REPORT ON ICALP 2022

49th EATCS International Colloquium on Automata, Languages and Programming

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The *49th EATCS International Colloquium on Automata, Languages and Programming (ICALP 2022)*, the flagship conference and annual meeting of the *European Association for Theoretical Computer Science (EATCS)*, took place in Paris, on July 4-8, 2022. The event was held in hybrid format, and it was hosted by the Research Institute on the Foundations of Computer Science (IRIF) at the Université Paris Cité.

The main conference was preceded by a series of workshops on July 4, 2022. The following workshops were held as satellite events of ICALP 2022:

- Parameterized Approximation Algorithms Workshop (PAAW),

- Combinatorial Reconfiguration,

- Recent Advances on Total Search Problems,

- LearnAut: 4th edition of the Learning and Automata workshop,

- Algorithmic Aspects of Temporal Graphs V (AATG),

- Trends in Arithmetic Theories,

- Structure Meets Power,

- Straight-Line Programs, Word Equations and their Interplay,

- Graph Width Parameters: from Structure to Algorithms (GWP).

The scientific programme of ICALP 2022 consisted of 3 unifying lectures and 3 invited lectures of the two tracks of ICALP, the presentation of 127 contributed papers (which were selected by the Program Committees out of 433 submissions) and award sessions with the lectures of the Gödel Prize 2022, the EATCS Award 2022, and the Presburger Award 2022 recipients.

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Organisation of ICALP 2022, Environment Sustainability, and EATCS'50 special event. ICALP 2022 had two special features: it aimed toward a more sustainable model of conference, and it presented an exhibition for the 50 years of ICALP and the EATCS.

Towards environmental sustainability several steps were taken:

ICALP 2022 signed the *TCS4F manifesto* (`http://www.tcs4f.org`), a TCS initiative pledging for a reduction of the carbon footprint of our research practices.

The conference ran in *full hybrid mode*. The call for papers explicitly allowed remote participation for authors who would have to take the plane to reach Paris. The hybrid conference used the HOPIN conference platform and the WHY.VISION company took care of the local technical support. The regular talks were 25 minutes long including questions, both for onsite and online speakers. The distant talks (less than one fourth) were presented live, and were smoothly alternating with onsite speakers during the sessions. The virtual platform streamed all the talks, and a replay of all presentations was accessible for several weeks to all participants. Interaction with other participants and speakers was possible through a chat.

An *extended stay support scheme* was organised. It advertised eight participating research laboratories accessible by train from Paris, that were offering to fund collaborations between their members and conference attendees, under the condition that no plane would be taken between the conference and the collaboration.

A *colocated conference* "Highlights of Logic, Games and Automata 2022" (on Track B topics) was scheduled the week before ICALP in Paris.

An *environmental chair*, Hugo Férée, was appointed, with as goal to evaluate the carbon footprint of the conference. The conference emitted 205 tons of CO_2-equivalent (CO_2-e): 172 for ICALP itself, and 30 more for workshop-only participants. Some 33 extra tons would have been emitted if all ICALP speakers would have come to Paris. 6 other tons would have been produced if the Highlights participants did go back home between the two events.

2022 was the *50 year anniversary* of both the EATCS and its flagship conference ICALP. A special *exhibition* was conceived and displayed at IRIF, first during the cocktail, and then for the rest of the conference. The scientific advisory board was chaired by Sylvain Schmitz (IRIF), and consisted of Luca Aceto, Susanne Albers, Giorgio Ausiello, Gilles Dowek, Phokion G. Kolaitis, and Mike Paterson. Extra contributors were solicited: Simon Apers, Alex Bredariol Grilo, Ioannis Chatzigiannakis, Geoffroy Couteau, Pierluigi Crescenzi, Irène Guessarian, Hugo Herbelin, Ce Jin, Jean-Jacques Levy, Kurt Melhorn, Subhasree Patro, Sylvain Périfel, and Jean-Éric Pin. Sandrine Cadet and Sylvain Schmitz were coordinators of the exhibition.

The registration costs were 540€ for regular participants (390€ for students) attending onsite, and 340€ for virtual participants (40€ for students). An extra fee of 100€ was charged for paper authors for covering the LIPIcs proceedings, and organising the event. The workshop day unique price was 50€. This choice was taken for mitigating uncertainties concerning remote participation, and running the hybrid mode.

The organisers and the attendees committed to the ICALP code of conduct, and two SafeToC counsellors, Sophie Laplante and Daniela Petrisan, were appointed.

On behalf of the entire community, we warmly thank the organizers in Paris for their fantastic efforts that helped to make ICALP 2022 and the 50th anniversary of EATCS a great success.

Paper selection and work of the Program Committee. After 15 years running the ICALP conference with three tracks, ICALP returned in 2020 to the original two-track format. The ICALP 2022 program had the following two tracks:

- Track A: Algorithms, Complexity, and Games.

