Indirect Detection of Massless Particles (Hions) Through Light Diffractions Experiments

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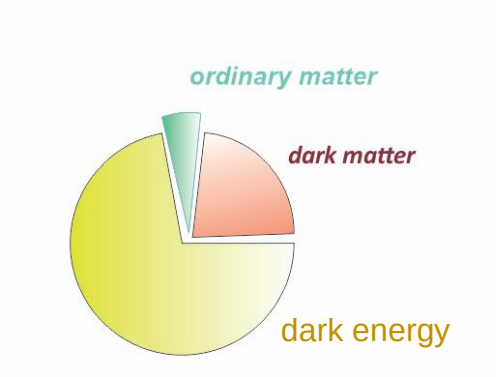
The Main Types of Matter in the Universe

- Modern science claims that our universe is about 4.6% ordinary matter (nucleons, electrons, atoms etc.). Another 23% is mysterious dark matter, which we know very little about, since it is inaccessible for direct observation and, accordingly, 72.1% is dark energy, which we also know little about.



- The most popular hypothesis is the "cosmological constant", which states that dark energy is the "cost of the existence of space.“
- The hypothesis of "quintessence" is also popular - a scalar field unknown for today, which leads to the existence of the same dark energy as the first hypothesis.

Scalar Field

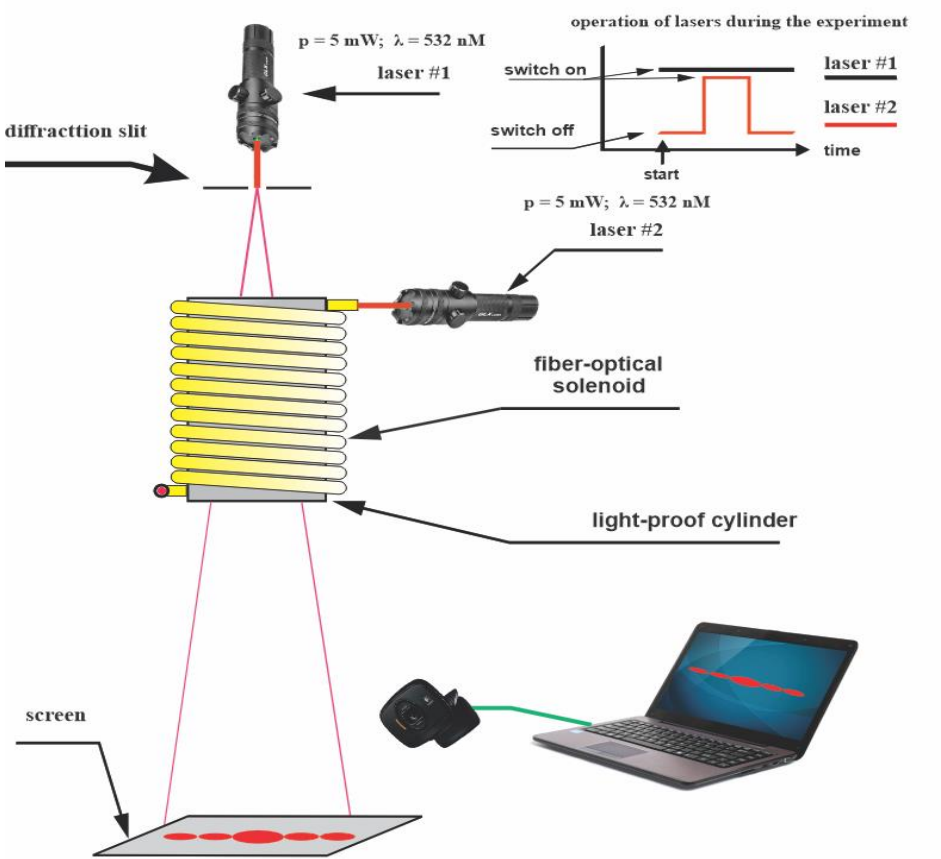
- Although a fundamental scalar field has not yet been observed experimentally, it is generally accepted that such fields play a key role in the construction of modern theory of elementary particles.
- There are several important hypothetical scalar fields, for example, the Higgs field for the Standard Model, dark energy-quintessence for the theory of quantum vacuum, etc. Recall that the presence of each of them is necessary for a complete classification of the theory of fundamental fields, including for the string theory.
- As shown in [Savvidy, G.K., Phys. Lett. B 1977, 71, 133–134.], as well as in work [Scharf, G., Il Nuovo Cim. A 1996, 109, 1605–1607.], the radiative corrections of the massless Yang–Mills theory, in the framework of the SU(3) gauge symmetry group, leads to instability of the vacuum state, which corresponds to the asymptotic freedom of gauge theories and is due to infrared features.
- Thus, within the framework of the Yang-Mills theory, including taking into account non-Abelian terms, it is impossible to obtain solutions for massless particles, and this is a very serious problem for the theory.

