

Soap bubbles offer key to maximizing efficiency

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Frank Morgan, Atwell Professor of Mathematics at Williams College, is chiefly concerned with optimization. He investigates how to optimize shapes with minimal surfaces. Morgan will speak at the UA on Feb. 10 during a sponsored talk. (Photo courtesy of the Worcester Polytechnic Institute)

(PhysOrg.com) -- People seek out shortcuts just about everywhere -- in traffic, at grocery stores, in weight loss regimens and on keyboards. But Frank Morgan, an upcoming UA guest speaker, said soap bubbles present the most simple example of heightened efficiency.

Some people are motivated to find the shortest drive home, the quickest way to weight loss or the fastest line in the grocery store.

One motive for such behaviors is the desire for greater efficiency. It turns out, certain soap bubbles have the same intention.

[Mathematician](#) Frank Morgan and his colleagues have determined that certain types of double bubbles maximize efficiency, a finding that can be philosophically tied to human efforts.

"Soap bubbles are a serious math topic," said Morgan, the Atwell Professor of [Mathematics](#) at Williams College. "We spend our lives trying to minimize and maximize things, and mathematicians are trying to solve that issue and look for the simplest examples."

Morgan, also vice president of the American Mathematical Society, will speak about his research this week during a University of Arizona colloquium sponsored by the mathematics department.

Morgan said the reason soap bubbles are round is not that the molecules that constitute them are round, but because they "just want to be efficient, to enclose a given volume of air with the least surface area or energy," Morgan said.

The round shape, observed for thousands of years, was mathematically proved optimal in 1884.

"It's more of a geometric issue because a sphere is the least-area way that you can enclose that amount of air," said Morgan, who has published six books and more than 100 scientific articles. In 1999, he and his collaborators proved the "Double Bubble Conjecture."

The double bubble theorem effectively states that the double bubble "provides the least-perimeter way to enclose and separate two prescribed volumes," according to a paper Morgan co-authored that was published in 2004.

"The new theorem is based on the philosophy that soap bubbles are trying to minimize their energy – as you do when deciding what route to

take in the morning," Morgan said.

Morgan said the same goes for many practical questions: How do I minimize expenses? How do I maximize my profits? How do I maximize my happiness?

"So, the soap bubbles solve a math problem at minimizing energy, which is one of the biggest questions in mathematics: How do you minimize something?"

This is promising research, he said.

"You can understand anything in nature by understanding its effort to minimize energy," Morgan said.

"If we can understand soap bubbles, we can solve other problems," he added. "What's amazing about the soap bubbles is that we can now prove beyond any doubt what's best. Isn't math amazing?"

More information: Morgan's talk, "The Double Soap Bubble Theorem," is free and open to the public and will be held on Thursday, Feb. 10 at 4 p.m. at Flandrau: The UA Science Center, 1601 E. University Blvd.

His talk coincides with the UA Flandrau Soap Bubble Math Fun and Family Fun Time, which will be held Feb. 10 at 5:30 and 6 p.m. and again Feb. 11 at 6:30 p.m.

As part of Flandrau's event, Morgan also will be hosting hands-on demonstrations Feb. 10 – one at 5:30 p.m. that is free and open to the public, and another at 6 p.m. requiring Flandrau admissions fees.

He also will provide a demonstration Feb. 11 at 6:30. Flandrau

admissions fees apply.

Provided by University of Arizona

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