

THE PLATTSMOUTH AMATEUR RADIO CLUB

Communicator

October 2024

Honeybees get Charged Up

(ARnewsline 9/6/24) The University of Bristol's Botanic Garden in Stoke Bishop was all abuzz with bees on the 24th and 25th of August as visitors learned about the importance bees have as pollinators and agents of change in the overall environment. It was not so long ago, though, that the university's researchers made a sweet and surprising discovery about something else: They found that swarms of honeybees are capable of generating electrical charges in the atmosphere, ones that rival those of thunderstorm clouds. In fact, the more dense the swarm, the bigger the electrical charge.

The scientists recorded currents from swarms passing over a campus field station during 3-minute intervals. They recorded as many as 1,000 volts per metre.

The research was published nearly two years ago in the Smithsonian magazine and the journal, iScience. Don't get too excited about applying bee power to any amateur radio operation going portable in the vicinity of an apiary. According to an article in the magazine, Popular Science, 50 billion bees would be needed to provide power to an LED light. That means even the smallest of the small rigs could not even hope to get on the air, operating Q R Bee.

<https://www.arnewsline.org/>

<https://www.planetbee.org/post/honeybees-electrify-their-environment>

[https://www.cell.com/iscience/fulltext/S2589-0042\(22\)01513-9](https://www.cell.com/iscience/fulltext/S2589-0042(22)01513-9)

Vortex Cannon Generates Toroidal Electromagnetic Pulses

(Physics World 19 Sep 2024 Isabelle Dumé)

Toroidal electromagnetic pulses can be generated using a device known as a horn microwave antenna. This electromagnetic “vortex cannon” produces skyrmion topological structures that might be employed for

information encoding or for probing the dynamics of light-matter interactions, according to its developers in China, Singapore and the UK.

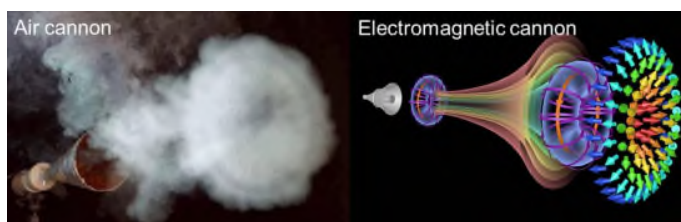
Examples of toroidal or doughnut-like topology abound in physics – in objects such as Mobius strips and Klein bottles, for example. It is also seen in simpler structures like smoke rings in air and vortex rings in water, as well as in nuclear currents. Until now, however, no one had succeeded in directly generating this topology in electromagnetic waves.

A rotating electromagnetic wave structure In the new work, a team led by Ren Wang from the University of Electronic Science and Technology of China, Yijie Shen from Nanyang Technological University in Singapore and colleagues from the University of Southampton in the UK employed wideband, radially polarized, conical coaxial horn antennas with an operating frequency range of 1.3–10 GHz. They used these antennas to create a rotating electromagnetic wave structure with a frequency in the microwave range.

The antenna comprises inner and outer metal conductors, with 3D-printed conical and flat-shaped dielectric supports at the bottom and top of the coaxial horn, respectively

“When the antenna emits, it generates an instantaneous voltage difference that forms the vortex rings,” explains Shen. “These rings are stable over time – even in environments with lots of disturbances – and maintain their shape and energy over long distances.”

Complex features such as skyrmions The conical coaxial horn antenna generates an electromagnetic field in free space that rotates around the propagation direction of the wave structure. The researchers experimentally mapped the toroidal electromagnetic pulses at propagation distances of 5, 50 and 100 cm from the horn aperture, using a planar microwave anechoic chamber (a shielded room covered with electromagnetic absorbers) to measure the spatial electromagnetic fields of the antenna, using a scanning frame to move the antenna to the desired measurement area. They then connected a vector network analyser to the transmitting and receiving antennas to obtain the magnitude and phase characteristics of the electromagnetic field at different positions.



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Note: Thanks to all who have paid their dues and those who have given additional donations. All donations are greatly appreciated. Please let me know of any corrections.



Meetings are 8am the last Saturday of most months at Mom's Café in Plattsmouth.

Tuesday night get-togethers at Plattsmouth Burger King at 6 PM or so.

PLATTSMOUTH AMATEUR
RADIO CLUB

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MINUTES of
the
MEETING

The August Meeting was held at Mom's Café on Saturday, August 31, 2024. The meeting was called to order by President Roger Behrns at 8:11 am.

Those in attendance were Roger (KBØOGO), Kevin (KIØPY), Ray (N5SEZ), John (KCØHYD), Shirley (KCØHYE), Chuck (AIØN), Jim (WØJRN), Derek (WØDBW), Gary (WDØCFC), Paul (WFØPCE), Scott (N8VCL) and Stanley (KFØRMZ).

The Minutes of the July meeting were approved on a motion by John and seconded by Chuck.

The Treasurer's report showed expenses of \$300 for insurance and a \$50 donation to the Village of Murray. Dues of \$30 were received. This leaves \$492.55 in the General Fund and \$315 in the Repeater Fund for a total of \$807.55. The report was accepted on a motion by John and second by Paul.

There being no other business, the meeting was adjourned at 8:13 on a motion by Paul and seconded by John.



Meeting Calendar

8am, Sat September 28
8am, Sat October 26
8am, Sat November 30
at Mom's Café.