Stochastic Extension of Yang-Mills Theory

- Tosolvethisproblem,werecentlyproposedusingcomplexstochasticdifferentialequations(SDEs)ofLangevintypeasthebasicequationofmotion,forwhichtheYang-Millsequationsaretheprincipleoflocalcorrespondence[Gevorkyan,A.S.,Particles 2019, 2, 281–308].
- Inparticular,forthegaugesymmetrygroupSU(2)xU(1),whichdescribeselectroweakfields,wehaveprovedthepossibilityoftheformationofastablemasslessBoseparticle(hion)withspin1inthelimitofstatisticalequilibrium.

Vector Field and the Idea of Its Experimental Registration

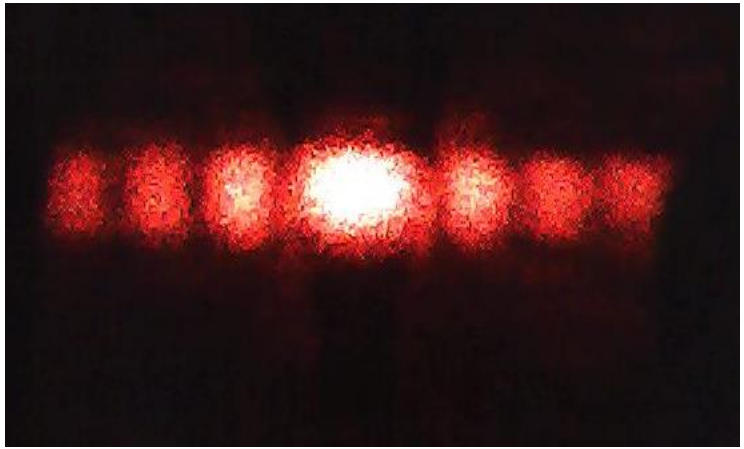
- As already mentioned, the scalar field practically fills the entire space evenly.Moreover, we have the right to speak about space when it is filled with a scalar field.
- However, we have shown theoretically that a scalar field has a finite probability of decay on a vector field, which consists of massless, chargeless particles, i.e. hions that have unit spins.
- We assume that they should also be uniformly and isotropically distributed in space, so that on atomic volume scales the total spin should be equal to zero.
- Unfortunately, it is impossible theoretically to estimate either the size or the concentration of hions in space, since the theory includes two unknown constants that can be determined only by experimental way.
- If everything said is correct, then a natural question arises, namely, how to influence the vector field so that the isotropy of the spin distribution is violated in space?
- Obviously, this would lead to the appearance of polarizability in space and, accordingly, would change the refractive indices of the vacuum.
- In other words, our goal is to transform the vector field, which is a component of dark energy, into a phase object by external influence and register it experimentally.

