

Is there a Proteus of Nature?

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The PROTEUS project ran from September 2018 to February 2024 and produced several outputs in the form of publications (more than 35 contributions, including three monographs), seminar series and conferences. Our YouTube channel hosts videos of our events and obtained more than 31 589 views.

The characterising trait of the project lies in its capacity to deal with fundamental puzzles and conceptual difficulties surrounding cosmology and its history thanks to a multidisciplinary research team that included philosophers, historians of philosophy and physicists. By employing novel methodologies and enhancing conceptual innovation in the field of philosophy, PROTEUS aimed at inspiring theoretical physicists working at the intersection of relativity and quantum theory.

Publications and events

The research team organised several important events, such as the first History and Philosophy of Cosmology Conference in Milan (September 2022) and Perspectives on Time and Atemporality in Cosmology and Natural Sciences (July 2023) that will result in the publication of a monographic volume entitled *Time and Timelessness in Fundamental Physics and Cosmology* (Springer). Of particular

relevance for Kant studies is the event organised by members of the research team at Villa Vigoni (13–15 November 2023) entitled *Analogie und Wissenschaft in Kants Kritik der Urteilskraft*, which will also produce a future publication.

Revolutionary AI search for philosophical texts

PROTEUS also generated a key exploitable result (KER); it created a

prototype of an AI-based search called Timaeus that can perform inter-textual and tensorial searches on philosophical texts collected in our digital archive “Timaeus and its legacy” (<https://www.timaeuslegacy.eu>) in both ancient and modern languages. The research team is actively collaborating with companies to commercialise a potentially revolutionary tool for the humanities, enhancing creative research and allowing extremely high precision of results and respect for ethical values.

Scientific contributions

PROTEUS reintroduced the significance of philosophy and its history in tackling fundamental tensions in Western thought when representing time in cosmology. In particular, the work of Plato and Kant emerged as a precious legacy to identify the limits of current philosophical debates surrounding the so-called ‘problem of time’ in physics. Indeed, the notion of time is polysemous, and one must clearly distinguish any reflection upon the flow of time (which does not strictly pertain to physics) from any operational definition of it, which in turn depends on the use of the mathematical model at hand and its purpose(s).

The investigation of the notion of time should not prevent us from elaborating further on the notion of atemporality or timelessness, especially on the ground of current proposals in physics regarding the emergence of spacetime. The project deeply investigated different senses of atemporality, including instantaneity, and has shown that the latter can be used to think of a-chronic transitions. It has also shown the necessity of temporal order in a wide range of physical models. Thus, there is no such thing as time in itself, nor timelessness in itself, but this does not mean that we cannot denote models of processes in fundamental physics and cosmology as temporal or atemporal. Indeed, we should interpret time and timelessness as modes of ordering rather than substances or fundamental constituents of reality. This move allows one to show that a taxonomy of ordering

can encompass both atemporal models and temporal ones without contradiction. This taxonomy of ordering is nothing other than a modern representation of what Kant once called “Proteus of Nature”; namely, it is a spirit governing the algorithm that nature follows. This, in turn, offers a fundamental hint: we have to cast our theories about what we think is a fundamental level of reality as being able to spell out both temporal and atemporal modes of mathematical ordering and computing. This mirrors the idea that the universe we live in shows both characteristics. In other words, the project suggests a departure from the Kantian solution, according to which time is a form of intuition and a formal intuition in its objective representation. Simultaneously, it rejects the platonic conception of time proposed in the *Timaeus* as something pertaining to the sensible world, as a projection of an eternal form put into motion.

The project’s results suggest that nature dictates physical interactions in our universe that respond to both temporal and atemporal ordering. Through mathematical language, we grasp the form of these interactions and their principles of action, which can embody temporal or atemporal modes, but we generally do so separately.

Future focus

The project’s next step is to enhance the legacy produced over the past five years by creating a large community of students in philosophy and physics who tackle these questions systematically. In this sense, the most valuable legacy of PROTEUS is the project COSMOS (<https://cosmosproject.unimi.it/en/>), which runs until 2026 and is fostering a large collaboration of philosophers, historians and cosmologists to be consolidated in the years to come by means of its network.



PROJECT NAME
PROTEUS – Paradoxes and Metaphors of Time in Early Universe(s)

PROJECT SUMMARY

PROTEUS studies the main strategies devised by Western philosophy in representing time in cosmology. It aims to modify current metaphysics and its relationship with cosmology in light of recent scientific debates in quantum gravity and quantum cosmology, thereby boosting new methods and research lines in the history and philosophy of cosmology. This objective has been achieved and gave rise to the COSMOS Network (<https://cosmosproject.unimi.it/en/network/>) and to the proposal of reinterpreting atemporality and the notion of ordering in philosophy.

PROJECT PARTNERS

The PROTEUS project is based at the Department of Philosophy of the University of Milan and at the Department of Philosophy of the Autonomous University of Barcelona (UAB). Its members collaborated with the Institute for High Energy Physics (IFAE). Other collaboration partners include groups from Rome (CNR/ILIESI and Sapienza) and Munich (LMU).

PROJECT LEAD PROFILE

Silvia De Bianchi is Associate Professor at the University of Milan. In 2018, she started the ERC Starting Grant PROTEUS. From 2021, the project’s co-beneficiary institution is the Universitat Autònoma de Barcelona, where the PI led the activity of seven research team members. The other three members actively worked in Milan and are still contributing to the dissemination of the project and the implementation of its KER (<https://timaeus-prototype.celi.it>). She is also the PI of the COSMOS project (2021–2026) based at the University of Milan.

PROJECT CONTACTS

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