, United Kingdom (2004-2005)

• Associate Professor of Physics (2002)

• Institute for Advanced Studies in Basic Sciences, Zanjan, Iran (1997-)

• Amir-Kabir University of Technology, Tehran, Iran (1991-1996)

• Ph.D. in Physics, University of Kentucky, Lexington, Kentucky, USA (1990)

• Instructor at Lexington Community College, Lexington, Kentucky (Fall 1990)

• M.S. in Physics, University of Kentucky (Dec. 1985)

• B.S. in Electrical Engineering with High Distinction, U. of Kentucky (1982)

• Bellarmine College (Freshman year), Louisville, Kentucky (1979-1980)

• Thomas Jefferson High School, Louisville, Kentucky (Spring 1979)

• Alborz High School, Tehran, Iran (1973-1979)

Thesis advisor and mentor: Professor Joseph P. Straley

• M. Ansariara, S. Emadi, V. Adami, A. E. Botha, and M. R. Kolahchi, Nonlinear Dynamics **100**, 3685 (2020)
• A. E. Botha and M. R. Kolahchi, Scientific Reports **8**, 1830 (2018)
• M. R. Kolahchi, A. E. Botha, and Yu. M. Shukrinov, J. Supercond. Nov. Magn. **30**, 1659 (2017)
• A. E. Botha, Yu. M. Shukrinov, and M. R. Kolahchi, Nonlinear Dynamics **84**, 1363 (2016)
• A. E. Botha, Yu. M. Shukrinov, and M. R. Kolahchi, Proceedings of the 4th South Africa - JINR Symposium, Few to Many Body Systems: Models, Methods and Applications (Dubna, September 21-25, 2015), edited by F. Šimkovic, pp.135-141 (2016)
• A. E. Botha, Yu. M. Shukrinov, S. Yu. Medvedeva, and M. R. Kolahchi, J. Supercond. Nov. Magn., **28**, 349 (2015)
• Yu. M. Shukrinov, A. E. Botha, S. Yu. Medvedeva, M. R. Kolahchi, and A. Irie, CHAOS **24**, 033115 (2014)
• Yu. M. Shukrinov, S. Yu. Medvedeva, A. E. Botha, M. R. Kolahchi, and A. Irie, Physical Review B, **88**, 214515 (2013)
• M. R. Kolahchi, Yu. M. Shukrinov, M. Hamdipour, A. E. Botha, and M. Suzuki, Physica C, **491**, 63 (2013) (This volume is dedicated to PLASMA 2012: The 8th International Symposium on Intrinsic Josephson Effects and Plasma Oscillations in high-T_c Superconductors, edited by Lutfi Ozyuzer)
• A. E. Botha, Yu. M. Shukrinov, and M. R. Kolahchi, Chaos, Solitons & Fractals, **48**, 32 (2013)
• Yu. M. Shukrinov, M. Hamdipour, M. R. Kolahchi, A. E. Botha, and M. Suzuki, Physics Letters A, **376**, 3609 (2012)
• A. Valizadeh, M. R. Kolahchi, and J. P. Straley, Physical Review B, **82**, 144520 (2010)
• A. Valizadeh, Kh. Jahanbani, and M. R. Kolahchi, Physical Review A, **81**, 023616 (2010)
• Yu. M. Shukrinov, M. Hamdipour, and M. R. Kolahchi, Physical Review B, **80**, 014512 (2009) • also selected and published in the Virtual Journal of Applications of Superconductivity, John R. Clem, Editor
• Y. Azizi, M. R. Kolahchi, J. P. Straley, Proceedings of the 15th Gava Zang Meeting on Condensed Matter Physics, Spring 2009
• M. R. Kolahchi, Journal of Physics: Conference Series **129**, 012039 (2008)
• A. Valizadeh, M. R. Kolahchi, J. P. Straley, Journal of Nonlinear Mathematical Physics **15**, Supplement 3, 397-406 (2008)
• F. Osanloo, M. R. Kolahchi, S. McNamara, and H. J. Herrmann, Phys. Rev. E **78**, 011301 (2008)
• A. Valizadeh, M. R. Kolahchi, and J. P. Straley, Phys. Rev. B **76**, 214511 (2007)