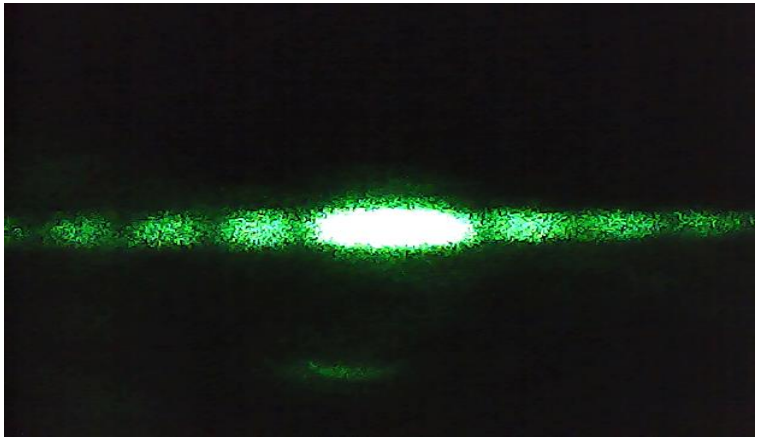


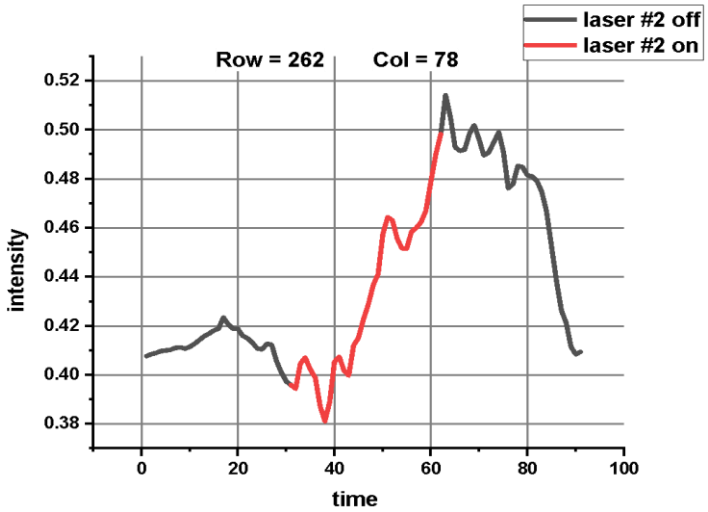
Block diagram of the experiment 1.

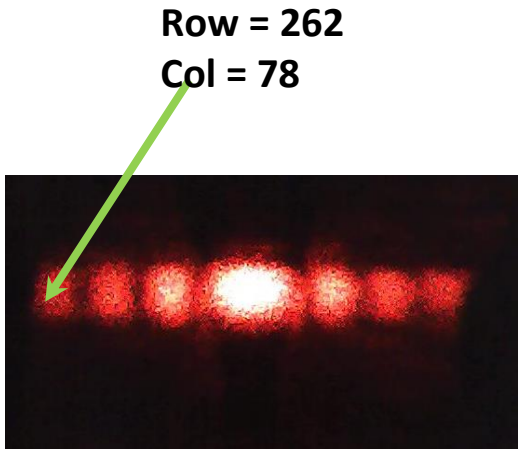
Col = 640

Row = 480

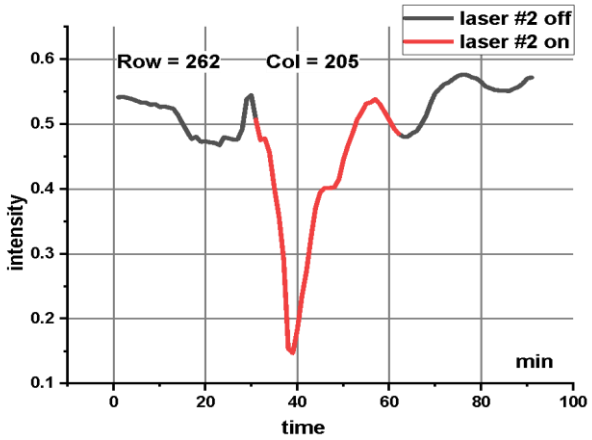


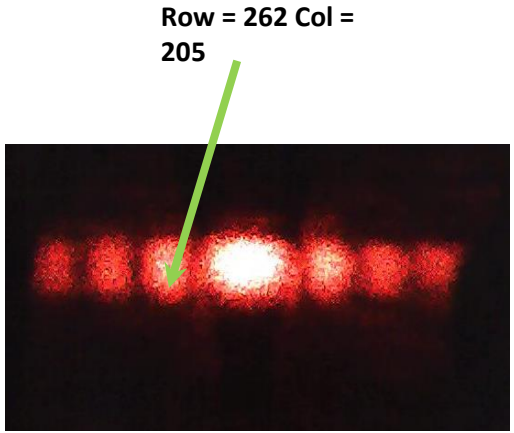




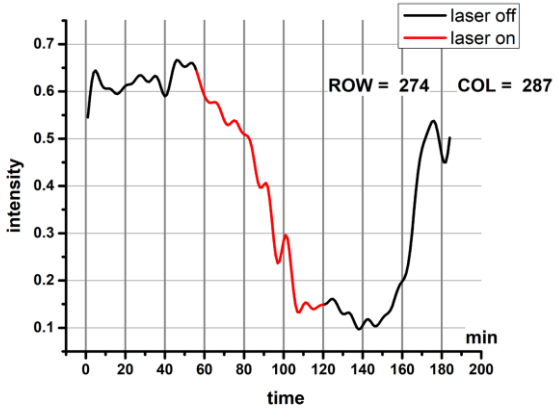


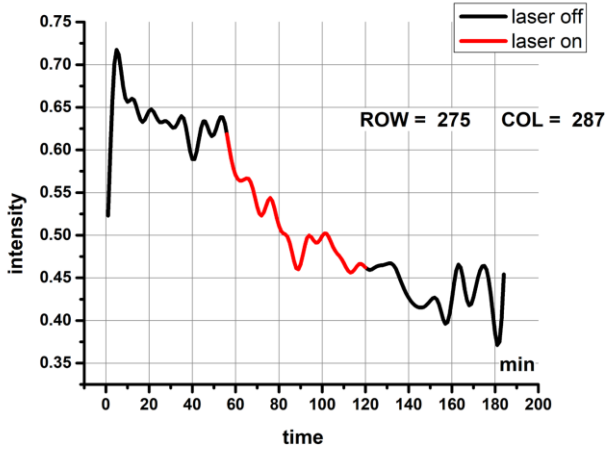
the illumination intensity of the pixel at coordinates Row = 262 Col = 78 without aluminum foil

