

# Special Session “Information in Natural Sciences”<sup>†</sup>

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<sup>†</sup> Presented at the Conference on Theoretical and Foundational Problems in Information Studies, IS4SI Summit 2021, Online, 12–19 September 2021.

**Abstract:** The Special Session “Information in Natural Sciences” of the conference “Theoretical and Foundational Problems in Information Studies” (TFP) at the 2021 IS4SI Summit focused on information in Natural Sciences. Seven authors contributed extended abstracts based on their results, which are introduced in brief in this overview article. The topics presented for TFP session 3 have spanned a rather wide range of contributions, including discussions on the concept of quantitative information applied in Natural Sciences (NS), the dynamics of physical information in NS, and information epistemology and knowledge on neuronal information processing, which help in understanding the effects of information in human cultural and political decision making.

**Keywords:** information; definition; paradigm; information discipline; probability; phenomenology; ontology of information

## 1. Overview of the Extended Abstracts Presented during the Special Session “Information in Natural Sciences” of the TFP Conference at the 2021 IS4SI Summit

In the extended abstract titled “About the nature of quantum information”, Olimpia Lombardi, Principal Researcher of CONICET and Professor at the University of Buenos Aires, supported the claim that there are no reasons to admit that quantum information is qualitatively different from classical information.

In the extended abstract “Informational restrictions in the formulation of physical laws by researchers”, Boris Menin proposed an application of information theory for randomizing qualitative and quantitative sets, allows a phenomenon under study to become calculable.

In “Obtaining information about nature with finite mathematics”, Felix Lev argued for the use of finite mathematics, which involves only a finite amount of numbers, instead of classical mathematics, where the implication of limits, infinitesimals, continuity, etc. generate notorious problems, when describing nature at the most fundamental level. In addition to the extended abstract, a video of the presentation can be found at [https://drive.google.com/drive/folders/1vYENmyT2\\_my7wGozYGh8Xg9S6fK0TNP4](https://drive.google.com/drive/folders/1vYENmyT2_my7wGozYGh8Xg9S6fK0TNP4) (accessed on 10 March 2022).

In “Nonlinearities and Interference - their importance for the study of information”, Annette Grathoff summed up the knowledge about linear interference and nonlinear mixing in wave dynamics gained in (radio-) engineering disciplines, which might be interesting and may help to better understand physical information dynamics.

In “Informational approaches lead to Formulations Of Quantum Mechanics On Poincaré Disks”, Arturo Tozzi from the Center for Nonlinear Science, Department of Physics, University of North Texas, argued that quantum mechanical dynamics not only can be modelled with but also really took place on non-Euclidean hyperbolic manifolds, with the observables portrayed in terms of a collection of tiles on a hyperbolic Poincaré disk.



**Citation:** Grathoff, A. Special Session “Information in Natural Sciences”.

*Proceedings* **2022**, *81*, 35.

<https://doi.org/10.3390/proceedings2022081035>

proceedings2022081035

Published: 14 March 2022

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Carlos Eduardo Maldonado from the School of Medicine, Universidad El Bosque, Bogotá argued that life sets up a mindset about the physics of immaterial things and proposed biosemiotics as a first-hand approach for such physics in “Five Arguments toward Understanding Life in the Light of a Physics of the Immaterial”.

In his extended abstract “The indeterminacy of scientific theories and the end of deterministic ideas”, Gerhard Luhn together with Gerald Hüther (both from the Academy for the development of human potential, Göttingen) observed that the modern deterministic worldview increasingly undermines the ability of people to feel touched by new information and discussed this in view of the findings from neurological research that suggests that living beings succeed in loosening their internal barriers through “touch” and “things that get under our skin” and can therefore overcome traditional patterns.

The following list is the extended abstracts presented during Session 3 of the TFP conference at the 2021 IS4SI Summit, in the order they were introduced above:

“About the nature of quantum information.”

Lombardi, O.

“Informational restrictions in the formulation of physical laws by researchers.”

Menin, B.

“Obtaining information about nature with finite mathematics.”

Lev, F.

“Nonlinearities and Interference—their importance for the study of information.”

Grathoff, A.

“Informational approaches lead to Formulations Of Quantum Mechanics On Poincaré Disks.”

Tozzi, A.

“Five Arguments toward Understanding Life in the Light of a Physics of the Immaterial.”

Maldonado, C.E.

“The indeterminacy of scientific theories and the end of deterministic ideas.”

Luhn, G., Hüther, G.

The very fruitful and scientifically rewarding discussions in the groups of the Special Session “Information in Natural Sciences” were instructive regarding information dynamics in human communication. Since these discussions were related to the study of information, all participating scholars found the observation from one particular discussion to be very interesting, and thus, we share it here. Many words lose their neutral character in a given context and (sometimes unintentionally—as happened here—and sometimes with purpose) clearly show the perspective from which a speaker views the topic. In more polarizing topics, with hardening positions, the sole use of a word (such as occupation), which manifests a subjective position inside a sensitive context (such as territory), has the power to immediately, almost instantaneously, change an objective scientific discussion into an emotional dispute where incompatible positions need to be defined and separated first. Interestingly, to continue the objective original discussion, here opposite opinions incompatible in the context of the original discussion needed to be agreed upon. Only afterwards could the fruitful exchange go on for a long time.

## 2. Conclusions

In this overview, we outlined the abstract (theoretical) models presented at the Special Session “Information in Natural Sciences” of the conference “Theoretical and Foundational Problems in Information Studies” (TFP) and published in the Proceedings of the IS4SI Summit 2021.

From our point of view, Information Science (IS) is a very large collection of models concerning information phenomena. It is very important to model IS itself, i.e., to create appropriate models that give a comprehensive representation of interrelations between these models.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The author declares no conflict of interest.