• Nahal, Amjad, Ghods, Khajehpour, Reyhani, Kolahchi, J. Appl. Phys. **100** 053503 (2006)
• M. R. Kolahchi, Proceedings of the 12th Gava Zang Meeting on Condensed Matter Physics, Spring 2006
• H. Fazli, R. Golestanian, P. L. Hansen, M. R. Kolahchi, Eur. Phys. Lett. **73**, 429 (2006)
• H. Fazli, R. Golestanian, M. R. Kolahchi, Phys. Rev. E **72**, 011805 (2005)
• M. R. Kolahchi, Proceedings of the International Conference on Physics, Amirkabir University of Technology, 487 (2004)
• M. R. Kolahchi and J. P. Straley, Physical Review B **66**, 144502 (2002)

• M. R. Kolahchi and H. Fazli, Physical Review B **62**, 9089 (2000)
Behavior of a Josephson junction array with golden mean frustration
• M. R. Kolahchi, Annual Reviews of Computational Physics VIII,
D. Stauffer, ed. World Scientific 2000
Some aspects of dynamics of Josephson junction array at golden mean frustration • M. R. Kolahchi, Physical Review B **59**, 9569 (1999) Ground state of uniformly frustrated Josephson junction array at irrational frustration
• M. R. Kolahchi, Physical Review B **56**, 95 (1997)
Finding local minimum states of Josephson junction arrays in a magnetic field
• M. R. Kolahchi, Proceedings of the Second Gava Zang Meeting on
Condensed Matter Physics, Spring 1996
Lattice with quasiperiodic ground state
• M. R. Kolahchi and J. P. Straley, Physical Review B **43**, 7651 (1991)
Ground state of the uniformly frustrated two-dimensional XY model near f=1/2

University?
M. R. Kolahchi, Iranian Physical Society Quarterly ('Physics Today') **4**, 26 Spring (2014)

Remembering brief moments with John Archibald Wheeler
M. R. Kolahchi, Iranian Journal of Physics **27**, 54 Spring-Summer (2009)

LZ complexity in chaotic dynamical systems and the quasiperiodic Fibonacci sequence
D. Arasteh and M. R. Kolahchi, Iranian Journal of Physics Research **1**, 207 (1998)

Tools for evaluating scientific journals
M. R. Kolahchi, Rahyaft Science Policy Quarterly **15**, 28 (1997)

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teaching graduate and undergraduate courses

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condensed matter physics, statistical physics, quantum mechanics, computational physics, superconductivity, neuronal excitations, advanced topics in condensed matter physics + practically every course on the undergraduate physics curriculum

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• talk at CHAOS2018 11th Chaotic Modeling and Simulation International Conference 5 - 8 June 2018 Rome, Italy (held at the Faculty of Economics, "Sapienza" University of Rome) : Chimera States as Drive-Response Systems
• talk at the Physics Colloquium, IASBS Feb. 2018 : The first nuclear reactor by man: Chicago Pile-1 (CP-1)
• talk entitled "Cassini's Mission" at the School for gifted undergraduate students, IASBS, Feb. 2018
• talk at ICSM2016 5th International Conference on Superconductivity and Magnetism 24 - 30 April 2016 Fethiye, Turkey : Chimera States in an Intrinsically Coupled Stack of Intrinsic Josephson Junctions
• talk at the 21th Gava Zang meeting on Condensed Matter Physics, IASBS, May 2015 : Coherence coexists with incoherence
• talk at the 9th International Symposium on Intrinsic Josephson Effects and THZ Plasma Oscillations in High-Tc Superconductors (THz-PLASMA 2014), Kyoto Univ. Kyoto, Japan, Nov. 30-Dec. 3, 2014 : Structured Chaos in a Devil's Staircase of the Josephson Junction

`http://sk.kuee.kyoto-u.ac.jp/plasma2014/`
`http://sk.kuee.kyoto-u.ac.jp/plasma2014/wp-content/uploads/2014/11/ScientificProgram.pdf`
`http://sk.kuee.kyoto-u.ac.jp/plasma2014/wp-content/uploads/2014/11/ListofPresentations.pdf`
`http://sk.kuee.kyoto-u.ac.jp/plasma2014/wp-content/uploads/2014/04/GP1.jpg`

• invited talk at the 2nd One Day Conference on Superconductivity and its Applications held at Dept. of Electrical Engineering, Sharif University of Technology, Feb. 28, 2011 : Synchronization Effects in a Strongly Coupled Nano-Mechanical Single-Electron Transistor

• lectures entitled "Memory: A Basic Model" at the School for gifted undergraduate students, IASBS 2011

• presented a talk at the 12th Gava Zang meeting on Condensed Matter Physics, Institute for Advanced Studies in Basic Sciences (IASBS), Spring 2006

• talk entitled "Starting on granular matter" at the School for gifted undergraduate students, IASBS 2003

• three lectures entitled "Life is nonlinear" at the School for gifted undergraduate students, IASBS 2001

• two lectures entitled "The role of simulations in physics" at the School for gifted undergraduate students, IASBS 1998

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as thesis advisor

Ph.D.

