Bell tones from the piano FREE

Murray Campbell

Physics Today **67** (10), 10 (2014);
https://doi.org/10.1063/PT.3.2531

in the number of black holes formed by spontaneous collapse.

Winkler's second proposal is to increase the baryon fraction of the universe. But that comes at a cost: Inflation constrains the total energy-density content of the universe. Increasing the baryon content at the expense of dark matter could result in less galaxy formation and, hence, fewer black holes. Decreasing the dark energy gives more time for galaxies to collide before the accelerating expansion disrupts clusters. And that process turns spiral galaxies with cold disks into hot ellipticals that don't form massive stars—again resulting in fewer black holes.

Winkler further proposes that virtual black holes vastly outnumber real ones, but there is no reason based in a real calculation to suppose that virtual black holes exist or that they must spawn new universes.

Lee Smolin
(lsmolin@perimeterinstitute.ca)
Perimeter Institute for Theoretical Physics
Waterloo, Ontario, Canada

Bell tones from the piano

Murray Campbell's article "Evaluating musical instruments" (PHYSICS TODAY, April 2014, page 35) was quite interesting. A statement in the section "What makes an excellent piano?" particularly caught my eye. Campbell writes, "Some pianists believe that by merely altering the manner in which the key is depressed, it is possible to change the timbre of a single note, without altering its loudness. It is hard to see how that can be true."

In one of Camille Saint-Saëns's piano concertos—I forget which one—a key is struck in such a way that it produces a bell-like tone. I asked a virtuoso pianist about it after hearing him play the concerto (this was 30 years ago), and he said that what we heard was a harmonic. He had to strike a key in a certain way to achieve it, and each piano was different in regard to the technique required. He said that to get it right for the concert, he had to experiment with that particular Steinway. I'd love to learn more about the technique involved.

Jon Orloff
(jon.orloff@mindspring.com)
Rockaway Beach, Oregon

■ **Campbell replies:** Although I don't recognize the musical context Jon Orloff refers to, he raises several interesting points about "harmonics" in piano music. The term is used to describe a common technique in violin and guitar playing in which the player touches the string lightly at a distance L/n from the bridge, where L is the string length and n an integer. The light touch suppresses the modes of vibration of the string when it is sounded, except for modes that have a node at the point touched.

To obtain this effect on the piano, the player reaches inside the instrument with one hand to touch the string while playing the keyboard with the other. I don't think the technique was used at the time when Camille Saint-Saëns was composing. A more likely explanation has been suggested by Anders Askenfelt, the piano acoustics expert at KTH in Stockholm. A carefully judged and forceful accent on the relevant note gives a sound rich in upper "harmonics." Depressing the sustaining pedal just before the note is struck allows sympathetic vibrations from unstruck strings to contribute to the mix of high-frequency components, which are, in fact, slightly inharmonic. The high-frequency components decay faster than the lower frequencies, and the resulting sound has some similarity to that of a struck bell.

Murray Campbell
(d.m.campbell@ed.ac.uk)
University of Edinburgh
Scotland

Energetic flares in the search for habitable exoplanets

Exoplanet searchers will, I suspect, find the article "Warm planets orbiting cool stars" by John Johnson (PHYSICS TODAY, March 2014, page 31) interesting and encouraging.

In his section on habitable zones, I wish Johnson had considered the effect of flares among low-mass stars of the M-class main sequence. The internal structure of those stars, coupled with rapid spin, can produce frequent energetic flares. They are important to the discussion because a planet whose temperature places it within the habitable zone would be vulnerable to carbon-chemistry damage from the flares' ionizing radiation. "Life on a planet near one of these flare stars might be quite difficult."[1]

Earth is shielded from the Sun's less-frequent flares by its magnetic fields. An extrasolar planet orbiting a flare star