Wigner Scientific Computing Laboratory

15th GPU Day

Massive Parallel Computing For Science And Industrial Application

HUN-REN
Hungarian Research Network

HUN
REN

wigner

lombiq

9999
WAY TO THE CLOUD

skyblocks

THE FUTURE OF MASSIVE PARALLEL AND QUANTUM COMPUTING

EMERGING ACCELERATOR PLATFORMS

IMAGE PROCESSING, COMPUTER VISION, AND RECONSTRUCTION

INDUSTRIAL APPLICATIONS

GRAPHICS, RENDERING, AND IMAGE SYNTHESIS

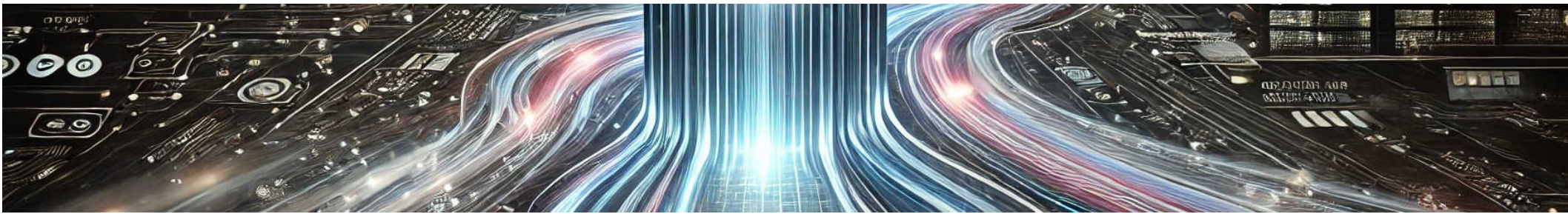
COMPUTING AND VISUALIZATION IN EDUCATION

QUANTUM COMPUTING SIMULATION

MACHINE LEARNING, NEURAL NETWORKS, FEATURE RECOGNITION

MANY-CORE COMPUTING IN PHYSICS AND OTHER FIELDS OF SCIENCE

One Lab – Many Project
Review of the WSCLAB



Gergely Gábor Barnaföldi
WSCLAB, HUN-REN Wigner Reseach Centre for Physics

MTA
Centre
of Excellence

ROLE>_

WSCLAB's origin

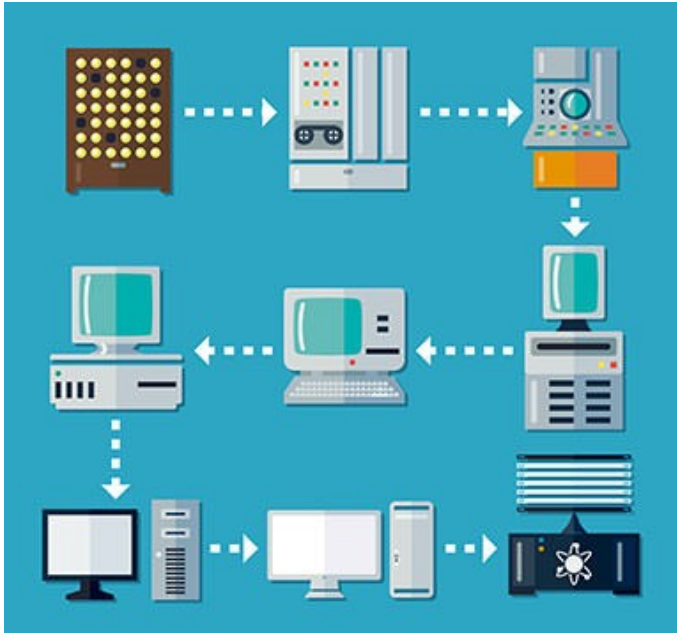
15 YEARS IN PARALLEL COMPUTING (WIGNER GPU LABORATORY) & HPC @ WDC

The aim of the Wigner GPU Laboratory is to provide support for any fields in science in sense of parallel computing techniques, especially for faster numerical calculations in gravitational and high-energy physics, astronomy, astrophysics, material sciences, and detector simulations. We have started with GPU technologies in 2009, but later our aim was improved to any kind of parallel computing technology. Today, many- and multi-core, GPU, FPGA, Xeon Phi technologies are all available in the laboratory. Beside the academic environment and other institutes, we have connections to industrial partners as well.



