

# INAF HPC SCHOOL - BASIC

Luca Tornatore, I.N.A.F.

## 2025 INAF Course on HPC - Basic Module



September, 22nd - 26th, OACT, Catania

# Welcome

## Welcome at the Basic Module of the HPC INAF School 2025 edition

hosted from 22nd to 26th of September by the  
Observatory of Catania.

# Welcome

Let's express our gratitude to the LOC

**Alessandro Costa**

**Fabio Vitello**

**Salvo Scavo**

that has co-organised the course, all the logistics and  
the set-up of the cluster PLEIADI @ OACT

# Welcome

Your teachers and instructors will be

**Luca Tornatore**

**David Goz**

**Giovanni Lacopo**

**Antonio Ragagnin**

**Giuliano Taffoni**

from OATS (Trieste)

# What you're gonna learn this week ?





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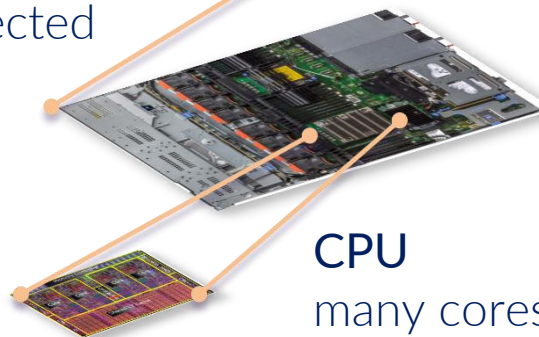
# HPC platform



~100  
interconnected  
racks



**RACK**  
~100 of  
interconnected  
nodes



**NODE**  
multiple CPUs (2-4)  
multiple GPUs (2-8)  
multiple FPGAs  
multiple Vector Acc.

**CPU**  
many cores





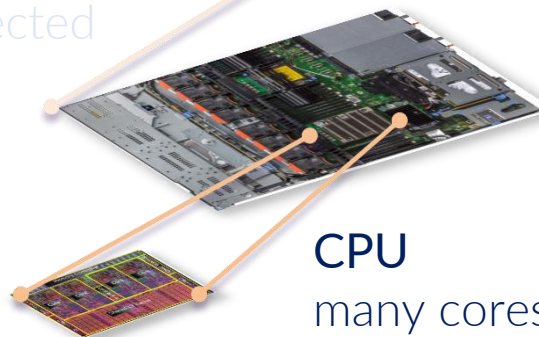
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# What you're gonna learn this week ?

The INAF school is (being) planned to be modular

## **BASIC HPC single node**

Modern Architecture  
Code Optimization  
Multi-threading  
Debugging  
Profiling

Introduction, fundamental  
concepts, toolbox to exploit  
a **single node**  
1 week

## **BASIC HPC multi node**

MPI  
Message Passing

toolbox to exploit  
**multiple nodes** in  
distributed memory  
3 days

## **Advanced HPC**

Advanced MPI  
Advanced OpenMP

more **sophisticated**  
**parallelism** and  
algorithms, scaling at  
thousands of nodes  
4 days

## **GPUs**

~3 days

## **Advanced profiling**

~3 days

# What you're gonna learn this week ?

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Modern Architecture  
Code Optimization  
Multi-threading  
Debugging  
Profiling

Introduction, fundamental  
concepts, toolbox to exploit  
a **single node**

## **BASIC HPC multi node**

**We are here**

toolbox to exploit  
**multiple nodes** in  
distributed memory

## **Advanced HPC**

Advanced MPI  
Advanced OpenMP

more sophisticated  
parallelism and  
algorithms, scaling at  
thousands of nodes

**GPUs**

**Advanced  
profiling**

# The plan of the week

	22/9 MONDAY	23/9 TUESDAY	24/9 WEDNESDAY	25/9 THURSDAY	26/9 FRIDAY
	<i>CPU architecture &amp; code optimization</i>	<i>Parallelism &amp; Intro to OpenMP</i>	<i>OpenMP</i>	<i>OpenMP / Profiling &amp; Debugging</i>	<i>Profiling &amp; Debugging</i>
09:00	Welcome Address		OpenMP	OpenMP	Debugging
09:30		Intro to parallel computing			
10:00	CPU Arch. & Optimization		exercises	exercises	exercises
10:30					
11:00	break	break	break	break	break
11:30			OpenMP		Conclusions
12:00	exercises	Intro to OpenMP		Profiling	exam
12:30			exercises		
13:00					
13:30	LUNCH BREAK	LUNCH BREAK	LUNCH BREAK	LUNCH BREAK	
14:00					
14:30					
15:00	CPU Arch. & Optimization	OpenMP	OpenMP	exercises	
15:30					
16:00	break	break	break	break	
16:30					
17:00				exercises	
17:30	exercises	exercises	exercises	Debugging	
18:00					
18:30				exercises	

# The (temporary) repo

[https://github.com/lucatornatore/INAF\\_HPC\\_School\\_2025](https://github.com/lucatornatore/INAF_HPC_School_2025)



# Before starting

If some of you has any issue in accessing the cluster  
**pleiadi.oact.inaf.it**

with the user name and ssh key, please at the coffee break  
ask either Fabio Vitello or Salvo Scavo.

Your user name is  
**hpcschool\$NN**

Find the association \$yourname<>**\$NN**  
in the file **Account\_list.pdf** on the git

[https://github.com/lucatornatore/INAF\\_HPC\\_School\\_2025](https://github.com/lucatornatore/INAF_HPC_School_2025)

that's all, have fun



“So long  
and thanks  
for all the fish”