Review on the project

Modern mathematical physics.

Integrable systems and symmetries.

As it is written in the abstract of the project, the authors propose 5 tasks for consideration:

1) "Study of algebraic and differential structures in holographic systems"
2) "Construction of the action of a non-Abelian N=(1,0), d=6 tensor multiplet, which has as many properties as possible for six-dimensional superconformal theories"
3) "Description of unitary irreducible representations of multidimensional Poincaré groups and symmetry groups of AdS (anti-de Sitter) spaces"
4) "Study of issues related to the holographic renormalization group"
5) "Generalization of the results of Strominger-Yau-Zaslow for the case of a target space, which is an arbitrary algebraic manifold.

As one can be seen from this listing, the first four tasks are in one way or another related to the holographic approach. Although the holographic approach originated within string theory, it has now become a powerful method in its own right for studying strongly interacting systems in both high energy physics and condensed matter theory. Although the holographic approach originated within the framework of string theory, it has now become a powerful method in its own right for studying strongly interacting systems in both high energy physics and condensed matter theory. The holographic approach is based on the AdS/CFT duality, and this duality can be established for a rather limited range of models, in which strict requirements on the symmetry of the corresponding systems are satisfied. However, the holographic approach is actively used for physical systems where these symmetries are modified or broken, and in this version it becomes a phenomenological approach that is actively used both in high energy physics and in the theory of condensed states, as well as in information theory.

From the point of view of the overall contribution to the development of the holographic approach, not all of the proposed and listed above research areas are equivalent.

There are the following remarks corresponding to the points listed above:

1) It is not very clear which models are planned to be considered in paragraph 1) and what is non-triviality and novelty.

2) Since the group of (super)conformal symmetries is important in the general context of holographic duality, this problem is interesting, because its solution after compactification can lead to new results concerning both models in a realistic number of dimensions and in low-dimensional cases.

3) The problem proposed in this paragraph is a useful problem, but the reference to Wigner is problematic, because it involves the construction of an appropriate theory of the "boundary".

4) It is supposed to study holographic renormalization group flows for low-dimensional examples, which seems to be useful for understanding models in realistic dimensions.

5) This range of questions is related to mirror symmetry in string theory. Here, the authors of the project did not indicate the scientific groundwork that they have.

Assessing the proposed research as a whole, I can note that these are useful studies that, perhaps, in certain directions will make a significant contribution to the development of theoretical and mathematical physics.

Doctor of Physical and Mathematical Sciences, Professor,
corresponding member of RAS,
chief Researcher of Steklov Mathematical Institute of RAS

I.Ya. Aref'eva

I. Aref'eva