

John Russo
Curriculum Vitae

Roma,
30/07/2024

Part I – General Information

Full Name	John Russo
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Part II – Education

Type	Year	Institution	Notes (Degree, Experience,...)
University graduation	2006	Sapienza University of Rome	MSc degree
PhD	2010	Sapienza University of Rome	PhD in Physics

Part III – Appointments

IIIA – Academic Appointments

Start	End	Institution	Position
10/2019	current	Sapienza University of Rome	Associate Professor
09/2019	10/2019	University of Bristol	Associate Professor
12/2015	08/2019	University of Bristol	Lecturer in Applied Mathematics
12/2013	11/2015	The University of Tokyo	Project Research Associate
12/2011	11/2013	The University of Tokyo	JSPS Postdoctoral Fellow
12/2010	11/2021	The University of Tokyo	Project Researcher

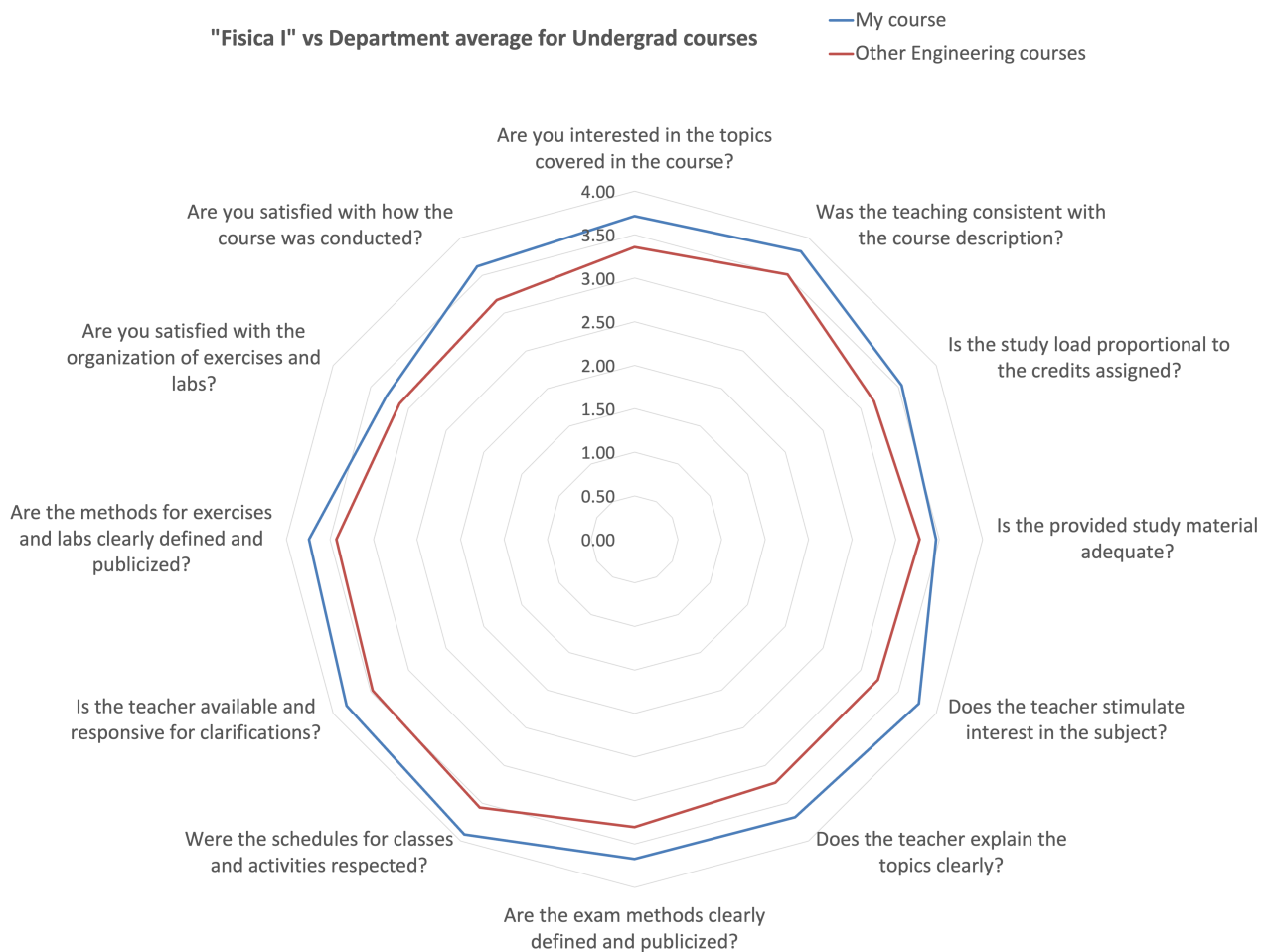
IIIB – Other Appointments

None

Part IV – Teaching experience

Year	Institution	Lecture/Course
2020-current	Department of Physics, Sapienza	<i>Physics of Liquids</i> . 6 credits, 25 students/year
2020-current	Department of Civil Engineering, Sapienza	<i>Fisica I</i> . 9 credits, 120 students/year
2016-2018	School of Maths, Bristol	<i>Foundational Mathematics</i> . 6 credits, 80 students/year

Below I report a graph of student evaluations for my 2024 “Fisica I” course (blue line, averaged over 140 student evaluations), compared with the average over the other courses of the Department of Aerospace Engineering (red line). Questions are scored from 1 to 4, with 4 being the best score. A similar graph, outperforming the Department average on all questions, applies to the “Physics of Liquids course” (with 20 student evaluations), and for all academic years I’ve been teaching in Sapienza.



Part V - Society memberships, Awards and Honors

Year	Title
