Advances in High Energy Physics

Special Issue on
Planck-Scale Deformations of Relativistic Symmetries

CALL FOR PAPERS

After more than 80 years of study, the problem of formulating a quantum theory of gravity, unifying Einstein's theory of general relativity with quantum theory, remains unsolved. This is clearly due primarily to the complexity of the problem, but we might have been stalled also by some unrecognized, yet incorrect assumptions. Over the last 15 years, there was particular interest in the quantum-gravity literature in the possibility that quantum-gravity effects might have significant implications for relativistic symmetries, contrary to what had been most frequently assumed. The first wave of such studies involved quantum-gravity effects that would "break" relativistic symmetries (preferred frame) but it was then realized that it is also possible to more smoothly "deform" relativistic symmetries (novel relativistic laws but still without a preferred frame). The study of the possibility of deformed relativistic symmetries has already produced intriguing results technically and conceptually and also in phenomenology, but several grey areas remain in our understanding of the relevant models.

This special issue focuses on quantum-gravity-induced deformations of relativistic symmetries, with a rather broad perspective. Indeed, improvements in this research area are needed from different directions. Surely important would be a deeper understanding of the formalism usable for the description of deformed relativistic symmetries, such as the formalism of Hopf algebras and of theories with curved momentum spaces ("relative-locality framework"). It would also be valuable to establish more rigorously whether and how deformed relativistic symmetries may arise in quantum-gravity theories which were not originally intended to produce such deformations, such as Loop Quantum Gravity, Group Field Theory, theories with Space-Time Noncommutativity, Causal Dynamical Triangulations, and Causal sets. Also, studies that mainly focus on the possibility of broken relativistic symmetries, but providing some comparison with the deformed-relativistic-symmetry scenario, would be valuable. Improvements of the phenomenology of deformed relativistic symmetries would evidently be important, and for this too, by contrast, progress in the phenomenology of broken relativistic symmetries could be valuable.

Potential topics include but are not limited to the following:

- Hopf-algebra relativistic symmetries
- Theories with modified dispersion relations
- Relative locality and theories with curved momentum spaces
- Spacetime noncommutativity
- Thermodynamics with deformed relativistic symmetries
- Theories with minimal length
- Horava-Lifshitz gravity
- String-theory models with implications for relativistic symmetries
- Theory and phenomenology of the rainbow-gravity scenario
- Phenomenological consequences of deformed relativistic symmetries
- Phenomenological consequences of broken relativistic symmetries

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Manuscript Due
Friday, 12 May 2017

First Round of Reviews
Friday, 4 August 2017

Publication Date
Friday, 29 September 2017