

Inventions, Innovations and Publications: An Academic Perspective

Ozgur Yavuzcetin
Associate Professor of
Physics



University of Wisconsin
Whitewater

Comparison: Inventions and Innovations

Inventions

- **Completely new idea**
- **Creation of a new product, device**
- **May require scientific knowledge**
- **Can be patented, requires novelty**
- **Requires \$**

Innovations

- **Improving an existing idea**
- **Making a device more practical**
- **Technical and marketing skills**
- **Adds value, fulfills the needs**
- **Can bring in \$\$**



Comparison: Inventions and Innovations

Inventions

- **Wheel, car tire**
- **Integrated circuit (Robert Noyce 1959)**
- **Electric light bulb (Edison)**
- **Photovoltaic cell (Bell Labs, 1954)**
- **Computer mouse (Engelbart, 1963)**
- **Thermostat (Warren Johnson, 1883)**
- **Transistors (Bell Labs, 1947)**

Innovations

- **Henry Ford's Model T**
- **Apple Computers (Steve Jobs)**
- **Electric light bulb after commercialization**
- **Solar panels, solar garden lights**
- **Apple and Microsoft**
- **Johnson Controls (multi-zone control)**
- **Smart Phones**



More on Innovations and Inventions

- **Innovation is implementation of invention with added value**
- **Many inventions do not have any value**
- **Innovations can solve problems**
- **Innovations in business, require customers, competitiveness and value**



What about Publications?

- **Engagement of knowledge and professional achievements**
- **Reflection of expertise**
- **Showcase for departments, colleges, schools**
- **Required for promotion and funding**

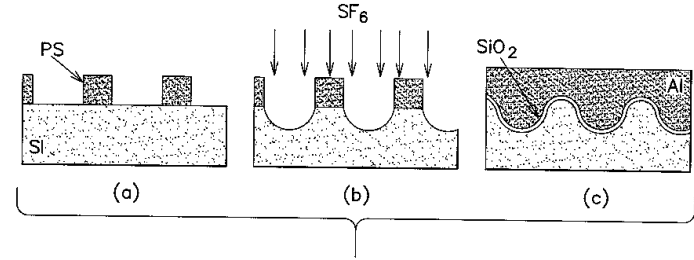
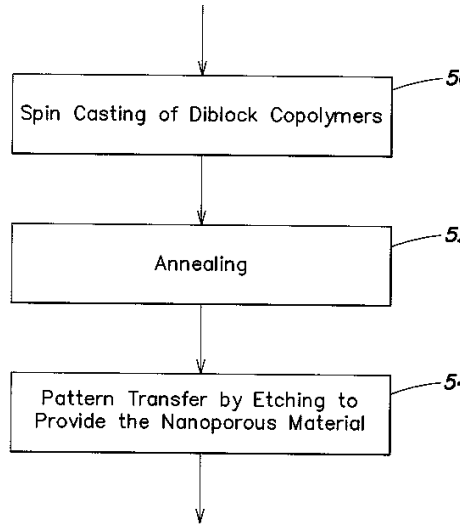
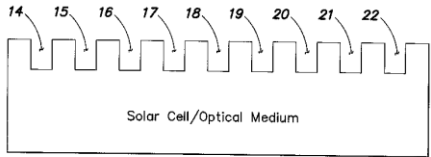
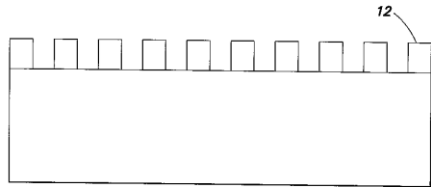
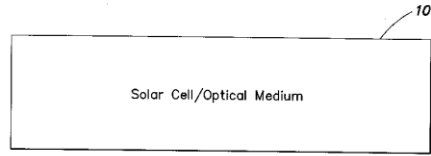


Publications and Innovations

- **Starting a Ph.D. usually starts with imitation (reading literature in that field)**
- **Implementation follows**
- **New scientific findings can lead to publications and inventions**
- **...Where is innovation then?**



