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# THE PRESBURGER AWARD 2021

## LAUDATIO FOR SHAYAN OVEIS GHARAN

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The 2021 Presburger Committee has unanimously selected

### **Shayan Oveis Gharan**



as the recipient of the 2021 EATCS Presburger Award for Young Scientists for his creative, profound, and ambitious contributions to the Traveling Salesman problem.

Traveling Salesman is a drosophilia of theoretical computer science: immediately accessible, intellectually appealing, computationally difficult, and extremely well-studied. It serves as a milestone and showcase for progress in our scientific understanding of the design and analysis of algorithms.

Oveis Gharan's work began during his PhD thesis, in a paper that presents an asymptotically sublogarithmic approximation guarantee for the Traveling Salesman problem for the general (or, "asymmetric") case. The primary tool is the negative dependence between the presence of edges in a certain distribution on random spanning trees of a graph, a theme that has matured and expanded throughout

much of the recipient's work. In a remarkable tour de force, Oveis Gharan and his coauthors followed this up with a  $(3/2 - \varepsilon)$ -approximation for the symmetric graphic case, and later also for the metric case. These results rely on a deeper understanding of negative dependence through the lens of strongly Rayleigh measures and real-stable polynomials, the polyhedral structure of the Held–Karp polytope, and the combinatorics of near-minimum cuts in a graph.

Besides his work on TSP, Oveis Gharan exhibits an amazingly consistent ability to make progress on many other problems that had remained open for decades. For example, a Cheeger inequality proved by Oveis Gharan and co-authors was the main technical tool in Miclo's proof of a 40-year old conjecture of Simon and Høegh-Krohn in the field of mathematical physics. The interplay between analysis, probability, and combinatorics is a hallmark of his research programme and a sterling example of how questions arising from theoretical computer science lead to profound progress in related fields.

#### The Presburger Committee 2021

- Mikołaj Bojańczyk
- Thore Husfeldt (chair)
- Meena Mahajan

The Presburger Award is given to a young scientist (in exceptional cases to several young scientists) for outstanding contributions in theoretical computer science, documented by a published paper or a series of published papers. The award is named after Mojzesz Presburger who accomplished his path-breaking work on decidability of the theory of addition (which today is called Presburger arithmetic) as a student in 1929.

The award includes an amount of 1000 € and an invitation to ICALP 2021 for a lecture.

The following is the list of the previous recipients of the EATCS Pressburger Awards:

2020 Dmitriy Zhuk	2014 David Woodruff
2019 Karl Bringmann and Kasper Green Larsen	2013 Erik Demaine
2018 Aleksander Mądry	2012 Venkatesan Guruswami and Mihai Patrascu
2017 Alexandra Silva	2011 Patricia Bouyer-Decitre
2016 Mark Braverman	2010 Mikołaj Bojańczyk
2015 Xi Chen	