Research

Department faculty members do fundamental research in classical fields of mathematics such as algebraic geometry, number theory, partial differential equations, and probability. They also lead the way in newer areas, such as combinatorics, non-smooth analysis, optimization, and theoretical computer science. In addition to intrinsic mathematical research, members of the department collaborate on interdisciplinary projects with faculty from Applied Mathematics, Statistics, Computer Science and Engineering, Bioengineering, Genome Sciences, Electrical Engineering, Mechanical Engineering, Physics, and the Applied Physics Laboratory. Here are some examples of recent research:

- One faculty member has solved a longstanding open problem in the geometry of Riemannian manifolds, showing that knowledge of the distance function on the boundary determines distance overall. This work, featured in Nature, would allow one in principle to determine what is inside an object—the earth for instance—without destroying it.

- Another recently discovered a formula for counting all tanglegrams of a given size. Tanglegrams are combinatorial objects that arise in subjects as varied as the study of cospeciation in biology and analysis of software projects in computer science.

- In work with chemists at UW and beyond, a faculty member solved a probability problem about crystal deposits on a flat surface, thereby providing the theoretical justification for a procedure that may be used for cancer detection.

- If one wishes to develop a procedure for packing objects of different weights and sizes into the smallest number of boxes in the fastest time, a suitable algorithm will be slow and inefficient. One of our faculty members made a major advance by finding an efficient algorithm producing solutions that, if not optimal, are demonstrably close to optimal ones.

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