

# ICFO Colloquium | Mind the gaps: The fraught road to quantum advantage

JENS EISERT

September 07, 2026
10:00 to 11:00
ICFO Auditorium

**PROFILE:**
Jens Eisert is a professor of quantum physics at the Freie Universitat Berlin and is affiliated with the Helmholtz Center Berlin. He develops new technological applications based on insights into quantum mechanics and tries to understand the complexity of complex quantum systems. It is characteristic for his work to make use of tools of theoretical physics and mathematics, but to apply them to pragmatically motivated problems. He is one of the most visible and prolific researchers in his field. On the basis of his work, he has been awarded two ERC grants, a EURYI award (the predecessor of the ERC StG), and a Google NISQ award.

**ABSTRACT:**
In recent years, quantum computing has made tremendous strides, bringing us to an exciting

juncture. However, this progress also presents new challenges, particularly when it comes to understanding the true potential and limitations of quantum computers. This talk will explore both the promise and the obstacles facing quantum computing today.

We will begin by examining the current limitations of quantum error mitigation, highlighting the challenges we face before achieving fully fault-tolerant quantum architectures. In relation to quantum error correction-presumably the fastest-growing field in quantum information theory today-we will argue that it is essential to set intermediate goals on the path toward building a fault-tolerant quantum computer, and to embrace notions of co-design-metaphorically speaking, to i¿½mind the gap.i¿½ We then turn to qua tum algorithms, examining the theoretical advantages of quantum computing in combinato ial optimization. While the potential is clear, a significant gap remains between these theoret cal results and their practical application to real-world problems. Finally, we argue that qua tum simulation is likely to be the field in which we first observe quantum advantages with tang ble utility. Despite these challenges, the talk will conclude on an optimistic note, emphasi ing the rapid pace of progress in the field and the exciting possibilities ahead.
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**Hosted by:** Antonio Acin