• Ground state and dynamics of aperiodic Josephson junction arrays: The role of the vortex lattice (2011)
• Study of synchronization in a triangular plaquette of Josephson junctions and a chain of triangular plaquettes (2008)

• Study of sediment transport in the saltation regime with H. J. Herrmann and S. McNamara (2008)
• Study of the collective behavior of rod-like polyelectrolytes using computer simulation methods in cooperation with R. Golestanian (2005)

Master's

• The Fractal Basin Boundary in the Dynamical System (2019)
• Learning through synchronous synaptic activity (2016)
• Moderation and belief propagation in the framework of socio-physics (2015)
• Investigation of the neuron's dynamics within the Morris-Lecar model (2012)
• Investigation of synchronization and bursting in a triangular array of Morris-Lecar neurons with S. Emadi (2011)
• Study of dynamic memory of gradually changing objects (2010)
• The Hodgkin-Huxley model of the neuron with S. Emadi (2010)
• Bose-Einstein condensation and formation of vortex lattices in dilute gases (2009)
• Levitation using the diamagnetic property (2006)
• Study of the homogeneous cooling and inelastic collapse in a one-dimensional granular system using the event driven molecular dynamics method (2004)
• Study of the internet traffic within the Ohira-Sawatari model (2003)
• Dynamics of a globally coupled series array of Josephson junctions (2003)
• Superheating field of a superconducting slab (2003)
• Synchronization of coupled oscillators with nearest neighbor coupling (2001)
• Numerical calculation of entropy from trajectory of motion (2001)
• Ground state of a quasiperiodic Penrose lattice of Josephson junctions in presence of a perpendicular magnetic field (2001)
• Glassy behavior in Josephson junction arrays (1999)
• Ground state of Josephson junction arrays in transverse magnetic field (1999)
• Determination of some characteristic dynamical parameters of chaotic systems (1995)

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books/articles translated

• Kirsten Franklin, Paul Muir, Terry Scott, Lara Wilcocks, and Paul Yates, Introduction to Biological Physics for the Health and Life Sciences, with M.E. AbuKazemi, 2013
• Jearl Walker, Halliday, Resnick, Fundamentals of Physics third volume, with M.E. AbuKazemi and J. Pashaie-Rad, 2010
• Amit Goswami, Quantum Mechanics, 2nd ed. with Firooz Arash; Markaz-e-Nashr-e-Daneshgahi, 2009
• Jearl Walker, Halliday, Resnick, Fundamentals of Physics second volume, with M.E. AbuKazemi and J. Pashaie-Rad, 2009

• Jearl Walker, Halliday, Resnick, Fundamentals of Physics with M.E. AbuKazemi and J. Pashaie-Rad, 2008
• thirty one articles translated for the Farsi translation of the MacMillan Encyclopedia of Physics M. E. AbuKazemi ed. to the Farsi edition, vol. 1 (2002); vol. 2 (2006); vol. 3 (2008)
• Wave physics: oscillations, solitons, chaos by Stephen Nettel, Springer 1995
• co-translator of: Berkeley physics course vol 3, Waves by Frank S. Crawford
• articles in several issues of Iranian Journal of Physics, since 1994

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member of the board of editors of the Iranian Journal of Physics, 2007-2011

assistant editor to the Farsi translation of the MacMillan Encyclopedia of Physics vol. 1 (2002); vol. 2 (2006); vol. 3 (2008)
Institute for Advanced Studies in Basic Sciences and Bonyad Daneshnam-e-Bozorg Farsi, M. E. AbuKazemi editor

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guest editor to the Annual Reviews of Computational Physics VIII, edited by Dietrich Stauffer, World Scientific (2001)

