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Editorial / Éditorial

The present issue of the *C. R. Physique* is an exception.

For more than 10 years, most of our issues have been thematic ones, essentially devoted to particularly hot and important topics. Articles are all invited contributions, in which the leading experts in the field present their points of view. These thematic issues are extremely useful and appreciated. However, although we try to make them attractive for a broad audience, they are mainly directed toward specialists, even though those specialists are not the same for one issue as they are for another.

The present issue is not a special one. It contains articles on several, quite different, subjects: quantum gravity, nuclear technology, various aspects of solid-state physics, turbulence. Four of these articles were invited; two of them have been spontaneously submitted by their authors.

According to our rules, we only examine manuscripts that are recommended by a member of the French Academy of Sciences. This does not mean, of course, that we systematically reject any manuscript submitted without such a recommendation. All manuscripts are read by a member of the editorial committee who decides whether there is chance that such a recommendation will be obtained. We would like to receive more submissions of good manuscripts. One such article, by Hamed Marzougui, appears in the present issue. It is devoted to turbulence in magnetohydrodynamics. The other "spontaneous" article is written by three members of the French Academy of Science and deals with nuclear safety.

The other four articles are invited ones, whose authors have received awards from the French Academy of Sciences. Is it not unfortunate that frequently it is known that Dr. X or Prof. Y has been rewarded with some prize, while nobody knows what his contribution was?

Henri Alloul's paper presents his view on cuprates, these astonishing oxides that become superconductors at quite high temperatures, although there is no agreement about the cause of their superconductivity. More precisely, Alloul talks about the pseudogap, making the interest of this concept clear for non-experts.

Élisabeth Bouchaud's contribution is devoted to brittleness of glasses. Let me say a few words on the first reference of her bibliography, an article published by A.A. Griffith in 1921. An article that probably should be quoted in elasticity textbooks and that is generally not. Actually Griffith explained why, in many materials, elasticity breaks down for much lower tensile stresses than one might expect, and it breaks down because the material... breaks![1] Elisabeth Bouchaud's investigation is mainly based on the penetration of water in cracks. A method that, of course, requires a very slow propagation of the crack, much slower than when we drop a glass.

Pierre Vanhove's article gives a pedagogical introduction to quantum gravity and how to deal with it within supersymmetry and string theory. He discusses various consequences, especially regarding corrections to the gravitational force and black holes.

Finally Sylvia Serfaty presents the research of a mathematician on a physical problem: Abrikosov's vortices in second kind superconductors. Most of physicists will say that this problem has been solved a long time ago. However, we are glad to publish this article which, hopefully, will contribute to the improvement of relationships between mathematicians and physicists. Physicists need the help of mathematicians, for instance they wish to have students with an appropriate mathematical education. Let me give an example: since many decades, physicists have been calculating perturbation expansions that work well when limited to the first order, sometimes better at the second order, worse at the third order, and would be catastrophic at a higher order. This would be more understandable if students were aware of Émile Borel's work on diverging series.[2] A more recent example is the idea of taking the limit $n = 0$ of an integer n. The most spectacular case is Parisi's replica symmetry breaking method. Physicists have tested the method, found that the results seemed to be correct, speculated that the method was therefore probably correct, found other methods that gave the same results... until finally a mathematician was able to justify the method, though not in all cases.[3] A difficulty in the relation between physicists and mathematicians lies in the language. In her contribution, Sylvia Serfaty presents her research in a vocabulary accessible

[1] Y. Quéré, Physique des matériaux, Ellipses, Paris, 1957.
[2] E. Borel (1901) Leçons sur les séries divergentes, https://archive.org/details/leonssurlessrie01boregoog.
[3] See for instance, M. Talagrand, Annals of Mathematics 163 (2006) 221–263, http://annals.math.princeton.edu/2006/163-1/p04.

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to physicists, but this vocabulary is not the one a physicist would use! In particular, she speaks of “phase transitions” in the case of a finite system at non-vanishing temperatures, where the partition function has no singularity. What she has in mind is indeed the minimum of free energy, which can correspond to a single vortex or two or three vortices, etc., and the obtained bifurcations are perhaps the most interesting result in her paper. By publishing the work of a mathematician in a physical journal, we hope to facilitate a dialogue that will orient the research of the formers toward fields in which their help is most required.

On the front cover of this issue, Élie Cartan’s portrait recalls how fruitful this dialogue can be. He invented spinors (with a different name) in 1913, nine years before the experimental discovery of spin by Stern and Gerlach, and fifteen years before Dirac derived his equation.

Jacques Villain
Editorial Committee Coordinator

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