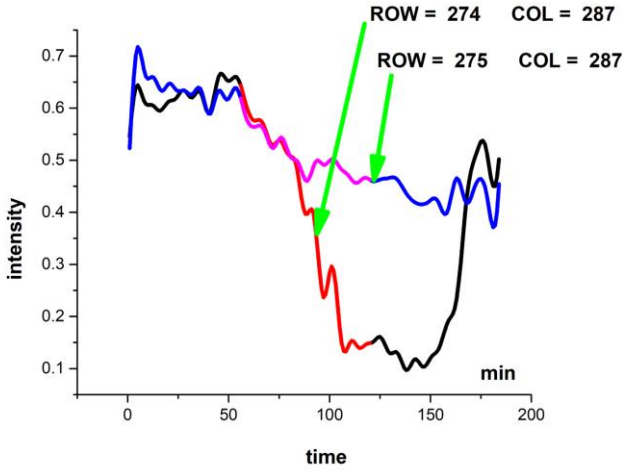


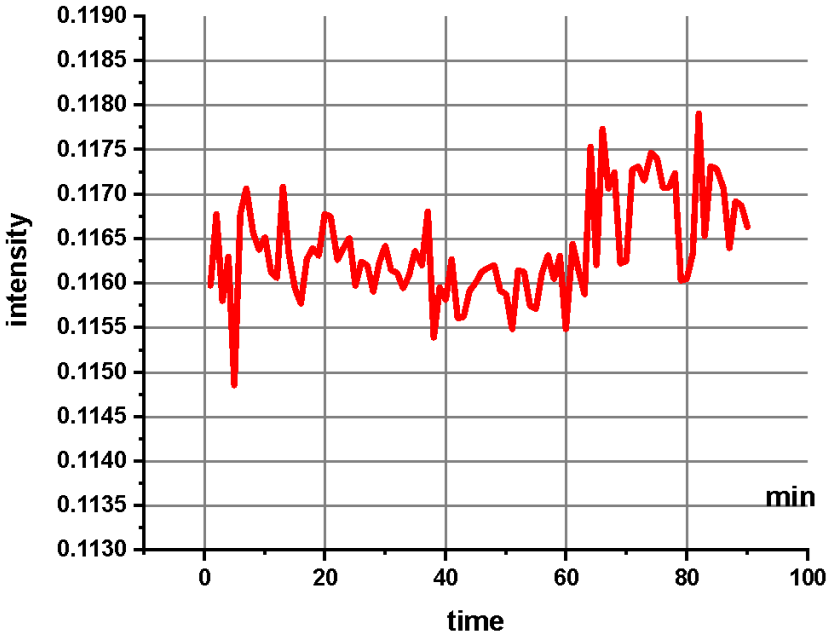


the illumination intensity of the pixel at coordinates
Row = 262 Col = 205

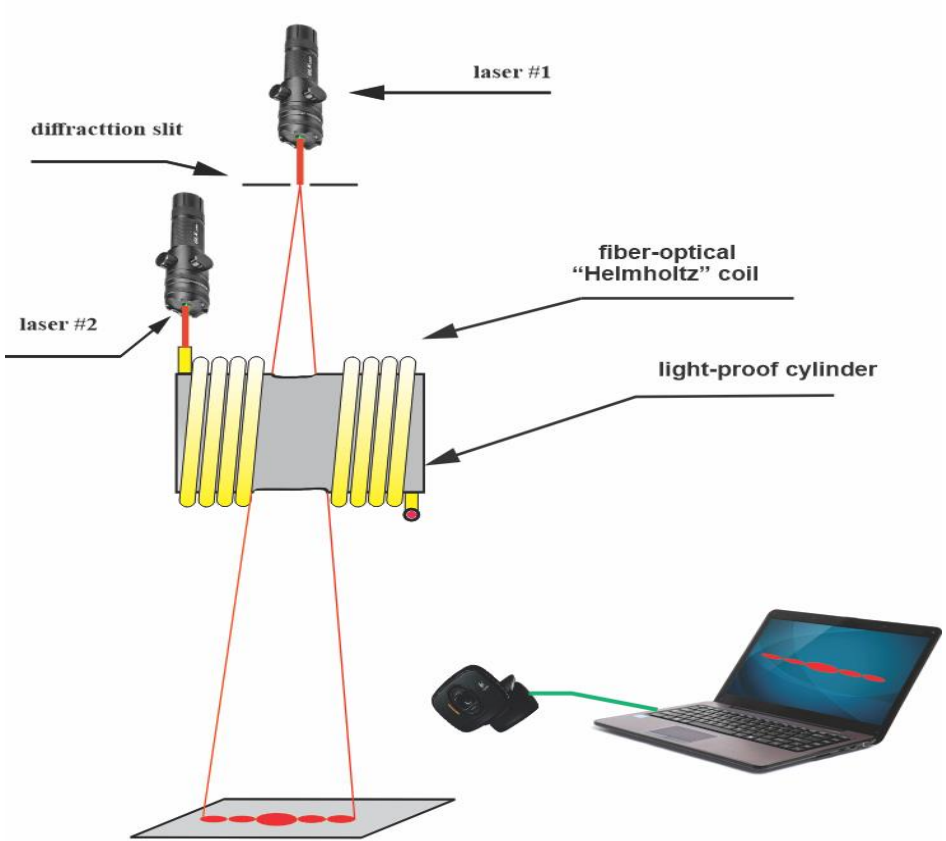

laser off
laser on
ROW = 274 COL = 287
intensity
time
min


laser off
laser on
ROW = 275 COL = 287
intensity
time
min