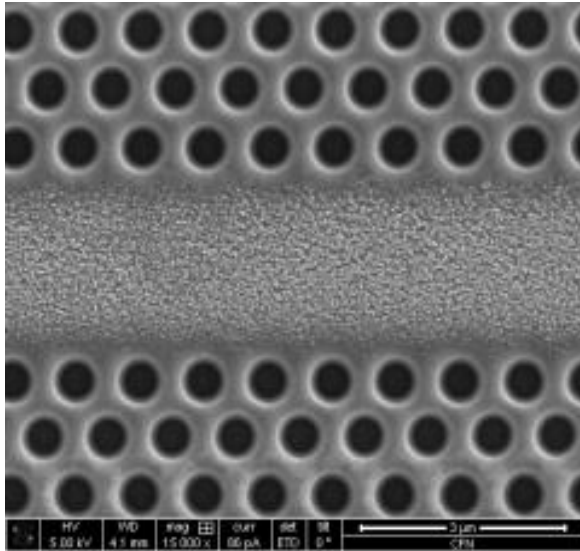
My First Patent: Index Tuned Antireflective Coating Using a Nanostructured Metamaterial



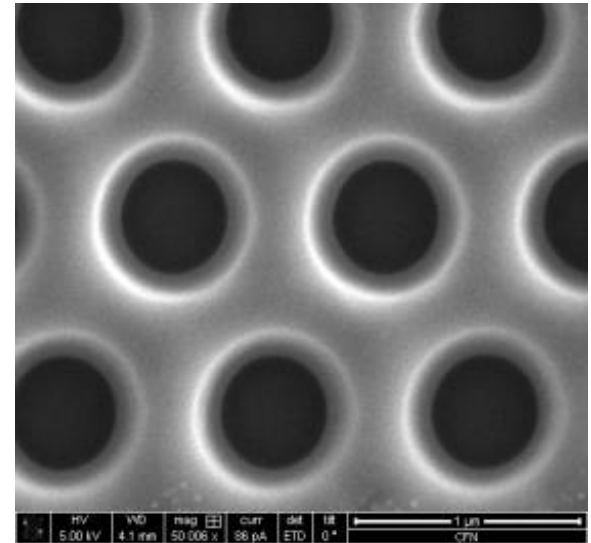
Grant Date: 2009-03-19

2010s Started working on a DARPA Project

I was “micro-machining” in crystals, so that we could “slow-down” light at certain wavelengths