2018	Philip Leverhulme Prize in Physics, by the Leverhulme Trust. The most prestigious prize in the UK for physicists within ten years of their doctoral thesis. The prize includes a significant financial grant intended to support the recipient's research activities. https://www.leverhulme.ac.uk/philip-leverhulme-prizes-2018 https://www.bristol.ac.uk/news/2018/november/leverhulme-2018.html https://en.wikipedia.org/wiki/Philip_Leverhulme_Prize#2018
2017	<i>SMTG Young Scientist Award</i> , by the Royal Society of Chemistry's Statistical Mechanics and Thermodynamics Group. The prize is given biennially to an exceptional scientist in the early stages of their career, working broadly in the area of statistical mechanics and thermodynamics.
2015	<i>University Research Fellowship</i> , from the Royal Society, UK. Most prestigious individual research fellowship in the UK. https://royalsociety.org/news/2015/09/new-urfs-2015/
2011	<i>JSPS postdoctoral fellowship</i> , from the Japan Society for the Promotion of Science. Most prestigious individual research fellowship in Japan.

Part VI - Funding Information [grants as PI-principal investigator or I-investigator]

Year	Title	Program	Grant value
2018-2024	PI	ERC starting grant	952,561 Euro
2019	Co-I	Leverhulme trust grant	402,051 Pounds
2018	PI	The Leverhulme Prize	100,000 Pounds
2015-2020	PI	University Research Fellowship	565,536 Pounds
2011-2013	PI	Japan Society for the Promotion of Science	80,000 Pounds

I'm **PI** of the PNRR flagship project "*Development of new Neural Network potentials for Soft Matter applications*" which coordinates the activities of 4 Co-I members of our Department (Prof. Sciortino, Prof. De Michele, Prof. Rovigatti, and Dr. Leoni).

Part VII – Research Activities

Reference numbers in square brackets refer to the list of articles in Part IX.