• College of Science, Engineering and Technology, University of South Africa (UNISA), 12 July to 12 September 2015, Johannesburg, South Africa (as guest)
• 4th South Africa - JINR Symposium
Few to Many Body Systems: Models and Methods and Applications
September 21-25, 2015, BLTP JINR Dubna, Moscow Region, Russia (as guest)
• Department of Physics, University of South Africa, Pretoria, South Africa, Dec. 2 – Dec. 16, 2013 (as guest)
• BLTP, JINR, Dubna, Russia, April 24 – May 4, 2013 (as guest)
• The 8th International Symposium on Intrinsic Josephson Effects and Plasma Oscillations in High-Tc Superconductors (PLASMA 2012)
Izmir Institute of Technology, Izmir, Turkey, June 10-13, 2012
(contributed a poster)
• The International Conference on Theoretical Physics 'Dubna-Nano2010'
Dubna, Russia, July 5-10, 2010
• The International Conference on Theoretical Physics 'Dubna-Nano2008'
Dubna, Russia, July 7-11, 2008
(contributed a poster) • Nonlinear Evolution Equations and Dynamical Systems (NEEDS) 2007
L' Ametlla de Mar, Spain, June 15-24, 2007
(contributed a paper with A. Valizadeh and J.P. Straley)

• The Centenary of Einstein's Annus Mirabilis, London, 4-5 March 2005
organized by The British Society for the history of science

• Summer School on the Theoretical Aspects of Computer Science,
Institute for Physics and Mathematics (IPM), Tehran 2000

• International Summer School on Statistical Physics and Probabilistic Methods in Computer Science
+ Conference on NP-Hardness and Phase Transitions, ICTP 1999 (as invited participant)
presented poster entitled: Slow dynamics in a Josephson juction array with the Golden mean frustration

• STATPHYS20 Paris July 98 (as invited participant) presented poster entitled: Ground state of irrationally frustrated Josephson junction arrays (under the topic of *Disordered media*)

• ICTP Extended Workshop on Frustrated Systems 1997 (as tutor)

• ICTP Workshop on Josephson-junction arrays 1995 (as invited participant)

• Fundamental Aspects of Quantum Theory, A conference on the Foundations of Quantum Mechanics to celebrate 30 years of the Aharanov-Bohm effect, December 14-16, 1989, The University of South Carolina, Columbia SC USA (coincident with Andrei Sakharov's death)

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organizing conferences

• served on the organizing committee of the 16th Gava Zang meeting on Condensed Matter Physics, Institute for Advanced Studies in Basic Sciences, Spring 2010
• served on the organizing committee of the 15th Gava Zang meeting on Condensed Matter Physics, Institute for Advanced Studies in Basic Sciences, Spring 2009
• served on the organizing committee of the 14th Gava Zang meeting on Condensed Matter Physics, Institute for Advanced Studies in Basic Sciences, Spring 2008
• served on the organizing committee of the 13th Gava Zang meeting on Condensed Matter Physics, Institute for Advanced Studies in Basic Sciences, Spring 2007
• served on the scientific committee of the Iran's Annual Physics Conference for the year 2003
• organized the 8th Gava Zang meeting on Condensed Matter Physics,
Institute for Advanced Studies in Basic Sciences (IASBS), Spring 2002
• organized the 7th Gava Zang meeting on Condensed Matter Physics, IASBS, Spring 2001
• organized the 6th Gava Zang meeting on Condensed Matter Physics, IASBS, Spring 2000
• a member of the organizing committee of the First Regional Summer School on Scaling and Disordered Systems 3-16 July 1999, Gava Zang, Zanjan, Iran
• served on the scientific committee of the Iran's Annual Physics Conference for the year 1999

• organized the 5th Gava Zang meeting on Condensed Matter Physics, IASBS, Spring 1999 • organized the 4th Gava Zang meeting on Condensed Matter Physics, IASBS, Spring 1998

• Member of the University's Board of Supervisors (2005-2010; 2016-)

• Member of the Supervisory Committee (2009-2010)

• Head of the Physics Department (2007-2009)

• Director of the library (2001-2003)

• Member of the research council (2000-2003)

Associate Member of Sigma Xi (initiation ceremony 1982)
Member of Sigma Pi Sigma (Honor Society of Physics Students, init. 1985)
Member of the Iranian Physical Society
Lifetime member of the American Physical Society

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