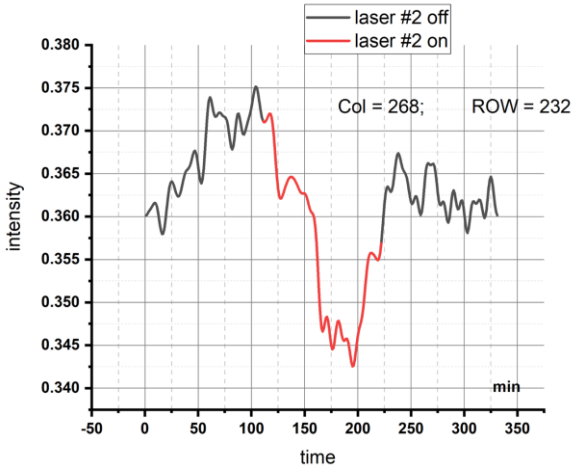

ROW = 274 COL = 287
ROW = 275 COL = 287
intensity
time
min

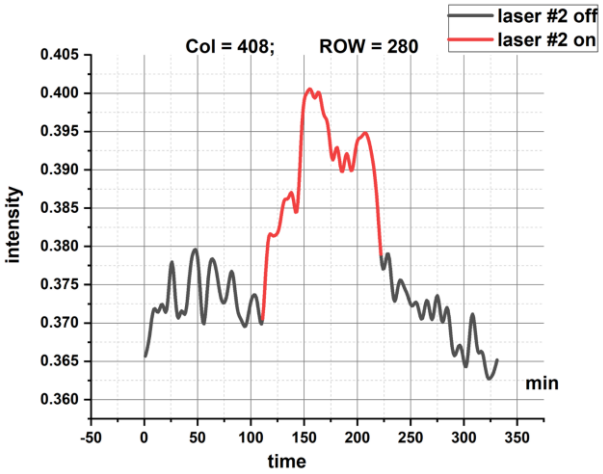


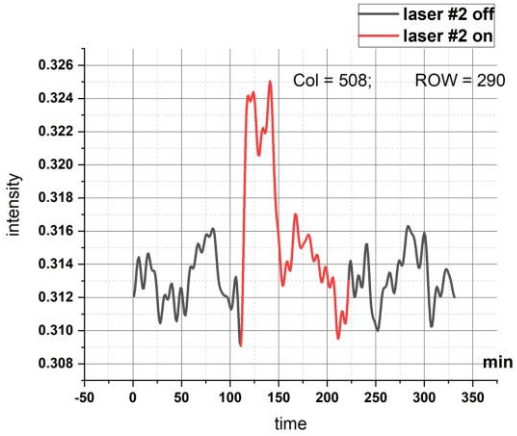
the average illumination intensity of the screen



Block diagram of the experiment 2.







the illumination intensity of some pixel`s in experiment 2.

THANK YOU FOR ATTENTION!