PLATTSMOUTH ARC MEMBERSHIP REGISTRATION FORM			
Name		Call Sign	Class
Address	City	State	Zip
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Membership Type	Donation for:		Amount:
☐ Primary(\$15)	● Additional donations are gratefully accepted. ● New Hams are free during the year they receive their first license. ● Please give this form and dues to the club treasurer or any club officer.	☐ Repeater fund	☐ I prefer my donation to be anonymous.
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☐ Student (\$5)		☐ Other _____	
☐ New Ham		☐ General	
Any additional e-mail or cell phone #s?			

The researchers found that the toroidal pulses contained complex features such as skyrmions. These are made up of numerous electric field vectors and can be thought of as two-dimensional whirls (or “spin textures”). The pulses also evolved over time to more closely resemble canonical Hellwarth–Nouchi toroidal pulses. These structures, first theoretically identified by the two physicists they are named after, represent a radically different, non-transverse type of electromagnetic pulse with a toroidal topology. These pulses, which are propagating counterparts of localized toroidal dipole excitations in matter, exhibit unique electromagnetic wave properties, explain Shen and colleagues.

A wide range of applications The researchers say that they got the idea for their new work by observing how smoke rings are generated from an air cannon. They decided to undertake the study because toroidal pulses in the microwave range have applications in a wide range of areas, including cell phone technology, telecommunications and global positioning. “Understanding both the propagation dynamics and characterizing the topological structure of these pulses is crucial for developing these applications,” says Shen.

The main difficulty faced in these experiments was generating the pulses in the microwave part of the electromagnetic spectrum. The researchers attempted to do this by adapting existing optical metasurface methodologies, but failed because a large metasurface aperture of several metres was required, which was simply too impractical to fabricate. They overcame the problem by making use of a microwave horn emitter that’s more straightforward to create.

Looking forward, the researchers now plan to focus on two main areas. The first is to develop communication, sensing, detection and metrology systems based on toroidal pulses, aiming to overcome the limitations of existing wireless applications. Secondly, they hope to generate higher-order toroidal pulses, also known as supertoroidal pulses.

“These possess unique characteristics such as propagation invariance, longitudinal polarization, electromagnetic vortex streets (organized patterns of swirling vortices) and higher-order skyrmion topologies,” Shen tells Physics World. “The supertoroidal pulses have the potential to drive the development of ground-breaking applications across a range of fields, including defence systems or space exploration.”

<https://physicsworld.com/a/vortex-cannon-generates-toroidal-electromagnetic-pulses/>
<https://doi.org/10.1063/5.0218207>

NASA Discovers a Long-Sought Global Electric Field on Earth

(NASA 8/28/24) Using observations from a NASA suborbital rocket, an international team of scientists has, for the first time, successfully measured a planet-wide electric field thought to be

as fundamental to Earth as its gravity and magnetic fields. Known as the ambipolar electric field, scientists first hypothesized over 60 years ago that it drove how our planet’s atmosphere can escape above Earth’s North and South Poles. Measurements from the rocket, NASA’s Endurance mission, have confirmed the existence of the ambipolar field and quantified its strength, revealing its role in driving atmospheric escape and shaping our ionosphere — a layer of the upper atmosphere — more broadly.

Understanding the complex movements and evolution of our planet’s atmosphere provides clues not only to the history of Earth but also gives us insight into the mysteries of other planets and determining which ones might be hospitable to life. The paper was published Wednesday, Aug. 28, 2024, in the journal *Nature*.

Since the late 1960s, spacecraft flying over Earth’s poles have detected a stream of particles flowing from our atmosphere into space. Theorists predicted this outflow, which they dubbed the “polar wind,” spurring research to understand its causes.

Some amount of outflow from our atmosphere was expected. Intense, unfiltered sunlight should cause some particles from our air to escape into space, like steam evaporating from a pot of water. But the observed polar wind was more mysterious. Many particles within it were cold, with no signs they had been heated — yet they were traveling at supersonic speeds.

“Something had to be drawing these particles out of the atmosphere,” said Glyn Collinson, principal investigator of Endurance at NASA’s Goddard Space Flight Center in Greenbelt, Maryland, and lead author of the paper. Scientists suspected a yet-to-be-discovered electric field could be at work.

The hypothesized electric field, generated at the subatomic scale, was expected to be incredibly weak, with its effects felt only over hundreds of miles. For decades, detecting it was beyond the limits of existing technology. In 2016, Collinson and his team got to work inventing a new instrument they thought was up to the task of measuring Earth’s ambipolar field.

The team’s instruments and ideas were best suited for a suborbital rocket flight launched from the Arctic. In a nod to the ship that carried Ernest Shackleton on his famous 1914 voyage to Antarctica, the team named their mission Endurance. The scientists set a course for Svalbard, a Norwegian archipelago just a few hundred miles from the North Pole and home to the northernmost rocket range in the world.

“Svalbard is the only rocket range in the world where you can fly through the polar wind and make the measurements we needed,” said Suzie Imber, a space physicist at the University of Leicester, UK, and co-author of the paper.

On May 11, 2022, Endurance launched and reached an altitude of 477.23 miles (768.03 kilometers), splashing down 19 minutes later in the Greenland Sea. Across the 322-mile altitude range where it collected data, Endurance measured a change in electric potential of only 0.55 volts.

“A half a volt is almost nothing — it’s only about as strong as a watch battery,” Collinson said. “But that’s just the right amount to explain the polar wind.”

In general, the team found that the ambipolar field increases what’s known as the “scale height” of the ionosphere by 271%, meaning the ionosphere remains denser to greater heights than it would be without it.

<https://science.nasa.gov/science-research/heliophysics/nasa-discovers-long-sought-global-electric-field-on-earth/>