by the Juno gravity team, of which one of us (Anderson) is the team leader.

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Carbon from coal plants

In his review of *Earth: The Sequel—The Race to Reinvent Energy and Stop Global Warming* by Fred Krupp and Miriam Horn (PHYSICS TODAY, April 2009, page 63), Mark Ratner paraphrases from the book that a typical 500-MW coal-fired power plant ''emits roughly 1 ton of carbon dioxide for every kilowatt hour of electricity,'' and he adds, ''Such comparisons are easy to remember.'' But this one is also easy to discredit: Since CO_2 is about 25% carbon by weight, a 500-MW plant must therefore be consuming roughly 125 000 tons of coal per hour, or 3 million tons per day! The total daily coal production of the US is only 3 million tons.

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Electrostatic trick might affect human body

High-school physics students often try the fun experiment of holding a high-voltage pole while standing on an electrically isolating mat. Just like a bird perched on a high-voltage power line, the human body, which is electrically conducting, is all at approximately the same potential, and thus no current flows. As a result, the experiment is believed to be harmless, and students can enjoy the effects of electrostatic repulsion, like the standard classroom image of wild flyaway hair. The question can be raised, however, as to what happens to our skin. Air is an excellent supplier of charge, and it can be assumed that if our skin is at the same (positive) potential as the high-voltage generator, electrons will be attracted to the surface of our bodies. If the voltage supply is at tens of kilovolts, the energy with which electrons impinge on our skin can be as high as tens of kiloelectron volts. I wonder if anyone has ever studied the incidence of skin cancer in students who played with such an experiment for prolonged periods or, for that matter, in birds that rest on high-voltage cables. To be on the safe side, the experiment should be tested only briefly, if at all.

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Inspired by a century of physics

I love the last line in Michael Turner's Reference Frame "A Century of Physics: 1950 to 2050" (PHYSICS TODAY, September 2009, page 8). He wrote, "You'd have to be crazy to bet against physics." I am a high-school physics teacher in the Houston Independent School District and often have to answer questions from students about whether all the laws of physics have been discovered, leaving them with nothing much to look forward to in making their own revolutionary discoveries. My rudimentary answer remains rooted in the idea that physics, like all sciences, always offers an ever-expanding playing field where an answer carries with it a host of other questions that each need to be addressed in turn before the original question is completely answered. Invariably, I get polite nods from the students but always with curved eyebrows and traces of suspicion that their teacher's broad answer may, in fact, be a subtle admission that their observation is correct.

Turner's article will definitely help me give a more satisfying answer and perhaps, for a change, draw positive wide-eyed reactions from my students.

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Human discoveries predated by nature

The report on photonic-eyed shrimp on page 21 of the December 2009 issue of PHYSICS TODAY presents existentially exhilarating news. It reminds me of another instance in which hundreds or thousands of years of human development have culminated in meeting some obscure organism that evolved a long-sought technique perhaps a half billion years ago. In that case, hexactinellid siliceous sponges found in waters off Vancouver Island in British Columbia, Canada, assemble using cross-linked girders in almost exactly the forms used in some wondrous modern skyscrapers. Human construction has spent some 8000–10 000 years evolving from earthen mounds to pyramids, columns, and beams to the modern city.

Almost certainly, other examples of truly marvelous human discovery have been found predated among anciently evolved living organisms.

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Costs of raising the bar for medical physicists

I was not pleased to see that medical physicists are creating new requirements to enter their field (PHYSICS TODAY, May 2009, page 30). The reason cited by practitioners is "public safety," but no evidence of a public safety risk is given. Because the downsides are so high, we should demand compelling evidence before allowing the new requirements to proceed.

New degrees, difficult exams, and residency programs that students would have to pay for all provide large barriers to entry into the field. That means fewer jobs available to the general physics community and downward pressure on our earnings.

Because the supply of medical physicists will be reduced, the cost for those remaining will go up. President Obama says he wants to reduce the cost of medical care in America, but the new requirements will raise the cost of medical physicists' services.

The only sure winners from those changes are institutions that can charge monopolistic rates for their programs and the current practitioners who will have fewer competitors. Everyone cited in the article in favor of the change is from one of those two groups. Students were mixed, and patients who will be footing the bills for more expensive treatment were not asked.