Keywords	Brief Description
Self-Assembly	Since 2020 I was among the original proponents of a novel conceptual framework for solving inverse self-assembly problems, named SAT-assembly [PRL 125, 118003, 2020]. It consists in converting the topology of the target structure in a set of Boolean Satisfiability equations. We have successfully demonstrated the applicability of the SAT-assembly to design novel crystal structures, capsids [3], and recently quasi-crystals. Collaboration with experimentalists in Technical University of Munich has led in 2024 to a <i>Science</i> paper [1] which uses SAT-assembly to assemble for the first time a colloidal pyrochlore lattice. I am a co-owner of 1 patent and 1 patent-pending application for technologies related to SAT-assembly.
Glass Transition	I have extensively worked on different aspects related to structural glasses, e.g. locally favoured structures [6], point-to-set lengthscales [14], glass forming ability [10], ultrastability [PRL 127, 215501, 2021], and vapor deposition [2].
Statistical Mechanics	I have worked on several long-standing stat-mech problems, such as re-entrant network liquids [PRL 106, 085703, 2011], and topological phases in two-dimensional mixtures [11]. We have found the first quadruple point in a one-component system and formulated a generalized Gibbs rule of phases [Nat. Comm. 7, 12599, 2016]. Recently, we are focusing on the thermodynamics of mixtures with a large number of components, where we have discovered new phase diagram topologies, having vanishing lines of binary critical points, and always azeotropic mixtures [ACS Nano 17, 24841, 2023].
Water	I have contributed to the study of water anomalies and ice nucleation. We introduced the first microscopically-derived two-state model of water [15], which has had a big impact in the field with over 300 citations. We have clarified the nature of the fragile-to-strong transition [8]. We have found the first model of water with a re-entrant spinodal line [9]. We have proposed the existence of a new phase of ice, named ice 0, which we believe plays an important role in the homogeneous nucleation process [16]. I have co-authored the most cited (over 800 citations) review paper in water science of the last ten years [13].
Nucleation	I have worked extensively on nucleation phenomena, and in particular on non-classical nucleation pathways. We are the proponents of the scenario in which nucleation proceeds via differential ordering of multiple order parameters [Sci. Rep. 2, 505, 2012], a paper which has received considerable experimental attention (over 270 citations). Another important contribution is the definition of the polymorph selection criteria which states that the nucleating polymorph can be found by looking at the orientational order in the melt [5].
Algorithms	I am active in the development of new algorithms for molecular simulations and their analysis. Examples include Aggregation-biased moves for Patchy interactions [4], CNT-Umbrella sampling [16], semigrand Wang-Landau sampling [10,11]. Since 2022, together with a PhD student, we have developed from the ground up a Neural Network Potential (NNP) with self-tuning parameters (https://github.com/russojohn/Alphanes_Interface.git). The new potential is being applied on ab-initio potentials (aluminium and water), and for applications in Soft Matter. I have written a popular review article in Nature Reviews Physics [6] on static structure detection in liquids.
Experiments	I have long-standing collaborations with experimental groups (in Japan, UK, and the Netherlands) especially for the analysis of Confocal Microscope data. An example is the work on “Crystal-gels” [12]. I recently co-authored an extensive review paper [arXiv:2305.02452] on colloidal Hard Spheres which has been accepted for publication in <i>Review of Modern Physics</i> .

Part VIII – Summary of Scientific Achievements

Product type	Number	Data Base	Start	End
Papers [international]	66	Web of Science	2007	2024
Papers [national]	0			
Books [scientific]	0			
Books [teaching]	0			

	Web of Science	Google Scholar
Total Impact factor	666	666
Total Citations	4006	4285
Average Citations per Product	60.7	65.0
Hirsch (H) index	30	31
Normalized H index*	2.14	2.21

*H index divided by the academic seniority.

The following is a summary of my publications in high-impact journals.

<i>Journal Name</i>	<i>Number of Articles</i>	<i>Impact Factor</i>
<i>Chemical Reviews</i>	1	60.62
<i>Rev. Mod. Phys. (accepted)</i>	1	54.49
<i>Science</i>	1	47.73
<i>Nature Materials</i>	2	47.66
<i>Nature Reviews Physics</i>	1	36.27
<i>ACS NANO</i>	1	18.03
<i>Nature Communications</i>	3	17.69
<i>Rep. on Progr. in Physics</i>	1	17.26
<i>Physical Review X</i>	2	14.42
<i>Science Advances</i>	1	14.14
<i>PNAS</i>	4	12.78
<i>Physical Review Letters</i>	9	9.185

Part IX– Selected Publications

List of the publications selected for the evaluation. For each publication report title, authors, reference data, journal IF (if applicable), citations, press/media release (if any).

