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**ICFO**  
The Institute  
of Photonic  
Sciences



## **Master in Photonics – “PHOTONICS BCN” Master ERASMUS+ “EuroPhotonics”**

### **MASTER THESIS PROPOSAL**

**Dates: April 2020 - September 2021**

**Laboratory: Quantum Optic Theory**  
**Institution: ICFO – Institute of Photonic Sciences**  
**City, Country: Castelldefels, Spain**

**Title of the master thesis: Machine leaning in the quantum era**

**Name of the master thesis supervisor and co-supervisor:  
Maciej Lewenstein**

(for external proposals a co-supervisor from the program is needed)

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**Keywords: machine learning, quantum machine learning, neural networks, quantum neural networks, quantum many body systems**

**Summary of the subject (maximum 1 page):**

Machine learning (ML) today is one of the most important methods to treat big data and difficult computational/classification problems. The QOT group at ICFO has a very wide program of investigations of various kind of applications of classical machine learning: for recognition of quantum phases in quantum many body systems, for analysis of anomalous diffusion in classical systems, for interpretation of ML applications in quantum systems, for analysis of experimental data and so on. The group works also on quantum machine learning, with the focus on design of quantum neural networks and quantum machine learning devices, as well as general question concerning quantum advantage of quantum ML. Most of these problems deal with strongly correlated quantum or classical many body systems, and as such require the use of the most advanced methods of theoretical physics, and numerical simulations. Collaborations and bilateral guidance with experimental groups is necessary.

The MSc student will join one of the running research projects in the above areas, and contribute to a joint publication with the other members of the group. The student will be supervised by M. Lewenstein and one of the senior postdocs from the group.



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**Additional information (if needed):**

\* Required skills : **good preparation in methods of theoretical physics and numerical skills are welcome**

\* Miscellaneous :