



Regular article

Holographic principles in physics

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Abstract. It is a sample to write a paper for journal of holography applications in physics, where some applications of holography in physics introduced.

Keywords: Holography; Gravity; Field Theory; Superconductor.

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Table 1: Example of AdS/CFT dictionary.

Quantity ($\times L^{-2}$)	$\mathcal{N}=4$ SYM	AdS
Minimum radius of D-brane	$\frac{M_{rest}(T) + \Delta m(T)}{T_0}$	u_m
Radius of horizon	$\frac{m - M_{rest}(T)}{T_0}$	u_h
Lagrangian mass	m	$T_0 u_m$
Thermal rest mass shift	$\Delta m(T)$	$T_0 u_h$
Static thermal mass	$M_{rest}(T)$	$T_0(u_m - u_h)$

1 Introduction

Holographic principles have many implications in physics. One widely recognized concept is used in the fields of optics and laser physics, with numerous applications in health science and engineering. Holography, which is a versatile method for controlling light waves, has found extensive applications in the fields of imaging, display technologies, and security [1].

On the other hand, a different concept, but with a similar origin, is utilized in theoretical physics. The gauge/gravity duality is a well-known sample of holography. In that case, the AdS/CFT correspondence is a powerful mathematical tool to study strongly coupled systems [2]. It relates two different physical theories, one of them in to the bulk, the other on the surface. These conjectures have several applications in various areas of physics, which introduced briefly in next sections.

2 Particle physics

Study of quark-gluon plasma (QGP) by using AdS/CFT correspondence is one of the famous applications of holography in the elementary particle physics [3]. This conjecture is valid at large N limit:

$$N \rightarrow \infty. \quad (1)$$

Calculation of drag force by using energy-momentum matrix [4]

$$\begin{pmatrix} \pi_x^0 & \pi_x^1 \\ \pi_r^0 & \pi_r^1 \\ \pi_t^0 & \pi_t^1 \end{pmatrix} = \Pi \quad (2)$$

is one of the ways to study QGP as well as jet quenching parameter and shear viscosity to entropy ratio. Table 1. represents some dual quantities of both sides [5].

3 Condensed matter

Study of superconductor by using holographic dual theory of gravity is one of the new and interesting applications of holography in condensed matter physics [6]. For example in Fig. 1 we show behavior of electrical conductivity [7].

4 Nuclear physics

Also, it is possible to study nuclear force using AdS/CFT correspondence [8].

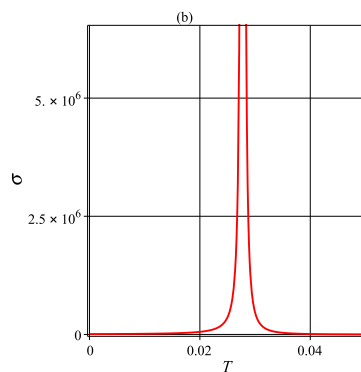


Figure 1: Typical behavior of electrical conductivity.

5 Cosmology

Holographic models of dark energy are of interesting models in cosmology [9].

6 Astronomy and Astrophysics

Study of neutron stars equation of state is one of the important applications of holography [10].

7 Conclusion

Holographic principles are powerful tools to study several areas of modern physics.

Authors' Contributions

All authors have the same contribution.

Data Availability

The manuscript has no associated data or the data will not be deposited.

Conflicts of Interest

The authors declare that there is no conflict of interest.

Ethical Considerations

The authors have diligently addressed ethical concerns, such as informed consent, plagiarism, data fabrication, misconduct, falsification, double publication, redundancy, submission, and other related matters.

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