References reported in reverse chronological order.

Reference 1:

Title: Inverse design of a pyrochlore lattice of DNA origami through model-driven experiments

Authors: Liu, H., Matthies, M., Russo, J., Rovigatti, L., Narayanan, R. P., Diep, T., McKeen, D., Gang, O., Stephanopoulos, N., Sciortino, F., Yan, H., Romano, F., Šulc, P.

Reference data: **Science**, 384(6697) (2024), 776-781.

Journal IF: 47.73

Citations (Google Scholar): 8

Reference 2:

Title: Structural signatures of ultrastability in a deposited glassformer

Authors: Leoni, F., Martelli, F., Royall, C. P., & Russo, J.

Reference data: **Physical Review Letters**, 130(19) (2023), 198201.

Journal IF: 9.185

Citations (Google Scholar): 5

Reference 3:

Title: Design strategies for the self-assembly of polyhedral shells

Authors: Pinto, D. E., Šulc, P., Sciortino, F., & Russo, J.

Reference data: **PNAS**, 120(16) (2023), e2219458120.

Journal IF: 12.78

Citations (Google Scholar): 14

Reference 4:

Title: The physics of empty liquids: From patchy particles to water

Authors: Russo, J., Leoni, F., Martelli, F., & Sciortino, F.

Reference data: **Reports on Progress in Physics**, 85(1) (2022), 016601.

Journal IF: 17.26

Citations (Google Scholar): 31

Reference 5:

Title: Nonclassical nucleation pathways in stacking-disordered crystals

Authors: Leoni, F., & Russo, J.

Reference data: **Physical Review X**, 11(3) (2021), 031006.

Journal IF: 14.42

Citations (Google Scholar): 36

Reference 6:

Title: Revealing key structural features hidden in liquids and glasses

Authors: Tanaka, H., Tong, H., Shi, R., & Russo, J.

Reference data: **Nature Reviews Physics**, 1(5) (2019), 333-348.

Journal IF: 36.27

Citations (Google Scholar): 184

Reference 7:

Title: Direct link between mechanical stability in gels and percolation of isostatic particles

Authors: Tsurusawa, H., Leocmach, M., Russo, J., & Tanaka, H.

Reference data: **Science Advances**, 5(5) (2019), eaav6090.

Journal IF: 14.14

Citations (Google Scholar): 99

Reference 8:

Title: Origin of the emergent fragile-to-strong transition in supercooled water

Authors: Shi, R., Russo, J., & Tanaka, H.

Reference data: **PNAS**, 115(38) (2018), 9444-9449.

Journal IF: 12.78

Citations (Google Scholar): 134

Reference 9:

Title: Water-like anomalies as a function of tetrahedrality

Authors: Russo, J., Akahane, K., & Tanaka, H.

Reference data: **PNAS**, 115(15) (2018), E3333-E3341.

Journal IF: 12.78

Citations (Google Scholar): 82

Reference 10:

Title: Glass forming ability in systems with competing orderings

Authors: Russo, J., Romano, F., & Tanaka, H.

Reference data: **Physical Review X**, 8(2) (2018), 021040.

Journal IF: 14.42

Citations (Google Scholar): 86

Reference 11:

Title: Disappearance of the hexatic phase in a binary mixture of hard disks

Authors: Russo, J., & Wilding, N. B.

Reference data: **Physical Review Letters**, 119(11) (2017), 115702.

Journal IF: 9.185

Citations (Google Scholar): 56

Reference 12:

Title: Formation of porous crystals via viscoelastic phase separation

Authors: Tsurusawa, H., Russo, J., Leocmach, M., & Tanaka, H.

Reference data: **Nature Materials**, 16(10) (2017), 1022-1028.

Journal IF: 47.66

Citations (Google Scholar): 43

Reference 13:

Title: Water: A tale of two liquids

Authors: Gallo, P., Amann-Winkel, K., Angell, C. A., Anisimov, M. A., Caupin, F., Chakravarty, C., Lascaris, E., Loerting, T., Panagiotopoulos, A. Z., Russo, J., Sellberg, J. A., Stanley, H. E., Tanaka, H., Vega, C., Xu, L., Pettersson, L. G. M.

