

## Radboud Center for Natural Philosophy (RCNP)

Reinforcing long-standing ties and existing strengths at Radboud University, and acting in the spirit of our University in strengthening its central aim of philosophical reflection, the idea is to use the 2022 Spinoza Award to Klaas Landsman to create something unique in the world: a new interfaculty **Radboud Center for Natural Philosophy**. This center will combine elements of:

- **mathematical physics**, so far represented at the Department of Mathematics of the Institute for Mathematics, Astrophysics, and Particle Physics (IMAPP) at the Faculty of Science (FNWI);
- **philosophy of science**, currently practiced both at the Institute for Science in Society (ISiS) within FNWI and generally at the Faculty of Philosophy, Theology and Religious Studies (FFTR);
- **history of science**, now studied at the Center for the History of Philosophy and Science (CHPS) within the FFTR (whose strength has typically been in early modern and medieval science).

Not just in Nijmegen, but everywhere else these disciplines are scattered (if represented at all), although in the 17th century founders of modern science like Newton actively combined them, and also in the 20th scientists like Einstein and Bohr, and more recently the 2020 “black hole” Nobel Laureate Penrose, were natural philosophers in the same spirit. Groups in what is called the philosophy of physics exist in top places like Cambridge, Oxford, and Princeton (with all of which we have very strong ties), but they reside in philosophy faculties and have almost no link to mathematics or even mathematical physics, which in our view (and given the examples of e.g. Newton and Penrose) is crucial here. In particular, in the interest of both research and teaching we aim at the highest possible level of conceptual as well as mathematical precision and clarity.

The opportunity to create such a center at Radboud University arises because of the unique combination of:

- a strong foundations-oriented mathematical physics group at IMAPP founded by Klaas Landsman (which has recently expanded its scope beyond quantum theory so as to include general relativity, Einstein’s theory of space, time, and gravity which also predicts the existence of black holes and gravitational waves, strengthening its embedding in IMAPP);
- the excellent international reputation of the equally unique CHPS led by Christoph Lüthy and Carla Rita Palmerino;
- the recent appointment of Lakatos Award winner Henk de Regt as a professor of the philosophy of science in ISiS.

Furthermore, launching this initiative now has been triggered not just by the Spinoza prize but also by ongoing attempts (predating the Spinoza award) to set up various international collaborations in the direction of the envisaged RCNP, including:

- 1) a proposal for a John Templeton Foundation (JTF) grant to be submitted in 2023, in which Radboud University, Princeton University, Western University, and KU Leuven join forces;
- 2) an ERC Synergy proposal, also in 2023, which will include Radboud University, KU Leuven, the University of Copenhagen, and either LMU (München) or Bonn University.

In addition, RCNP will develop close ties with relevant groups in at least Cambridge, Oxford, LSE, Harvard (notably via their Black Hole Initiative), the University of Minnesota, the University of Pittsburgh, and UC Irvine. Nationally, we expect to bring together highly valuable but small and scattered groups in the history and philosophy of physics at UvA, UU, RUG, and EUR. Route 2 of the National Science Agenda (NWA) explicitly also includes foundations of physics in its research agenda and has already given rise to the Dutch Institute for Emergent Phenomena (DIEP; currently located at the UvA), co-founded by Landsman. This would be a natural partner for our RCNP.

It seems realistic to initially focus on the foundations of physics, studied in an interdisciplinary way combining mathematical, philosophical, and historical approaches. In particular, the closely related themes of causality (and determinism), randomness, and emergence will be studied in the context of the great frameworks of modern physics, viz. classical physics, quantum (field) theory, general relativity, and statistical mechanics. At a later stage, the scope of the center might be expanded to the other exact and natural sciences, as well as neuroscience. But at any stage, the impact of an improved understanding of the foundations of a particular field on its teaching (both at the secondary school and the university level) will be an important part of the mission of the center, including the development of courses as well as research on the effectiveness thereof (in collaboration with the group in beta-didactics at FNWI). Special resources will be set aside for this, but all researchers in the RCNP would be expected to actively consider this impact.

The precise structure and location of the RCNP remain to be established, but iHub seems a good model: appointments and “base camps” are made at existing institutes (in our case these are IMAPP, ISiS, and CHPS) but an attractive location should be found where members of the center spend one or two days per week (and leading members perhaps even spend all their time).

To get the new center going it would be important to attract some top scholars in the field via *tenured* positions; although we see universities like Cambridge, Oxford, Princeton, etc. as friends and collaborators, we do compete with them in hiring people and simply have to offer more. Top people would, of course, contribute top research and teaching, but would also bring in more funding. In addition, the continuity of the center and ensuing excellence of Radboud University in this area beyond its initial 5-year or 10-year period must be contemplated. These positions will in part be pre-financed in part from the Spinoza grant. In view of the three disciplines we wish to combine and the three institutional embeddings proposed here, these positions will be in:

- *Mathematical physics* at the Department of Mathematics in IMAPP (FNWI);
- *Philosophy of physics* at ISiS (FNWI);
- *History of physics* at the Center for the History of Philosophy and Science (FFTR).

The levels of the positions are initially supposed to be UD1, but the one at IMAPP is eventually meant as a “roof tile” (dakpan) for Landsman (retiring at the end of 2029), whereas the one at ISiS will be a dakpan for Henk de Regt (retiring at the end of 2026). The position at FFTR is similarly meant towards growth to UHD and eventually HL (no dakpan has been mentioned in this connection, but it may arise). Their relevant counterparts would be Klaas Landsman (IMAPP), Henk de Regt (ISiS), and Christoph Lüthy & Carla Rita Palmerino (CHPS), respectively.

Landsman’s 2.5 M Spinoza prize will pre-finance each of these positions for 50% for 5 years. Apart from the Spinoza grant itself, funding for PhD and postdoc positions will come from the applications to JTF and ERC already mentioned; from NWO, including NWA (particularly from its Route 2); and here the three new UD’s at the envisaged RCNP will play a crucial role, as will Landsman himself, especially in connection with JTF and ERC applications. For example, a realistic JTF grant to Nijmegen would contribute 1M USD to the center, an ERC Synergy grant would allocate 2.5 M (if awarded), et cetera. New hires are expected to apply for ERC, NWO, and NWA grants, et cetera. But one would like, and expect about 10 people to be active in the center at any time, ranging from (new) PhD students to (new) UD’s to (existing) full professors, within a few years.

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Klaas Landsman