WSCLAB’s role

15 YEARS IN PARALLEL COMPUTING (WIGNER GPU LABORATORY) & HPC @ WDC



WSCLAB’s role

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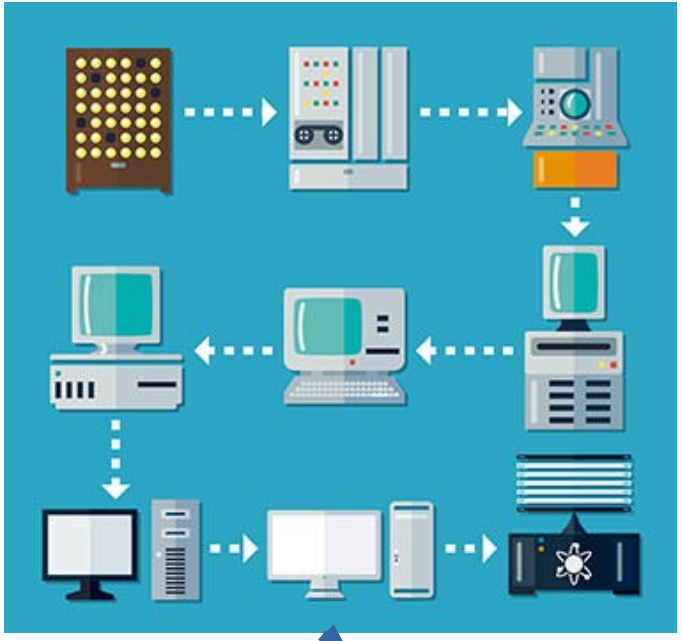

WSCLAB’s role

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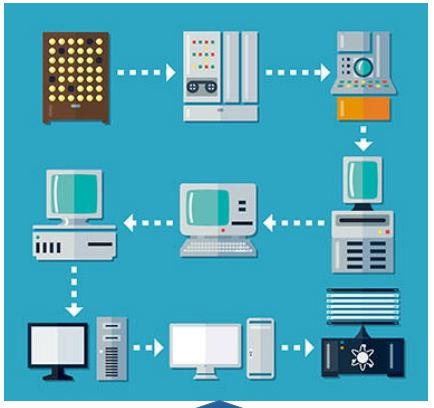


The History of WSCLAB's Wigner GPU Laboratory

- **2005-2008 Early years: idea of using GPU in HEP calculations**

  Starting of the WLCG Grid (ALICE & CMS) Tier-2 at the Wigner
- 2009 Discussion with GGB & P. Lévai & G. Debreczeni

  2 main direction: HEP & Gravity
- **2010- 1st GPU Day & formation of the Wigner GPU Laboratory**

  Students: M. F. Nagy-Egri & D. Berényi
- 2010- GPU Day series
- 2016- Lectures on Modern Computing in Science series
- 2016- Wigner GPU Lab Fellowship
- **2021- Wigner Scientific Computing Laboratory** (NKFIH TOP50 RI)

WSCLAB @ NKFIH TOP50 Research Infrastructure

START: 17TH DECEMBER 2021.

CERTIFICATE of RECOGNITION

This is to certify that

WIGNER Scientific Computing Laboratory (WSCLAB)

is recognized as an

EXCELLENT RESEARCH INFRASTRUCTURE in HUNGARY

in terms of its scientific performance and international collaboration.

Awarded by

the National Research, Development and Innovation Office Budapest, Hungary

on the 16th of December, 2021

Dr. István Szabó
Vice President for Science and International Affairs

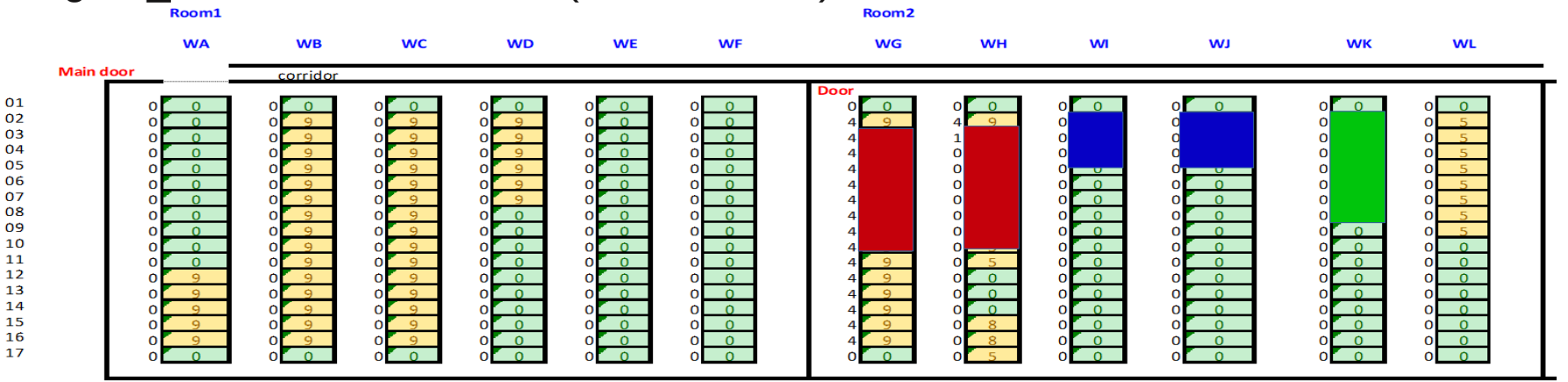
NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION OFFICE HUNGARY

