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Book of Abstracts

ID:81# Matrix Models and Fuzzy Spaces

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We study spaces that don't have to be continuous like ordinary space but can instead be built from matrices that replace the usual notion of points. These matrix spaces allow us to explore what happens when geometry itself becomes quantum. Our work includes well-known examples such as the fuzzy sphere and newer constructions like the fuzzy onion, where several fuzzy layers form a richer internal structure. By choosing different actions, we can define a variety of matrix models with distinct symmetries and dynamics, each revealing different aspects of quantum geometry. On these spaces, we build and analyse field theories to understand how their behaviour depends on the underlying structure and parameters of the model. Combining analytic calculations, bootstrap techniques, and large-scale simulations, we investigate how such quantum spaces behave and how classical geometry might emerge from them—creating a playground where geometry, quantum field theory, and statistical physics naturally meet.

ID:51# Proximity phenomena in heterostructures consisting of superconductor –ferromagnet

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Current demands on computing technologies and storage units, such as speed, low power consumption, and high memory density, are leading to the development of new technologies. One promising area is superconducting cryoelectronics, including qubits, superconducting spintronics, or memory cells. Devices combining two antagonistic phenomena –superconductivity and ferromagnetism –show great potential. Various effects can occur at their interfaces, such as the formation of π-junctions or triplet Cooper pairs, which enable the generation and transport of spin-polarized current. In this work, we report on the fabrication and electrical characterization of superconductor/ferromagnet/superconductor (S/F/S) nanostructures based on NbN superconducting electrodes and ferromagnetic Ni or Co interlayers. Transport measurements revealed that Co layers (20 and 50 nm thick) did not become superconducting via the proximity effect, while structures with similarly thick Ni layers exhibited zero resistance after the superconducting transition. This behavior indicates the possible formation of triplet Cooper pairs, further supported by I-V measurements showing a nearly field-independent critical current, which is characteristic for triplet superconductivity.

ID:53# Plasma-activated water enhances growth, antioxidant activity and sensory quality of hydroponically grown lettuce

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Cold atmospheric plasma generates multiple reactive oxygen and nitrogen species (RONS), which dissolve in water to form plasma-activated water (PAW), resulting in its subsequent chemical modifications. Due to the presence of RONS, PAW shows considerable potential in agriculture, as these species act as signaling molecules in plant metabolic pathways and enhance nutrient availability.

This study evaluates the effects of PAW produced via a transient spark (TS) discharge system on the growth and physiological responses of hydroponically cultivated lettuce (Lactuca sativa). Four experimental treatments were established: (1) a control group grown in ½ Hoagland's nutrient solution; (2) plants from seeds primed in PAW for 1.5 hours, then transferred to Hoagland's nutrient solution; (3) plants from seeds primed in PAW and subsequently cultivated in PAW supplemented with ½ Hoagland's nutrient solution; and (4) plants cultivated solely in PAW enriched with ½ Hoagland' s nutrients. Plant development was monitored over a 10-week period. At harvest, central rosette leaves (3–5 per plant) were analyzed for concentration of selected antioxidants, specifically soluble phenols and quercetin from flavonoids. Another important parameter was the activity of several antioxidant enzymes (superoxide dismutase, ascorbate peroxidase, guaiacol peroxidase, and glutathione reductase), which was measured in the mixture of two oldest and youngest leaves of plants. A sensory evaluation involving 15 participants assessed visual appearance, aroma, flavor, and texture. Our results showed that the combination of PAW treatment and seed priming led to increased biomass accumulation and enhanced activity of antioxidant enzymes. These plants also had higher concentrations of key antioxidant compounds. Among these antioxidants, flavonoids (in our case, quercetin) are the most powerful scavengers of free radicals and possess anti-inflammatory, antidiabetic, antiatherosclerotic, antihypertensive, and anti-aging properties. Sensory panel participants consistently rated the PAW-treated lettuce as more appealing and tastier, indicating strong potential for consumer acceptance and commercial application.

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ID:32# Accelerator Mass Spectrometry of Beryllium-10

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Beryllium-10 (^{10}Be) is a long-lived radioactive cosmogenic isotope of beryllium (half-life = 1.387 Ma), primarily produced in the Earth's atmosphere through spallation reactions induced by high-energy cosmic rays. Owing to its extended half-life and β^--decay mode, the quantification of ^{10}Be at ultratrace levels in natural samples is most effectively achieved using accelerator mass spectrometry (AMS). As a robust geochemical tracer, ^{10}Be is extensively utilised for geochronological applications and serves as a valuable tool in diverse fields of Earth and environmental sciences.
The CENTA (Centre for Nuclear and Accelerator Technologies) laboratory was founded in 2013 and is equipped with a 3 MV Pelletron accelerator from NEC (National Electrostatic Corporation, Middleton, USA). The first attempts to measure ^{10}Be in 2015 were done in cooperation with the VERA (Vienna Environmental Research Accelerator) laboratory of the University of Vienna; however, they were limited by insufficient background suppression in the high-energy part of the beamline. A major upgrade of the beam line was implemented in 2023 and allows almost total suppression of interfering ions. To suppress the main isobaric interference of ^{10}Be, the stable isotope ^{10}B, additional methods need to be implemented.
The full suppression of ^{10}B can be achieved by several techniques utilising different energy losses of boron and beryllium in matter. We have adopted the absorption technique, where a stack of silicon nitride foils with a defined areal density is used as an absorber in front of the gas ionisation detector used for the registration of ions. This technique was tested by using a 2+ charge state, for higher transmission and a gas ionisation chamber supplied by NEC was used as the end detector. Standard reference materials with an isotopic ratio of ^{10}Be/^{9}Be ranging from 2.502×10^{-11} to 1.01×10^{-13}, obtained from the University of California, were used for the determination of linearity in this range. When the production of BeH molecules was suppressed by increasing the pressure of the stripper gas in the accelerator, a background level of 5×10^{-14} was achieved.

ID:82# Reference laboratory data for astrophysics

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