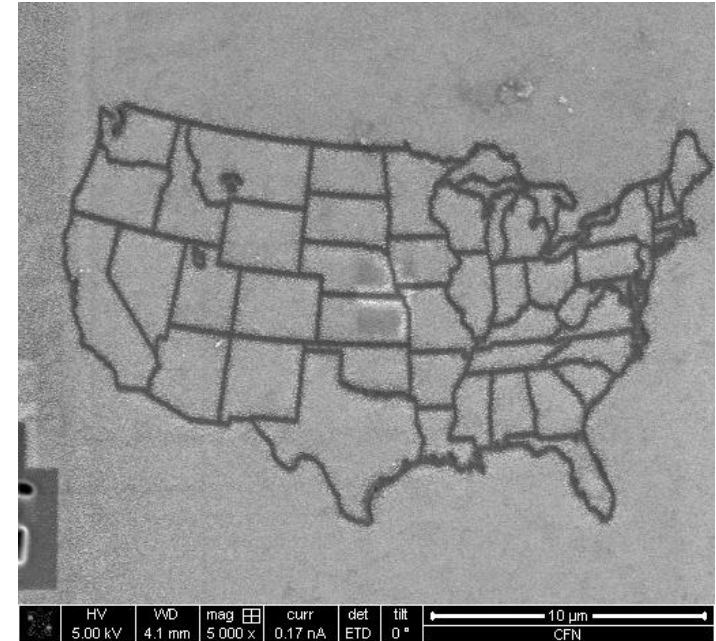
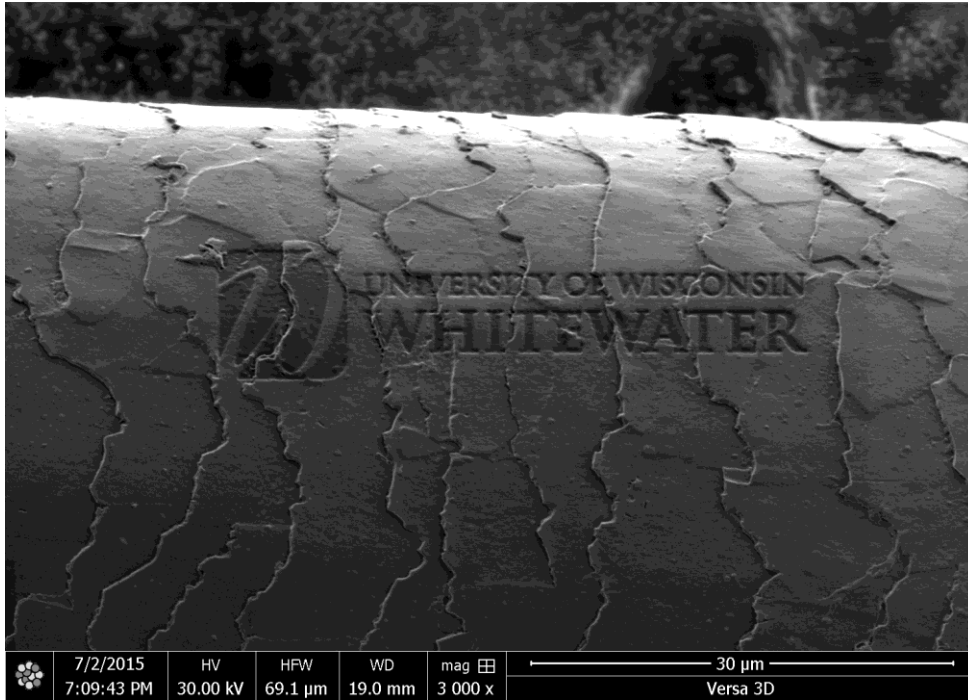


Our goal was to make an “all-dielectric” electric field sensor

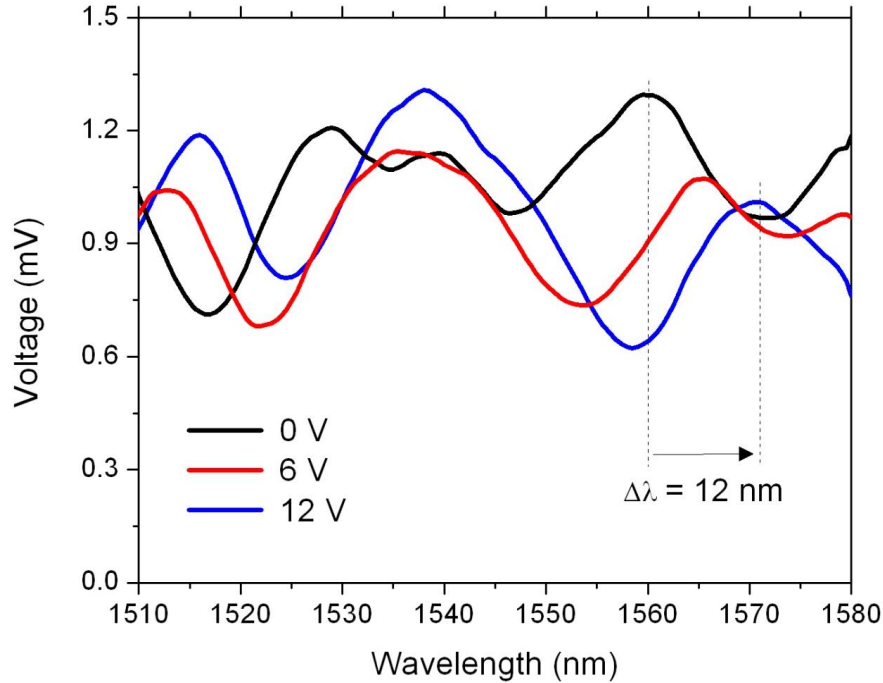


University of Wisconsin
Whitewater

Micro-machining was fun!



