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## BLUE

HOME **NEWS** BUSINESS SPORTS ENTERTAINMENT LIFE & STYLE SUBURBAN JOURNALS JOBS AUTOS HOMES SHOPPING

#1 ST. LOUIS WEB SITE

SITE SEARCH

Go!

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ADJUST TEXT: + | -

NEWS >

News > Science & Medicine > Story

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MISSOURI STATE NEWS

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NATION

WORLD

SPECIAL REPORTS

EDUCATION

RELIGION

SCIENCE & MEDICINE

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COMMUTING & TRAFFIC

COLUMNISTS

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SPECIAL REPORTS

PHOTOS & MULTIMEDIA

CORRECTIONS

NEWS OF THE WEIRD

P-D ARCHIVES

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BLOG ZONE

CONTESTS

EVENT CALENDAR

FORUMS

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### Ultrasonic sparking: Tiny bubbles can lead to bright flashes

— Eric Hand

12/18/2006

Researchers at the University of Illinois at Urbana-Champaign have found that ultrasonic bubbles cause crystals to flash 1,000 times more brightly than if the crystals were just crushed. The report was published last month in the journal Nature.

Many materials, including sugar, diamonds and even adhesive tape, flash when stressed or torn in a process called mechanoluminescence or triboluminescence.

Linda Sweeting, a former professor at Towson University, estimated that a fifth of all carbon-containing compounds and a third of compounds without carbon can flash to some degree.

The compounds flash because they have crystal structures that contain impurities or lack certain symmetries. When the crystals are stressed, electrons tend to flow to one side. Electric charge builds up.

When the structure finally breaks, the charge jumps across the spark gap, exciting whatever gas happens to be present.

"What we have here is just like lightning," said U of I chemistry graduate student Nathan Eddingsaas. Except a bit smaller: Eddingsaas and his adviser, Kenneth Suslick, tested crystals in thumb-sized glass tubes. Lightning is an electric charge jumping across a gap from clouds to the ground. The electrons excite gases in the air, mostly nitrogen, and create a big bolt of a spark.

Eddingsaas and Suslick work with ultrasonic horns, which create tiny bubbles in liquids. The violent collapse of the bubbles creates shock waves that accelerate microscopic particles into collisions with crystals at half the speed of sound.

Eddingsaas said that the extra brightness was due to both more crystal fractures and more intense fracturing. They tested the effect with sugar and other crystals.

Top of page

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Francis Bacon, the father of inductive science, discovered four centuries ago that sugar cubes flash when scraped, a phenomenon known as mechanoluminescence. Today, kids in dark closets chew wintergreen mints and spark at the mouth. Now imagine a thousand mints of light.

#### Why can you see wintergreen mints spark in the dark?

Wintergreen mints are an odd case of mechanoluminescence. When you bite one, the sugar crystals spark. But the excitation of the nitrogen gas isn't very visible to our eyes. However, that same electric energy excites the wintergreen chemical, methyl salicylate, causing it to fluoresce. Wintergreen fluoresces in a blueish part of the spectrum that is much more visible to our eyes, so the light appears brighter.

#### YESTERDAY'S MOST E-MAILED STORIES

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**Dave Barry's Year-End Review**

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[Last 7 Days]

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CONFIDENTIAL

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Magdata Foundation

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ARNOLD, MO  
ARNOLD SMILES

**med HILLSIDE MANOR**

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Hillside Manor

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