Rapbassador for science

By Tona Kunz

If there's one form of music instantly recognized around the globe, it's rap. The American genre informs, entertains, and has a low barrier to participation. You don't need a large vocal range or a backup band. You just need a message, delivered rapid-fire with style and bravado.

For a growing number of so-called Nerdcore rappers, the message is that people need to support basic research and math and science education if they want to hand future generations a nation worth bragging about. Rather than rapping about drugs, guns, and thug life, they take rap back to its roots as a tool for enlightenment and political discourse, with science and technology as common themes. The most famous example in the particle-physics world is "The Large Hadron Rap," which has racked up more than five million hits on YouTube; but there are plenty of others celebrating astrobiology, orbiting planets, computer codes, even $E=mc^2$.

Steve Rush, aka funky49, a science enthusiast from Florida and *Wired* magazine Nerdcore Hip Hop All-Star, gained notoriety in 2009 when he was commissioned by the Tampa Museum of Science and Industry to make the album *Rapbassador*. He came to Fermilab in August to premier a song, "Particle Business," about experimenters racing to discover the Higgs boson at the lab's Tevatron Collider. Dan Lamoureux, producer of the documentary *Nerdcore For Life*, filmed funky49 rapping in front of Wilson Hall, in the CDF experimental hall and the Tevatron main control room, and next to the Cockcroft-Walton particle accelerator.

When he's not rapping, funky49 works for a medical imaging company that uses MRI, a technology based on powerful magnets made of superconducting wire and cable that were developed in the 1970s to meet the needs of the Tevatron. "I have a job because of magnetic fields," he says. "I have a job because of science."

Here are funky49's lyrics, with commentary.

Photo courtesy of funky49

Physicists from the Collider Detector at Fermilab, or CDF, experiment have a 20-year tradition of playing in a rock band called Drug Sniffing Dogs, which was featured in the 2008 documentary *The Atom Smashers*. (See "Physicists Rock!" Jan/Feb 08.)

A common rap term, OG is short for original gangster but has also come to mean authentic or the first incarnation of something.

Particle physics researchers compete to get results first, but also use each other's results to cross-check discoveries, work with collaborators from all over the world, and tap the knowledge and infrastructure of past competitors to build the next generation of experiments.

$E=mc^2$ Albert Einstein's formula relates the mass of an object to its energy content.

Fermilab's first director, Robert Wilson, established a herd of bison at the laboratory in 1969 as part of his plan to blend science, art, and the environment and make the 6800-acre site a welcoming place. The bison also represent the site's frontier history.

Fermilab's two collider experiments, CDF and DZero, compete to make discoveries first.

Matter consists of two fundamental types of particles: the force-carrying bosons and the quarks and leptons, which are collectively called fermions.

To front is to put up a facade or make appearances.

Science classrooms use triple-beam scales to weigh chemicals; in rap, the term describes measurements of cocaine.

Brain drain: the migration of scientists to other countries in search of better research opportunities. For instance, many American particle physicists have been moving to Europe to work on the next big machine in the field, the Large Hadron Collider.

Through popular science books and a TV series, Carl Sagan educated people about astronomy, astrophysics, and other natural sciences. The Greek composer Vangelis created the music for Sagan's TV series.

Funky49: http://funky49.com and http://rapbassador.com
Videos by Dan Lamoureux: http://www.crapbotproductions.com

Particle Business

by funky49 (a.k.a. Steve Rush)

Rock stars of physics, particle business
smash matter, anti-matter and witness
quarks, bottom to top
they don't stop
"Where the Higgs at?"
Yo that's their mark!
Go! Go! Go!

Tevatron, OG atom smasher
Say Hello to CERN's party crasher
The new 'Lord of the Rings' LHC hear me
This be competitive collaboration baby
Strippin' electrons, makin ions
Of hydrogen, now pull that proton
Give it that speed we need to make
Real Science get achieved, I believe
Shock protons, Greatly accelerated
Two tera electron volts they rated
Fated to smash and get mated
Creatin' smaller bits, energy still equated
We love collisions, Take snap shots
Till we set the right shot, learn a lot
Yo, a mad grip of events do occur
Blast fast, Data stream is a blur
Normal events–They get ignored
Higgs events–They get adored!

High over frontier. Wilson Hall tall
With aesthetics, it's a science cathedral
For the people that see with math
Collider detector and massive graphs

DZero or CDF, who's the best?
If pressed I guess who's closest
To quench the measurement thirst
And who got their results in first

Collision detectors, Fermion collectors
This ain't the GO's with pocket protectors
These peeps cool like super-conducted
Magnets, you know four nine ain't frontin'

To me, triple beams don't mean
Pushin' mad coke, Its scientists in lab coats
So you ready for insight twilight or limelight?
Research in basic science, I'll fight

Whose side you with? R&D dollars?
Or pork spending for anyone who hollas?
Brain drain. No technology policy
Ballot box for better decisions in D.C.

Rap Carl Sagan over new Vangelis Keys
Science cutter clowns get smacked down please
I'm trippin' at students slippin' in
Test scores, Against the world they're dippin'

Let's be liftin', Positive like positrons
Before we ask where we gone wrong
Down with MTV, forget what you heard
Get lost in Cosmos and Mister Wizard

Quarks exist in six types: top, bottom, up, down, strange, and charm.

A reference to the J.R.R. Tolkien book series and how the Tevatron, now the world's highest-energy accelerator ring, will cede its title to the much bigger and more powerful Large Hadron Collider at CERN.

The combined energy of the Tevatron's proton-antiproton particle beam collisions is about 2 TeV, or two tera-electronvolts. "Tera" means "trillion." (See "Explain it in 60 seconds: terascale," Dec 07.)

Of the 10 million proton-antiproton collisions that take place in the Tevatron every second, physicists select fewer than 100 for further study. They program computers to make this selection automatically, based on which collisions produce the most interesting sprays of particles.

The design of Fermilab's 16-story Wilson Hall was inspired by a Gothic cathedral in Beauvais, France.

In a quench, super-cold superconducting magnets warm up and no longer conduct electricity without resistance. These events can damage the accelerator if not controlled. (See "Explain it in 60 seconds: magnet quench," Nov 08.)

The antisocial, nerdy scientist is a stereotype. Physicists, like anyone else, have a wide range of interests and social connections.

Basic research, the foundation for new technologies and industries, competes for federal money against legislators' pet projects—known as pork-barrel projects—for a limited pool of taxpayer money.

Taxpayers can use their votes to influence spending choices through the officials they elect.

On high-school proficiency tests, American science and math scores lag behind those of most other developed nations. Elementary and middle-school scores have been rising in math but have stagnated in science since the mid-1990s, according to *The Condition of Education 2009*, a report from the National Center for Education Statistics.

Positrons are the antimatter equivalents of electrons, with positive rather than negative charge.