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Flight of Imagination

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A Flight of Imagination

Finding poetic inspiration on the quantum plane, physics major Julia Savich '16 expresses the power of the liberal arts experience.

Story by **TIM OBERMILLER**

Photo illustration by **WIL FRANK '14 & ROBERT FRANK III '14**

It was an effort that combined literature and science, taking inspiration from both a 12th-century Indian mathematician and modern physics.

For physics major and senior Julia Savich '16, it was also a first serious attempt at writing poetry. “Electron Liberated” is her poem’s name. It describes what happens when electrons are subjected to two forces simultaneously, but for a reader who knows nothing about physics, it might read more like an existential drama, a kind of *Waiting for Godot* on the quantum plane. Our electron protagonist — “deserted by comrades / completely surrounded by symmetric nothingness” — journeys toward a path of freedom, described at the poem’s conclusion:

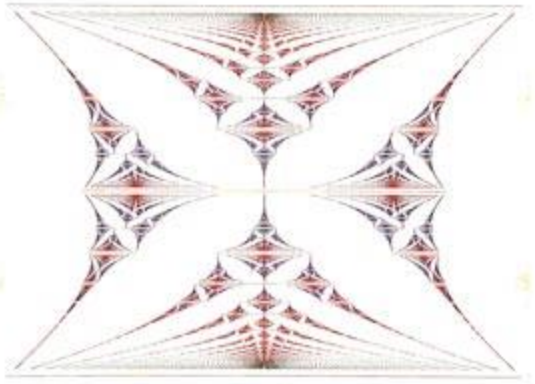
Climb, climb, climbing,
In every direction, gliding
from isolated point to isolated point.
The captive, floating out of the
restricting entrapments,
halts to take rest before flying again.
He lifts up, unhindered, to the levels beyond,
away from the controlling walls that once bound him.
Rising, falling, searching,
hunting in every direction for the next place to go.



Julia Savich '16

The phenomenon Savich describes in her poem is the “Hofstadter Butterfly,” a mathematical object first theorized by Douglas Hofstadter as a University of Oregon physics professor and recently confirmed in experiments. The senior wrote the poem at the suggestion of Narendra Jaggi, her faculty advisor and mentor and an IWU professor of physics.

Jaggi had heard from colleague Indu Satija, a physics professor at George Mason University, about the Lilavati Competition, a poetry contest commemorating the 40th anniversary of the Hofstadter Butterfly. The contest was named after a book of poetic mathematics written in Sanskrit by the 12-century Indian mathematician Bhaskara II.



First theorized by Douglas Hofstadter in 1976, the “Hofstadter Butterfly” (above) is famous for being an early, rare example of a fractal occurring in a quantum system. Savich’s poem about the mathematical object will be published in a book copyedited by Hofstadter himself.

Aware of Savich’s interests in creative writing, Jaggi encouraged Savich to enter the competition, which included a \$1,000 prize shared among the winners as well as publication of the poem in Satija’s upcoming book about the butterfly that will be copyedited by Hofstadter, who won the Pulitzer Prize for his book *Gödel, Escher, Bach: An Eternal Golden Braid* and who now teaches cognitive science at Indiana University.

Savich’s first order of business was to learn more about the Hofstadter Butterfly. What, Hofstadter had wondered, would happen to electrons subjected to two forces simultaneously: a magnetic field and the periodic electric field? These dueling forces, he theorized, would create a pattern of energy levels in a fractal structure that resembles a butterfly, where infinitely smaller versions of the pattern appear within the main one — an effect common in classical physics, but rare in the quantum world.

Having absorbed the basic physics, Savich sought out classmate Tia Patsavas ’15, who had taken several poetry courses as an English major. “She suggested that I write out a list of words to work off of and then form those words into a poem. The next day, I sat down in a quiet space and wrote down any word that came to mind while I was looking at a graph of Hofstadter’s butterfly.

“I paint as a hobby, and when I started to research Hofstadter’s butterfly, I was drawn to the graphical representation of the phenomenon. The graph was stunning, and I wanted to describe the striking aesthetics of it through my poem.”

Savich compiled her word list into a “choppy” poem, which she began revising with suggestions from Patsavas, who also suggested readings to help her develop her poetic voice. “We workshopped my poem many times, and eventually I took it to Dr. Jaggi, who gave me the seal of approval, suggesting only a slight change to the title.”

Jaggi remembers his reaction to the poem “was all smiles. It was just the right mix of imagination, playfulness, poetic license and poetry.”

The process of writing the poem is similar to other cross-disciplinary experiences Savich has encountered at IWU, she says.

“I apply what I learn in one class to my other classes,” she explains. “For instance, this semester I have been using what I learn in my technical drawing theatre class to hand draft diagrams for my directed study physics

course on renewable energy systems. This happens all the time in my classes, and I wouldn’t want it any other way. Writing the poem is no different; I apply what I learned from writing it when an opportunity arises.”



Savich (above) says IWU has stimulated her natural curiosity in ways she never imagined as a first-year student.



Savich demonstrated the science behind making soap bubbles at Homecoming 2015.

Upon graduating in May, Savich received the Phi Kappa Phi Award for outstanding senior student with exceptional promise for graduate or professional study. This fall she begins a master's degree program in engineering design at Northwestern University "to fill out my education in physics, environmental studies, building and art," she says. "I ultimately aim to enter into a rewarding career in product engineering and design with a focus on making everyday products more energy efficient. Working with Habitat for Humanity at IWU has shown me the great value of hands-on problem solving and developed in me a desire to improve the quality of life of others."

When asked what poetry and the arts can bring to our understanding of physics, Jaggi responds: "It is not about bringing anything to the 'understanding' of mathematics and physics! When I throw my grandson up in the air, and catch him giggling on the way down, I am not bringing anything to the understanding of Newtonian

Physics. It is about finding joy in multiple ways, in everything you do." Jaggi sees Savich's foray into poetry as an example of how "liberal arts universities encourage the growth of their students in multiple dimensions."

At Illinois Wesleyan, Jaggi says, students have "close, continued, meaningful and supportive relationships with their faculty. Most of us know the strengths, the weaknesses, the passions, the fears and the hopes of our students, and we always keep our ears and eyes open for opportunities that will enable their growth and success."

Electron Liberated

By Julia Savich

Step, step, stepping,
ascending into the intricate mystery above.

Branching, reaching, growing,
smoothly sweeping the infinite
open space,
yet uncontrollably fumbling
over imperceptible obstacles along the way.

Turning, only to find sharp corners blocking the visible path.
No gradual transitions to be made,
only unwieldy walls preventing fluid forward motion.

Nowhere to go but out.

Out and away from the weight of the crushing emptiness around.

Deserted by comrades,
completely surrounded by symmetric nothingness.

Barren voids glare all-knowingly,
hiding the coveted escape from their
blind prisoner.

Spinning, ambling about, trying to find a break.

Suddenly, the limitless arching world falls into place around.

Strong lines guide the path to freedom.
Only boundless expanse obscures the
distant passage.

Climb, climb, climbing,
In every direction, gliding
from isolated point to isolated point.
The captive, floating out of the
restricting entrapments,
halts to take rest before flying again.
He lifts up, unhindered, to the levels beyond,
away from the controlling walls that once bound him.

Rising, falling, searching,
hunting in every direction for the next place to go.

[Visit the Physics Department's website.](#)

Editor's note: The book in which Julia Savich's poem appears (on page 16-6) is available as a free download from the Institute of Physics: <http://iopscience.iop.org/book/978-1-6817-4117-8.pdf>