- Track B: Automata, Logic, Semantics, and Theory of Programming.

The PC chairs for the two tracks of ICALP 2022 were David Woodruff (Track A) and Mikołaj Bojańczyk (Track B). Their efforts were supported by 71 members of the Program Committees (43 in track A and 28 in track B). In response to the call for papers, a total of 433 submissions were received: 350 for Track A and 83 for Track B. Each submission was assigned to at least three Program Committee members, aided by more than 600 external subreviewers. The Program Committees decided to accept 127 papers for inclusion in the scientific program: 103 papers for Track A and 24 for Track B. This gives the acceptance rate for the entire conference to be 29.3%. The selection was made by the Program Committees based on originality, quality, and relevance to theoretical computer science. The quality of the submitted manuscripts was very high, and unfortunately many strong papers could not be selected. We take this opportunity of thanking both the Program Committees and the subreviewers for doing an exceptional selection job.

Statistical information about the number of papers submitted and accepted for the last several editions of the ICALP conference, as well as acceptance rates, are available in Tables 1–3.

Invited presentations. In addition to the contributed talks, ICALP 2022 featured three invited presentations by Leslie Ann Goldberg (Track A), Stéphan Thomassé (Track B), and Santosh Vempala (Track A), and three unifying talks by Albert Atserias, Constantin Daskalakis and Madhu Sudan:

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
Total	433	462	470	490	502	459	515	507	477	423
Track A	350	361	347	316	346	296	319	328	312	249
Track B	83	101	123	103	96	108	121	114	106	114
Track C	—	—	—	71	60	55	75	65	59	60

Table 1: Number of submitted papers at ICALP 2013–2022.

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
Total	127	137	138	146	147	137	146	143	136	124
Track A	103	108	102	94	98	88	89	89	87	71
Track B	24	29	36	31	30	32	36	34	31	33
Track C	—	—	—	21	19	17	21	20	18	20

Table 2: Number of accepted papers at ICALP 2013–2022.

- Albert Atserias (Universitat Politècnica de Catalunya): *Towards a Theory of Algorithmic Proof Complexity*

- Constantin Daskalakis (MIT): *Equilibrium Computation, Deep Learning, and Multi-Agent Reinforcement Learning*

- Leslie Ann Goldberg (Oxford): *Some New (And Old) Results on Contention Resolution*

- Santosh S. Vempala (Georgia Tech.): *The Manifold Joys of Sampling*

- Madhu Sudan (Harvard): *Streaming and Sketching Complexity of CSPs: A Survey*

- Stéphan Thomassé (ENS Lyon): *A Brief Tour in Twin-Width*

ICALP Proceedings. As it has been the tradition since 2016, ICALP proceedings were published with *LIPIcs*. *LIPIcs – Leibniz International Proceedings in Informatics* is a series of high-quality conference proceedings across all fields in informatics established in cooperation with Schloss Dagstuhl–Leibniz Center for Informatics. All 127 ICALP 2022 contributed papers presented at the conference, papers or abstracts accompanying the invited talks of Albert Atserias, Constantin Daskalakis, Leslie Ann Goldberg, Madhu Sudan, Stéphan Thomassé, Santosh

	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013
Total	29.3	29.6	29.4	29.8	29.3	29.8	28.3	28.2	28.5	29.3
Track A	29.4	29.9	29.4	29.7	28.3	29.7	27.9	27.1	27.9	28.5
Track B	28.9	28.7	29.3	30.1	31.3	29.6	29.8	29.8	29.2	28.9
Track C	—	—	—	29.6	31.7	30.9	28.0	30.8	30.5	33.3

Table 3: Acceptance rates (in %) for ICALP 2013–2022.

Vempala were published according to the principle of Open Access in LIPIcs Proceedings volume 229, and made available online and free of charge at `https://drops.dagstuhl.de/opus/portals/lipics/index.php?semnr=16238`. The proceedings editors are Mikołaj Bojańczyk, Emanuela Merelli and David P. Woodruff.

ICALP and EATCS Awards. The EATCS sponsors awards for both a best paper and a best student paper in each of the two tracks at ICALP, as selected by the Program Committees. During the general assembly, the ICALP Best Paper and Best Student Paper Awards were presented to the authors of the following papers:

Best Paper in Track A: Ian Newman and Nithin Varma. *Strongly Sublinear Algorithms for Testing Pattern Freeness*.

Best Paper in Track B: Jakub Gajarsky, Michał Pilipczuk, Wojciech Przybyszewski and Szymon Toruńczyk. *Twin-width and types*.

Best Student Papers in Track A: Joakim Blikstad. *Sublinear-round Parallel Matroid Intersection*, and Jakub Tětek. *Approximate Triangle Counting via Sampling and Fast Matrix Multiplication*.