Reference data: **Chemical Reviews**, 116(13) (2016), 7463-7500.

Journal IF: 60.62

Citations (Google Scholar): 807

Reference 14:

Title: Assessing the role of static length scales behind glassy dynamics in polydisperse hard disks

Authors: Russo, J., & Tanaka, H.

Reference data: **PNAS**, 112(22) (2015), 6920-6924.

Journal IF: 12.78

Citations (Google Scholar): 66

Reference 15:

Title: Understanding water's anomalies with locally favoured structures

Authors: Russo, J., & Tanaka, H.

Reference data: **Nature Communications**, 5(1) (2014), 3556.

Journal IF: 17.69

Citations (Google Scholar): 330

Reference 16:

Title: New metastable form of ice and its role in the homogeneous crystallization of water

Authors: Russo, J., Romano, F., & Tanaka, H.

Reference data: **Nature Materials**, 13(7) (2014), 733-739.

Journal IF: 47.66

Citations (Google Scholar): 228

Part X– Titles**Part X – Academic leadership****X.1 PhD supervision**

Name	Year	Institution
Camilla Beneduce	2022-2025	Department of Physics, Sapienza
Francesco Guidareli Mattoli	2021-2024	Department of Physics, Sapienza
Alberto Toffano	2020-2024	University of Bristol
Fergus Moore	2019-2022	Joint with Prof. C. Royall funded by EPSRC (BCEN CDT)
Yushi Yang	2019-2022	Joint with Prof. C. Royall funded by EPSRC (BCFN CDT)

X.2 Student supervision

BSc (undergraduate): 4 students in Applied Mathematics (Bristol) + 2 students in Physics (Sapienza)

MSc (graduate students): 7 students in Physics (Sapienza)

X.3 Conference organization

The following is a table of the conference in which I was/am in the Organizing Committee.

Name of Conference	Where	Year	Participants
Unifying Concepts in Glass Physics VII	Bristol	2018	150
Water UK	Bristol	2019	50
Grand Views of Soft and Liquid Matter Physics	Tokyo	2020 (cancelled for Covid)	80
From Water to Colloidal Water	Rome	2022	100
Grand Views of Soft And Liquid Matter Physics II	Tokyo	2025	-

X.4 Invited presentations

1. **Keynote Speaker at “7th International Soft Matter Conference”, Osaka, September 4-8, 2023.**
-Title: The inverse self-assembly problem as a coloring problem.
2. **Invited Speaker at “9th International Discussion Meeting on Relaxations in Complex Systems (9IDMRCS)”, Chiba, August 12-18, 2023.**
-Title: Structural signature of ultrastability in a vapor deposited glass-former.
3. **Invited Speaker at “26th International Congress on Glass (ICG)”, Berlin, July 3-8, 2022.**
-Title: Towards glasses with permanent stability
4. **Invited Speaker at “WaterEurope: Multiscale Simulations and Coarse-Grained Models for Water and Aqueous Systems”, CECAM, October 21-23, 2019.**
- Title: What We Learned So Far from Coarse-Grained Water Models.
5. **Invited Speaker at “Topical Meeting on Molecular Dynamics III”, Copenhagen, August 27, 2019.**
- Title: To MD or to MC, This is the Question.
6. **Invited Speaker at “Japan Physical Society Meeting”, Tokyo, Japan, August 7, 2019.**
- Title: The Kinetic Pathway of Crystal Nucleation Revealed by Machine Learning.
7. **Invited Speaker at “Water Under Extreme Conditions”, Rome, June 12-14, 2019.**
- Title: Crystalline Clusters in mW Water: Stability, Growth, and Grain Boundaries.
8. **Invited Speaker at “2019 International Workshop on Soft Matter and Biophysics Theories”, Beijing, China, May 11-14, 2019.**
- Title: Neural Networks for Nucleation.
9. **Invited Speaker at “Building Links Between Experiments and Computer Simulations of Crystallisation”, International Conference, July 12-14, 2017.**
- Title: Spontaneous Formation of Porous Crystals via Viscoelastic Phase Separation.
10. **Invited Speaker at “VISCOUS LIQUIDS AND THE GLASS TRANSITION (XIV)”, Søminestationen, Denmark, June 16-18, 2016.**
- Title: Nucleation and Glass-Forming Ability in Systems with Competing Orderings.
11. **Invited Speaker at “Molecular Simulation at Bristol”, University of Bristol, June 13, 2016.**
- Title: Four-Phase Coexistence in a Single-Component System? Yes, We Can.
12. **Invited Speaker at “In-situ Observation and Theory of Elementary Growth Processes of Crystal Surfaces and Interfaces”, International Conference, January 22-23, 2015.**
- Title: A New Metastable Form of Ice and Its Role in Ice Nucleation.
13. **Invited Speaker at “7th International Discussion Meeting on Relaxations in Complex Systems (7th IDMRCS)”, International Conference, July 21-26, 2013.**
- Title: Crystallization as the Ordering of Multiple Order Parameters.
14. **Invited Speaker at “The 3rd Workshop on Computational and Statistical Physics (CSP3)”, Kyoto, October 19-20, 2012.**
- Title: Bond Orientational Order in Crystallization.