We fabricated: Ultrasensitive Photonic Crystal Electric Field Sensor



This was probably the most sensitive dielectric sensor of the World!

DEVICE ACHIEVED $450 \mu\text{V}/\text{m}\sqrt{\text{Hz}}$



University of Wisconsin
Whitewater

What happened next...?

DARPA closed the program!!

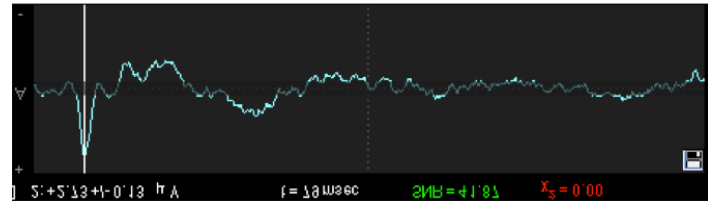
We started thinking...

- **If we can measure such small electric fields with this device, why not measure brain waves, which are also very small?**



We started working on brainwaves...

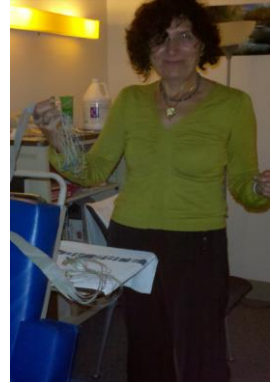
- EField™ (Electric Field Encephalography) System
- It is a system of high density array of electrodes, electronics and signal processing with algorithms.



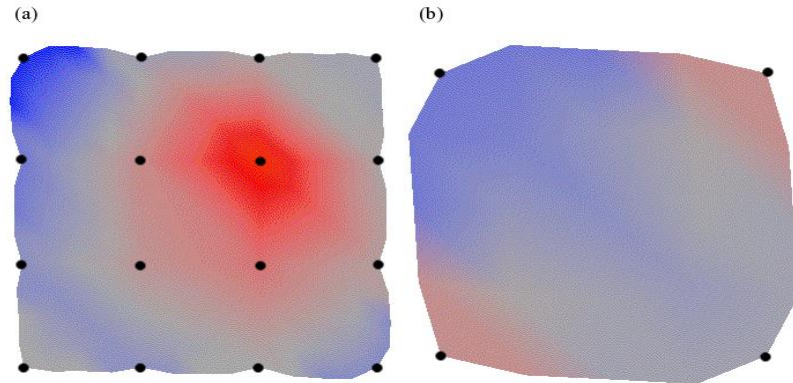
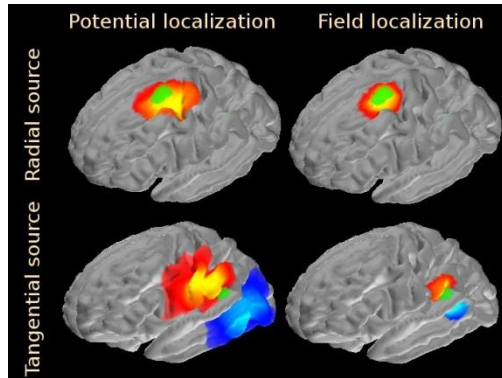
We got NSF I-CORPS Grant!

I became the “entrepreneurial lead”

Started pitching at different venues, to find “customers”. Started talking to neurologists, brain surgeons, sleep study labs, hospital EEG technicians, Brain-Computer-Interface specialists, epileptologists...



We did more research...



