



## פרופסור סרגיי טבצ'ניקוב

המחלקה למתמטיקה  
אוניברסיטת המדינה של פנסילבניה  
יוניברסיטי פארק, פנסילבניה, ארה"ב

### Professor Sergei Tabachnikov

Department of Mathematics  
Pennsylvania State University  
University Park, Pennsylvania, USA

קולוקוויום מתמטי | Math Colloquium

## CUSPS OF CAUSTICS BY REFLECTION AND OTHER 4-POINT THEOREMS

The Colloquium will be held on Monday  
12 January 2026, at 12:00  
**Room 006, Schreiber Building**  
Tel-Aviv University, Ramat-Aviv

הקולוקוויום יתקיים ביום שני  
12 בינואר 2026, בשעה 12:00  
חדר 006, בניין שרייבר  
אוניברסיטת תל-אביב, רמת-אביב

סמינר בגיאומטריה ודינמיקה | Geometry and Dynamics Seminar

## A TALE OF FOUR BILLIARDS: FOCUSING ON THE NONCONVENTIONAL ONES

The Seminar will be held on Wednesday  
14 January 2026, at 14:00  
**Room 309, Schreiber Building**  
Tel-Aviv University, Ramat-Aviv

הסמינר יתקיים ביום רביעי  
14 בינואר 2026, בשעה 14:00  
חדר 309, בניין שרייבר  
אוניברסיטת תל-אביב, רמת-אביב

כיבוד קל יוגש לפני ההרצאות | Light refreshments will be served before the lectures



## Sergei Tabachnikov

Department of Mathematics  
Pennsylvania State University  
University Park, Pennsylvania, USA

### ●●● CUSPS OF CAUSTICS BY REFLECTION AND OTHER 4-POINT THEOREMS

**January 12, at 12:00**

Room 006, Schreiber Building

The "Last Geometric Statement of Jacobi" asserts that the conjugate locus of a non-umbilic point on a triaxial ellipsoid has exactly four cusps. Proved only in this century, this result conjecturally holds for the loci of the 2nd, 3rd, etc., conjugate points as well. I shall discuss a billiard version of this problem: the surface is replaced by a plane oval, and the conjugate loci by the 1st, 2nd,... caustics by reflection with the radiant point located inside the oval. This problem has many extensions, for example, to Finsler billiards associated with a projective Finsler metric (the subject of Hilbert's 4th Problem) and to magnetic billiards. The four cusp result for the caustics by reflection in the latter case follows from still another 4-point theorem, a strengthening of the classical 4-vertex theorem of Mukhopadhyaya.

### ●●● A TALE OF FOUR BILLIARDS: FOCUSING ON THE NONCONVENTIONAL ONES

**January 14, at 14:00**

Room 309, Schreiber Building

A periodic orbit of a Birkhoff billiard is a polygon of extremal perimeter inscribed into the billiard table (a plane oval). One may replace the word "perimeter" by "area" and/or the word "inscribed" by "circumscribed". This provides three other billiard-like systems. Two of them, involving area, can be generalized to symplectic spaces, with the symplectic structure replacing the area form; this gives symplectic inner and outer billiards. I shall discuss properties of the symplectic outer billiards, including periodic orbits and the large scale behavior of its trajectories. I shall also discuss the large scale behavior of the trajectories of the planar outer length billiards. Finally, I will relate the inner symplectic billiards with still another billiard-like system, the Minkowski billiards, currently a popular subject of study in symplectic topology.

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**SERGEI TABACHNIKOV** is a Professor of Mathematics at Pennsylvania State University and a Fellow of the American Mathematical Society. He is known for his work in geometry, topology, and dynamical systems, including mathematical billiards, projective geometry, integrable systems, and cluster algebras, and is a founder of "bicycle mathematics."

He has mentored many young researchers and held leadership roles at ICERM, MASS, and the Heidelberg Laureate Forum. He is editor-in-chief of the Arnold Mathematical Journal and The Mathematical Intelligencer and serves on several other mathematics journal boards.