Friday 12 – Saturday 13 September 2025
Room C5 (Sala Lauree), Palazzo Albani,
Via Timoteo Viti 10, Urbino

Conference
"**Analogue black holes between physics and philosophy**"

The conference will also be accessible online via Zoom:
https://uniurb-it.zoom.us/j/82844885222?pwd=pn3213YKCea7A5bmv5I1WCFOtbk2H3.1

Abstract.
This conference brings together some of the leading physicists and philosophers working on the study of analogue black holes. Participants will discuss the theoretical foundations, experimental realizations, and philosophical implications of these systems, exploring how analogue models may, or may not, illuminate our understanding of black hole phenomena, including event horizons and Hawking radiation. The event aims to foster dialogue across disciplinary boundaries, highlighting the interplay between physical theory, laboratory experiments, and conceptual analysis.

FRIDAY, 12 SEPTEMBER

2:30 pm - 2:45 pm: Welcome by Andrea Viceré (Director, Department of Pure and Applied Sciences), Vincenzo Fano (President, The Italian Society for Logic and the Philosophy of Sciences), and Giovanni Valente (Polytechnic University of Milan)

2:45 pm - 3:45 pm: Jeff Steinhauer (Israel Institute of Technology): *Spontaneous Hawking Radiation in a Sonic Black Hole*

Abstract.
Stephen Hawking predicted that black holes should radiate, but observation of this Hawking radiation from a real astrophysical black hole seems unlikely, since the predicted temperature of the radiation is extremely low. Bill Unruh asserted that Hawking radiation might be observable in a sonic black hole, in which sound plays the role of light. We make such an observation in a sonic black hole formed from a Bose-Einstein condensate. We confirm that the Hawking radiation is spontaneous, thermal, and stationary. Furthermore, we follow the time evolution of the Hawking radiation, and compare and contrast it with the predictions for real black holes. We observe the ramp up of the Hawking radiation, similar to a real black hole. The spontaneous Hawking radiation ends, and stimulated Hawking radiation begins, when the sonic black hole forms an inner horizon in addition to the event horizon.

3:50 pm - 4:50 pm: Lina Jansson (University of Nottingham) and Silke Weinfurtner (online)(University of Nottingham): *Analogue Simulators: Loveliness as an Enabler of Likeliness*

Abstract.
We will argue that analogue simulations allow us to develop explanatory understanding of a particular kind that is not readily available to us by other means. While explanatory understanding is typically considered one goal of scientific theorising, it is generally treated as distinct from the goal of scientific testing by

empirical evidence. And for good reasons. It remains challenging to reconcile allowing explanatory considerations to carry confirmatory power with prevalent models of confirmation (such as Bayesian ones) without making explanatory considerations merely epiphenomenal to confirmatory success (or failure). We will suggest a way that explanatory considerations per se can enable (but not directly provide) confirmation and that this addresses some shortcomings with existing Bayesian analyses of analogue confirmation. This conceptual foundation can be applied to outline what would be required to leverage the explanatory advantage of analogue simulations into improved empirical access to the behaviour of otherwise largely inaccessible systems such as the early universe or black holes.

4:50 pm - 5:20 pm: Coffee break

5:20 pm - 6:20 pm: Karen Crowther (University of Oslo): *Dumb Holes: Universality or Analogy?*

Abstract.
Analogue experiments have been promoted as means of potentially confirming theoretical predictions about systems that are inaccessible under the relevant conditions. A focus has been on the example of potential confirmation of Hawking radiation in black holes via analogue `dumb hole' experiments in fluids. Dardashti et al. (2017, 2019) present arguments in support of this possibility, while Crowther et al. (2019) is critical that these arguments suffice. The latter analysis utilises the characterisation of analogue experiments given by the former two papers, upon which analogue experiments are supposed to differ from both conventional experiments as well as analogies. The defining feature was taken, by Crowther et al. (2019), to be the inaccessibility of the target system. This, however, not only rules out the possibility of such experiments being confirmatory, but also conflicts with the common belief that conventional scientific experiments can aim to provide knowledge about inaccessible target systems. So, if not inaccessibility of their target systems, what defines an analogue experiment? Here, I argue that there is nothing special about analogue experiments: Either, they are conventional experiments, or they are material analogies. Nevertheless, there remain particular challenges for the case of confirming Hawking radiation via dumb hole experiments, owing to inaccessibility issues.

8:00 pm: Conference Dinner

SATURDAY, 13 SEPTEMBER

9:00 am - 10:00 am: Stephan Hartmann (MCMP/LMU Munich): *Analogy-Based Reduction: A Non-Deductive Model of Intertheoretic Integration*

Abstract.
Classical models of reduction in the Nagelian tradition define reduction in terms of derivability. Yet many important intertheoretic relations in contemporary physics are non-deductive. This paper develops an alternative: *analogy-based reduction*. A relation counts as such when a *material analogy* transfers organising structure across domains, when the resulting model is *embedded* into a more fundamental framework by symmetry alignment, parameter calibration, and domain specification, and when it retains a degree of *explanatory autonomy*. Under these conditions, analogy-based reductions secure the same epistemic payoffs traditionally associated with reduction: cross-level consistency, mechanistic explanation, and confirmatory coherence. They are therefore not merely heuristic

but genuine reductions, complementing derivational and asymptotic accounts rather than replacing them. Case studies—including NJL--QCD,, Higgs--BCS, analogue gravity, and further examples—demonstrate the discriminating power of the model. In this sense, *reduction without deduction* is not only possible but indispensable to a complete account of intertheoretic integration.

10:05 am - 11:05 am: Vincenzo Fano (University of Urbino) and Marco Sanchioni (Sophia University Institute): *Phase Transitions in the Island Paradigm. A Case of Scientific Analogy*

Abstract.
The island transition in black hole physics has been widely compared to phase transitions in statistical systems. In this paper, we ask whether this constitutes a genuine scientific analogy. Drawing on five philosophical criteria for analogical reasoning, we examine the structural, explanatory, and epistemic dimensions of the comparison. We argue that the analogy is sufficiently robust to be scientifically meaningful, particularly in the absence of a complete theory of quantum gravity.

11:05 am - 11:35 am: Coffee break

11:35 am - 12:35 pm: Francesco Nappo (Polytechnic University of Milan)(j.w.w. Nicolò Cangiotti): *Falling in: Analogy or Universality?*

Abstract.
We consider two ways of justifying a broadly evidential role of black hole simulations in cosmology, respectively based on analogy and universality. We evaluate them along four dimensions along which they differ:

1- What types of physical arguments support the methodology?
2- What is the reason for the observed plurality of experimental approaches?
3- What is the highest level of confidence about Hawking radiation that the experimental practice can support?
4- What types of black hole simulations are worth pursuing in the future?

By examining each question in turn, this talk will argue that there are two distinct and mutually incompatible positions on the methodology of black hole simulations.

12:35 pm - 12:45 pm: Closing Remarks