Published papers



University of Wisconsin
Whitewater

And applied for more patents

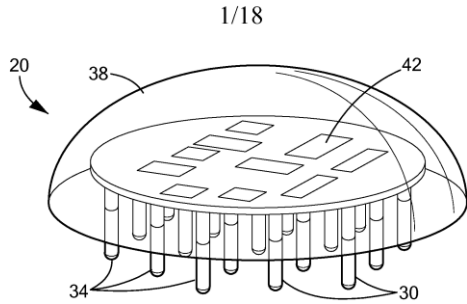


FIG. 1

Electric field encephalography:
electric field based brain signal
detection and monitoring,
Date of Patent: August 10, 2021

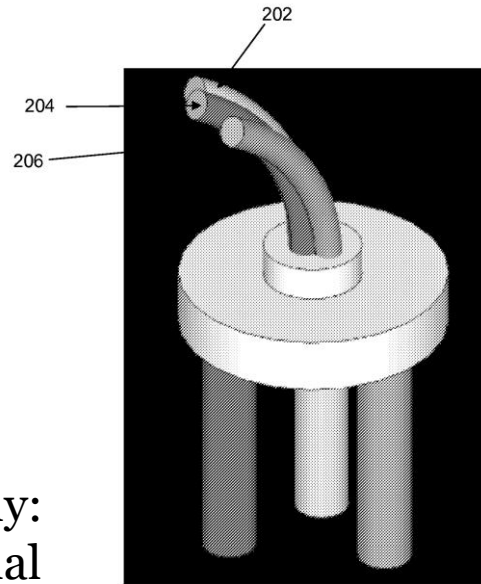


FIG. 2

Sensor system and process for
measuring electric activity of the
brain, including electric field
encephalography

Date of Patent: February 9, 2021

Started our company: NeuroFieldz Inc.

NeuroFieldZ



Ozgur
Yavuzcetin
Ph.D.

PRESIDENT

Expert in nano-fabrication, MEMS, electronics and instrument design. Instrumental in developing the hardware and signal processing for the EFEG™ Technology. Has more than 15 articles, and 4 patent/Invention disclosures. Expert in electronic and optical signal processing techniques and nano fabrication of electronic and optical materials. More than 20 years of hands-on experience in analog and digital electronics. Experience with wireless communication and microcontroller protocols, including UART and I2C and has built real-time wireless ECG/EEG systems.



Srinivas (Sri)
Sridhar, Ph.D.

CHAIRMAN OF THE BOARD

Distinguished Professor of Physics at Northeastern University and Lecturer on Radiation Oncology, Harvard Medical School. Published more than 170 articles and given 215 presentations worldwide, and several patents issued and applications pending. Key developer of the EFEG™ concept and its applications to neuroscience and neuromedical technologies. Expert in neurosensor physics and technology, nano-photonics, and nano medicine. Sridhar's work is focussed on translating his research discoveries into commercial and clinical products with a focus on improving human health. Has held numerous research and administrative leadership positions, supervising small groups as well as large multi-M\$ organizations.



Yury Petrov
Ph.D.

PRINCIPAL SCIENTIST

Expert in high-density EEG, psychophysics and functional brain imaging. Developed scientific software in Visual psychophysics library (PSPH), EEG electrode localizer (3Digit), FEM head modeling for EEG source localization (Tensoro), EEG data analysis and visualization (Harmony). Reviewer for major neuroscience journals.



University of Wisconsin
Whitewater

Incubating our company:

- **I started giving public pitches**
- **Attended pitching competitions**
- **Talking to angel investors**
- **Applying for federal grants**



But then...

I realized that this is not for me!



University of Wisconsin
Whitewater

In 2013 I joined UWW Physics Department.



UNIVERSITY OF WISCONSIN
WHITewater

[ADMISSIONS](#) [ACADEMICS](#) [CAMPUS LIFE](#) [EVENTS](#) [ATHLETICS](#) [CAMPUS INFO](#) [LIBRARY](#)

[EMAIL](#) [WINS](#) [D2L](#) [DIRECTORY](#) [STUDENTS](#) [FACULTY/STAFF](#) [ALUMNI](#)



SCIENCE MEETS BUSINESS | Physics students build technology for local company »

○○○○○



University of Wisconsin
Whitewater

Being a faculty at UWW is more fun!