X.5 Invited Research Positions (Fellowships) at Qualified Foreign or International Universities and Research Institutes

1. **Visiting Researcher at the Newton Institute for Mathematical Sciences, University of Cambridge**
Duration: 26th November, 2023 – 20th December, 2023
2. **Visiting Researcher at the Department of Applied Mathematics, University of Bristol.**
Duration: September 1, 2020 - Present.
3. **Visiting Researcher at the Department of Molecular Science and Nanosystems, Ca’ Foscari University (Venice).**
Duration: June 4 - July 4, 2019.

4. **Visiting Researcher** at the Institute of Industrial Science, **University of Tokyo**.
Duration: December 1, 2016 – 2019 (one month/year).

X.6 Patents

1. **Patent Number US202117192305**, “*Systems and Methods for Designing Self-Assembled Nanostructures*”, 03/04/2020, Co-Inventor.
2. **U.S. Non-Provisional Patent Application Serial No. 18/606,649**, “*Systems and Methods for Self-Assembly and Design of Optical Metamaterials*”, Filing Date: 15/03/2024, Co-Inventor

X.7 Teaching in Doctoral Schools

1. **Invited Lecturer** at “**Advanced School in Soft Condensed Matter ‘Solutions in the Summer’**”, **Bristol, July 5-9, 2021**.
- Topics: Self-Assembly
2. **Invited Lecturer** at “**Hamburg Centre for Ultrafast Imaging (CUI), Winter School**”
- Topics: Phase Transitions

X.8 Editorial Work

1. **Guest Editor** for “The European Physical Journal E” for the collection “Advances in Computational Methods for Soft Matter Systems”
2. Reviewer for all major Journals in the fields of Soft Matter Physics, Chemical Physics.

X.9 Industry collaborations

- **Scientific supervisor** of an Industrial CASE PhD Awards project, which are assigned by the public funding agency EPSRC (UK) and co-funded by an industrial partner. The project has **IBM Research (UK)** as the industrial partner, while my role is that of the academic partner. The project involves the study of biological glasses and includes the training of a PhD student (Alberto Toffano).

Project title: “*Understanding biological glasses via large-scale molecular dynamics simulations*”

From 01-05-2020 to the present.

X.10 Committees

- “*Placement*” committee member, Dipartimento di Fisica, Sapienza, 2024-current.
The committee is responsible for informing the students about job opportunities, and organizes questionnaires and seminars with Research Institutes and private organizations.
- “*Phd selection*” committee member, Dipartimento di Fisica, Sapienza, 2023
- “*VQR*” committee member, Dipartimento di Fisica, Sapienza, 2022
VQR prepares the Department report for the assessment of the quality of research. This is an extremely important document that is evaluated nationally and affects funding for the university.
- “*Equality and Diversity*” committee member, School of Maths, Bristol, 2017-2019
The committee works towards inclusiveness and during my tenure has received an Athena Swann silver medal, which is assigned to the most inclusive Departments in the UK.