A physics degree is extremely versatile and should not be limited unnecessarily. Mine has opened numerous doors, and I would like to think it is good enough to get me into medical physics if I so desire; it was good enough for every practitioner today.

We should not raise the nation's medical costs to make a few universities and current practitioners wealthier unless there is a compelling public safety concern.

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Spatial coherence from ducks

It is not generally appreciated that radiation from uncorrelated random sources—for example, radiation generated by spontaneous emission of light by atoms—can produce a well-behaved, spatially coherent field over large regions. An illustration of this fact is the diffraction image of a star in the focal plane of a telescope. On a good observing night, the image will consist of a bright central spot surrounded by dark rings that represent regions in the focal plane where destructive interference cancels the light. This is a manifestation of strong correlation—a high degree of spatial coherence—between light fluctuations in the aperture of the telescope. The phenomenon illustrates the so-called van Cittert–Zernike theorem of optical coherence theory.[1,2]

In this letter we provide an example of the generation of spatial coherence. Thirteen Rouen ducks jump into a still one-acre pond, disturbing the surface at randomly distributed positions and times. The water surface exhibits an irregular, rather incoherent spatial pattern, as seen in panel a of the figure.[3] With increasing distance and time, the pattern evolves into a more regular one, as captured in panels b, c, and d, which clearly indicate the generation of spatial coherence in the far field from randomly distributed sources.

References

1. L. Mandel, E. Wolf, *Optical Coherence and Quantum Optics*, Cambridge U. Press, Cambridge, UK (1995), sec. 4.4.4.
2. E. Wolf, *Introduction to the Theory of Coherence and Polarization of Light*, Cambridge U. Press, Cambridge, UK (2007), sec. 3.2.
3. The pictures are from a 28-second video clip, available at http://www.youtube.com/watch?v=4o48J4streE.

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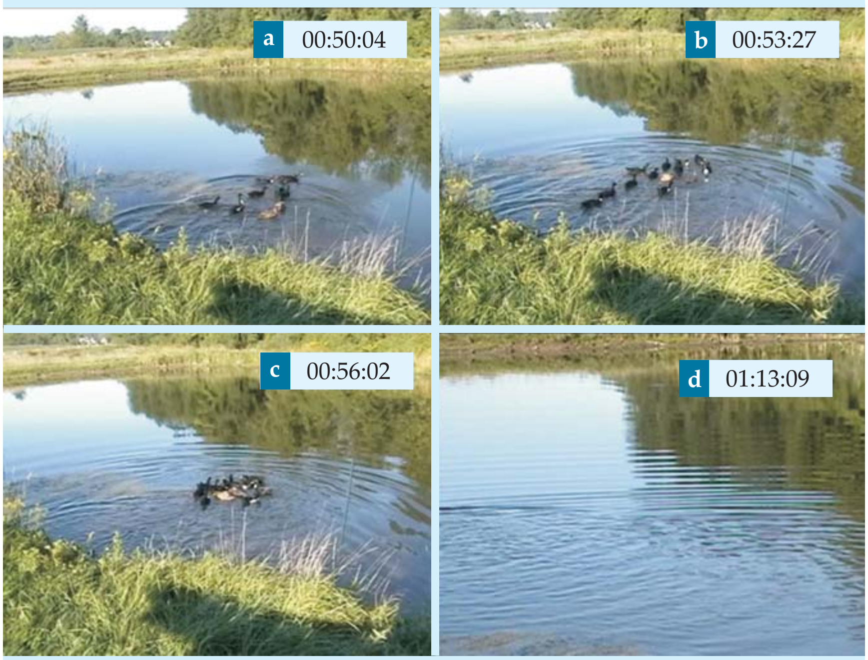
Correction

January 2010, page 23—The academic affiliation of Ahmed Zewail, one of three prominent US scientists who have agreed to serve as US science envoys to Muslim nations, was incorrect. Zewail is a professor at Caltech. ■



Generation of spatially coherent water waves from randomly distributed wave disturbances produced by 13 ducks jumping into a pool at time 00:47:12. The frame times are indicated.