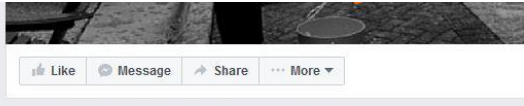
Whitewater City Market

@WhitewaterCityMarket

- Home
- About
- Photos
- Giveaway
- Likes
- Videos
- Events

Posts

Create a Page



Like Message Share More



Whitewater City Market added 3 new photos.
October 26 at 5:52am

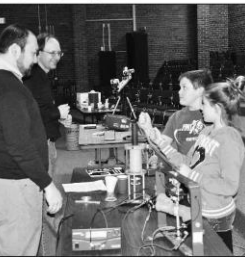
As Ozgur Yavuzcetin demonstrated, a small crowd that included Whitewater High School and UW-Whitewater physics students learned about how the power was demonstrated.



5 Likes 2 Shares

in politics soon brought her politics."

Among her later films were very rewarding, personally."



A FINE SCIENCE — Students at Luther Elementary School in Fort Atkinson recently have been treated to some extra science curriculum, courtesy of University of Wisconsin-Whitewater professors. In order to prepare students for the upcoming Fort Atkinson Regional Science Fair, UW-Whitewater professors were invited to Luther's classrooms to provide hands-on demonstrations of basic science principles. The program was organized through the University's Science Outreach program, with Debrae Cabret-Milner, mother of two Luther students, taking an active role at bringing the educators to the school. Each grade level learned about a subject that fits in with its regular curriculum, with various levels covering topics such as weather, chemistry, animal tracks and insects. Shown here, third-grade students learn about different types of energy from associated Professor Steven Sahyun and Assistant Professor Ozgur Yavuzcetin, both of the Physics Department. Above left, students pay close attention to the gas jet launchers, with instructions to clap each time they hear the word "energy." Above right, a student cranks a generator, while Sahyun explains how the device powers the lightsbulb before her. At left, students feel a balloon that is slowly re-inflating after being removed from a chamber of dry ice. Below left, Sahyun catches a washer launched into the air after Yavuzcetin turns on an electromagnet. Below right, students feel vibrations in their hands as they hold magnets close to the professors' electromagnet. — Daily Union photos by Lydia Stutz.



University of Wisconsin
Whitewater

I can still do hands-on projects



Can work with students one-on-one



I can work on more collaborated
projects

Monitoring Landslides
and Saving Lives



University of Wisconsin
Whitewater

Challenges and comparison for research at PUI vs Research University

Primarily Undergraduate Institution

- Continuity in research with UG
- Teaching load
- Student mentoring
- Lack of advanced facilities and funding
- Most work is done by faculty
- More time in the lab.

Research University

- Graduate students/postdocs
- Less teaching, more research, grants expected
- Graduate students cannot see their advisors.
- Most universities have facilities.
- PIs are busy with grant writing
- Research is more like business (PIs, postdocs, graduate students, ADAs).



At PUIs Faculty has more to do..



University of Wisconsin
Whitewater

At UWW inventions and Innovations continue



Learn and across the
at you place over

REALIZE YOUR IDEA

TAKE IDEAS TO MARKET

NEWS

EVENTS

GRANTS

IDEA 4: Better protective masks for the general public using hydrogels

Ozgur Yavuzcetin, Associate Professor, Physics
UW-Whitewater

"Hydrogels are relatively new polymers used commonly in super water absorbent medium, which can absorb 200-300 times their weight. Incorporating hydrogels or sodium polyacrylate as a filtering medium in face masks (used in disposable diapers, non-toxic), could reduce infection rates by absorbing water content from bioaerosols and acts as a two-way barrier. The hydrophilic electrostatic surface charges of hydrogels, could inhibit the electrophoretic mobility of viral particles."

This innovator is seeking interested partners for further development. Contact WiSys Regional Associate Tony Hanson at thanson@wisys.org for more information.

