

2010 : February 2010 - Fast Breaking Papers : Mokhtar Hassaine on AdS/CFT Correspondence

fast breaking papers - 2010

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Mokhtar Hassaine talks with *ScienceWatch.com* and answers a few questions about this month's Fast Breaking Paper Paper in the field of Physics.



Article Title: The geometry of Schrodinger symmetry in non-relativistic CFT

Authors: Duval, C; **Hassaine, M**; Horvathy, PA

Journal: ANN PHYS N Y, Volume: 324, Issue: 5, Page: 1158-1167, Year: MAY 2009

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SW: Why do you think your paper is highly cited? Does it describe a new discovery, methodology, or synthesis of knowledge?

During the past two years, several promising attempts to extend the anti-de-Sitter space/conformal field theory (AdS/CFT) correspondence to conformal non-relativistic physics have attracted much attention.

This is motivated by the fact that several non-relativistic conformal field models that govern physics exist in different experimentally accessible areas, such as condensed matter physics, atomic physics, or nuclear physics.

I would say that our paper presents another point of view, based entirely on geometric considerations.

SW: Would you summarize the significance of your paper in layman's terms?

In this AdS/CFT correspondence, one of the main ingredients is that the isometries of the AdS act on the boundary like the conformal group. The extension of this correspondence in the non-relativistic case forces us to find the equivalent of the AdS metric, and that was done by Dam Thanh Son of the Institute for Nuclear Theory at the University of Washington in his article: "Toward an AdS/cold atoms correspondence: A geometric realization of the Schrödinger symmetry," *Phys. Rev. D* 78: 046003, 2008, and also by Koushik Balasubramanian and John McGreevy of the MIT Center for Theoretical Physics in their article: "Gravity Duals for

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Nonrelativistic Conformal Field Theories," *Phys. Rev. Lett.* 101: 061601, 2008.

In our paper, we proposed a geometric approach to explain and derive the corresponding metric using previous ideas put forward by one of us—Christian Duval.

"At some time in the future, it will be of interest to investigate the condensed matter interpretation of these black-hole backgrounds."

SW: How did you become involved in this research, and were there any problems along the way?

We (Christian Duval, Mokhtar Hassaine, and Peter A. Horváthy) were involved in work on non-relativistic symmetries over a long period of time, starting with "Bargmann Structures And Newton-Cartan Theory," by C. Duval, G. Burdet, H.P. Kunzle, M. Perrin, *Phys. Rev. D* 31:1841,1985 and "Celestial mechanics, conformal structures and gravitational waves," by C. Duval, Gary W. Gibbons, and P. Horváthy, *Phys. Rev. D* 43:3907-22,1991.

SW: Where do you see your research leading in the future?

There have been new extensions of this non-relativistic version of the AdS/CFT correspondence for which the Schrödinger group has been replaced by the Lifshitz group. This new version is more appropriate in the context of standard holography.

There have been some interesting results in this set-up, with the discovery of various black hole configurations—see: E. Ayón-Beato, A. Garbarz, G. Giribet and M. Hassaine, "Lifshitz black hole in three dimensions," *Phys. Rev. D* 80: 104029, 2009. At some time in the future, it will be of interest to investigate the condensed matter interpretation of these black-hole backgrounds.

SW: Do you foresee any social or political implications for your research?

We do not have any such intentions. We do research in theoretical physics, and that's all.

Mokhtar Hassaine, Ph.D.

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KEYWORDS: KINEMATICAL INVARIANCE GROUP; MASSIVE GAUGE-THEORIES; CHERN-SIMONS; CONFORMAL SYMMETRY; FLUID-DYNAMICS; LUMINOUS ETHER; WAVES; QUANTIZATION; MECHANICS; ELECTRONS.



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