The **Vienna Center for Quantum Science and Technology** (**VCQ**)
invites you to a

# COLLOQUIUM TALK
by
## Gemma De las Cuevas
(*University of Innsbruck*)

## *From simplicity to universality and undecidability*

**Why is it so easy to generate complexity? I will suggest that this is due to the phenomenon of universality — essentially every non-trivial system is universal, and thus able to explore all complexity in its domain. We understand universality in spin models, automata and neural networks. I will present the first step toward rigorously linking the first two, where we cast classical spin Hamiltonians as formal languages and classify the latter in the Chomsky hierarchy. I will also talk about the other side of the coin of universality, namely undecidability, which comes from self-reference and negation as in "I am a liar". I will propose that there is undecidability everywhere, namely, that essentially every non-trivial question of a system is undecidable. I will also share some thoughts about the reach of universality and undecidability in other disciplines. Why is it so easy to generate complexity? I will suggest that this is due to the phenomenon of universality — essentially every non-trivial system is universal, and thus able to explore all complexity in its domain. We understand universality in spin models, automata and neural networks. I will present the first step toward rigorously linking the first two, where we cast classical spin Hamiltonians as formal languages and classify the latter in the Chomsky hierarchy. I will also talk about the other side of the coin of universality, namely undecidability, which comes from self-reference and negation as in "I am a liar". I will propose that there is undecidability everywhere, namely, that essentially every non-trivial question of a system is undecidable. I will also share some thoughts about the reach of universality and undecidability in other disciplines.**

**Monday, 22nd November 2021,**
**16:45 get-together with coffee and snacks!**

Main Lecture Hall at TU Wien, Atominstitut, Stadionallee 2, 1020 Vienna

**Host: Markus Müller**

for further information and the zoom-link please visit vcq.quantum.at/colloquium-ws21-22