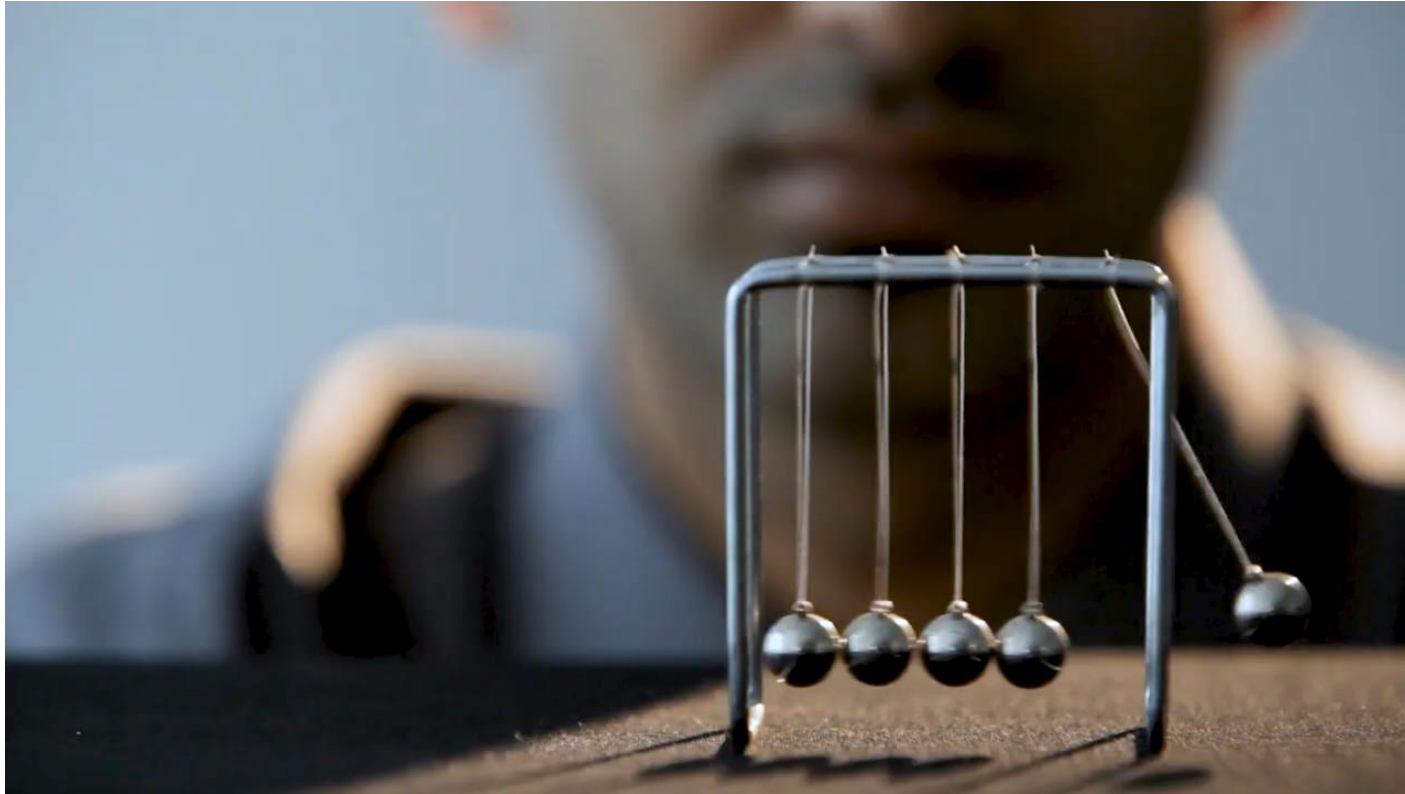


UW-Whitewater associate professor of physics receives a U.S. Patent



University of Wisconsin
Whitewater

Independent Inventions...



University of Wisconsin
Whitewater

Thank You!



University of Wisconsin
Whitewater