Best Student Paper in Track B: Gaëtan Douéneau-Tabot. *Hiding pebbles when the output alphabet is unary*.

The program of ICALP 2022 included presentations of several prestigious scientific awards sponsored or co-sponsored by EATCS:

- The **Gödel Prize 2022** was awarded to the following papers

    - **Zvika Brakerski, Vinod Vaikuntanathan**: *Efficient Fully Homomorphic Encryption from (Standard) LWE*. FOCS 2011: 97-106. SIAM Journal of Computing 43(2): 831-871 (2014), and

– **Zvika Brakerski, Craig Gentry, Vinod Vaikuntanathan**: *(Leveled) fully homomorphic encryption without bootstrapping.* ITCS 2012: 309-325. ACM Transactions on Computation Theory 6(3): 13:1-13:36 (2014)

The above papers made transformative contributions to cryptography by constructing efficient fully homomorphic encryption (FHE) schemes.[2]

- The **EATCS Award 2022**, the annual EATCS Distinguished Achievements Award given to acknowledge extensive and widely recognized contributions to theoretical computer science over a life long scientific career, was awarded to **Patrick Cousot** (New York University) for introducing and developing, together with his late wife Radhia Cousot, the framework of abstract interpretation for program analysis.[3]

- The **Presburger Award 2022** for Young Scientists was awarded to **Dor Minzer** (MIT) for for his deep technical contributions towards resolving the 2-to-2 Games Conjecture.[4]

- The **EATCS Distinguished Dissertation Awards 2022**, to promote and recognize outstanding dissertations in theoretical computer science were awarded to three researchers:

    – **Alexandros Hollender** for his dissertation *Structural Results for Total Search Complexity Classes with Applications to Game Theory and Optimisation*, advised by Paul W. Goldberg at the University of Oxford,

    – **Jason Li** for his dissertation *Preconditioning and Locality in Algorithm Design*, advised by Anupam Gupta and Bernhard Haeupler at the Carnegie Mellon University,

    – **Jan van den Brand** for his dissertation *Dynamic Matrix Algorithms and Applications in Convex and Combinatorial Optimization*, advised by Danupon Nanongkai at the KTH Royal Institute of Technology.

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[2]The laudatio for the Gödel Prize 2022 is available at `https://eatcs.org/index.php/component/content/article/1-news/2917-2022-05-21-19-57-34`.

[3]The laudatio for the EATCS Award 2022 is available at `https://eatcs.org/index.php/component/content/article/1-news/2918-the-eatcs-award-2022-laudatio-for-patrick-cousot`.

[4]The laudatio for the Presburger Award 2022 is available at `https://eatcs.org/index.php/component/content/article/1-news/2914-presburger-award-2022-laudatio-for-dor-minzer`.

- The EATCS has recognized two of its members for their outstanding contributions to theoretical computer science by naming them **EATCS Fellows** class of 2022:

    - **Samson Abramsky** (University College London) for fundamental contributions to logic in computer science, including domain theory in logical form, game semantics, and category-theoretic foundations of quantum computing.

    - **Orna Kupferman** (Hebrew University) for fundamental contributions to automata- and game-theoretic techniques aiming at the formal verification and reactive synthesis of computing systems.

The recipients of the Gödel Prize 2022 (Zvika Brakerski, Craig Gentry and Vinod Vaikuntanathan), of the EATCS Award 2022 (Patrick Cousot), and of the Presburger Award 2022 (Dor Minzer) gave presentations in the Award Sessions at ICALP 2022.

We congratulate all the winners and we hope their achievements will put the highlights of research in theoretical computer science in the spotlight, and will serve as inspirations to young researchers in the years to come.

We hope that this conference report gives you a glimpse of the rich scientific and social programme that made the 49th ICALP an unforgettable conference. Everyone involved in the organization of ICALP 2022 deserves the warmest thanks from the TCS community.

We wish to thank all authors who submitted extended abstracts for consideration, the Program Committees for their effort, and all the referees who assisted the Program Committees in the evaluation process. We are also grateful to the Conference Chair Thomas Colcombet and all the support staff of the Organizing Committee for organizing ICALP 2022. We also acknowledge support by FSMP, Université Paris cité, CNRS, Inria, IRIF and NOMADIC LABS.

The General Assembly of the EATCS was informed about the progress of the organization of the *50th EATCS International Colloquium on Automata, Languages and Programming*, ICALP 2023, that will take place in Paderborn, Germany, on July 10–14, 2023, with Sevag Gharibian as the general chair of the conference. The ICALP 2023 Program Committee Chairs are Uriel Feige (Track A) and Kousha Etessami (Track B). The ICALP 2022 call for papers is available at `https://icalp2023.cs.upb.de/call-for-papers/`.

We hope that you will make plans to submit your best work to ICALP 2023 and be able to go to Paderborn for the conference. We look forward to seeing you there.