HARDWARES>_

WSCLAB @ WDC

THE PLACE

- ✓ Wigner Analysis Facility (Wigner AF)
- ✓ Wigner GPU Laboratory
- ✓ Wigner_KFKI WLCG T2 Grid (ALICE+CMS)

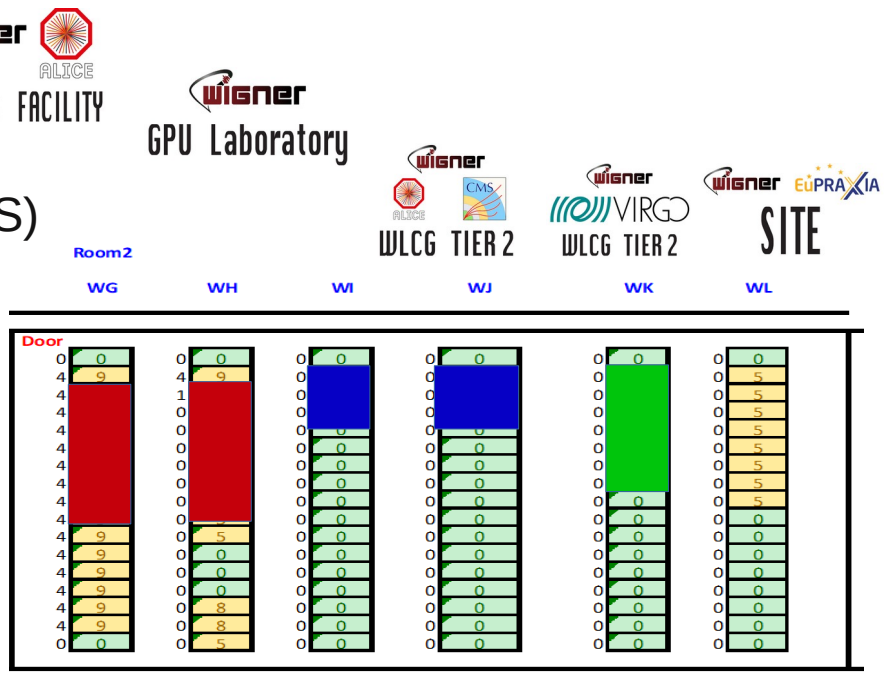


WSCLAB @ WDC

THE PLACE

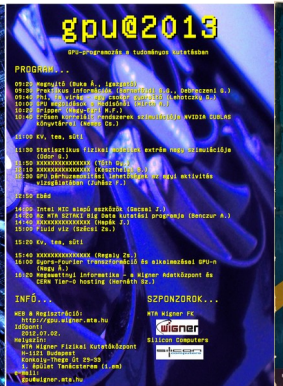
- ✓ Wigner Analysis Facility (Wigner AF)
- ✓ Wigner GPU Laboratory
- ✓ Wigner_KFKI WLCG T2 Grid (ALICE+CMS)
- ✓ New: LIGO/VIRGO
- ✓ New: EuPRAXIA

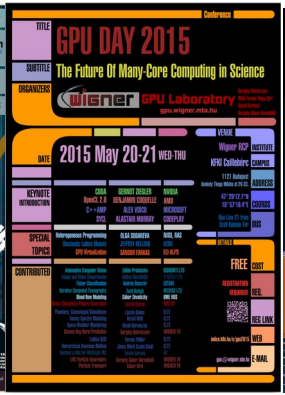
SERVING LARGE-SCALE EU & WORLDWIDE SCIENTIFIC COMMUNITIES

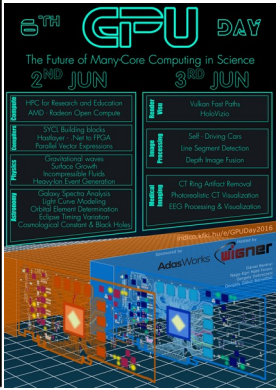


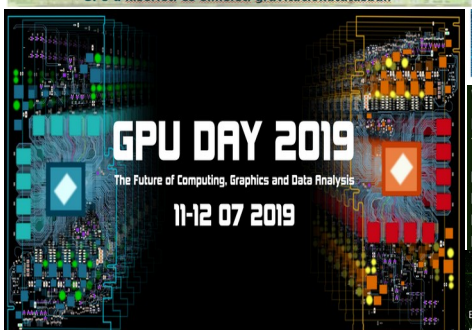
EVENTS>_

15 GPU Days so far...









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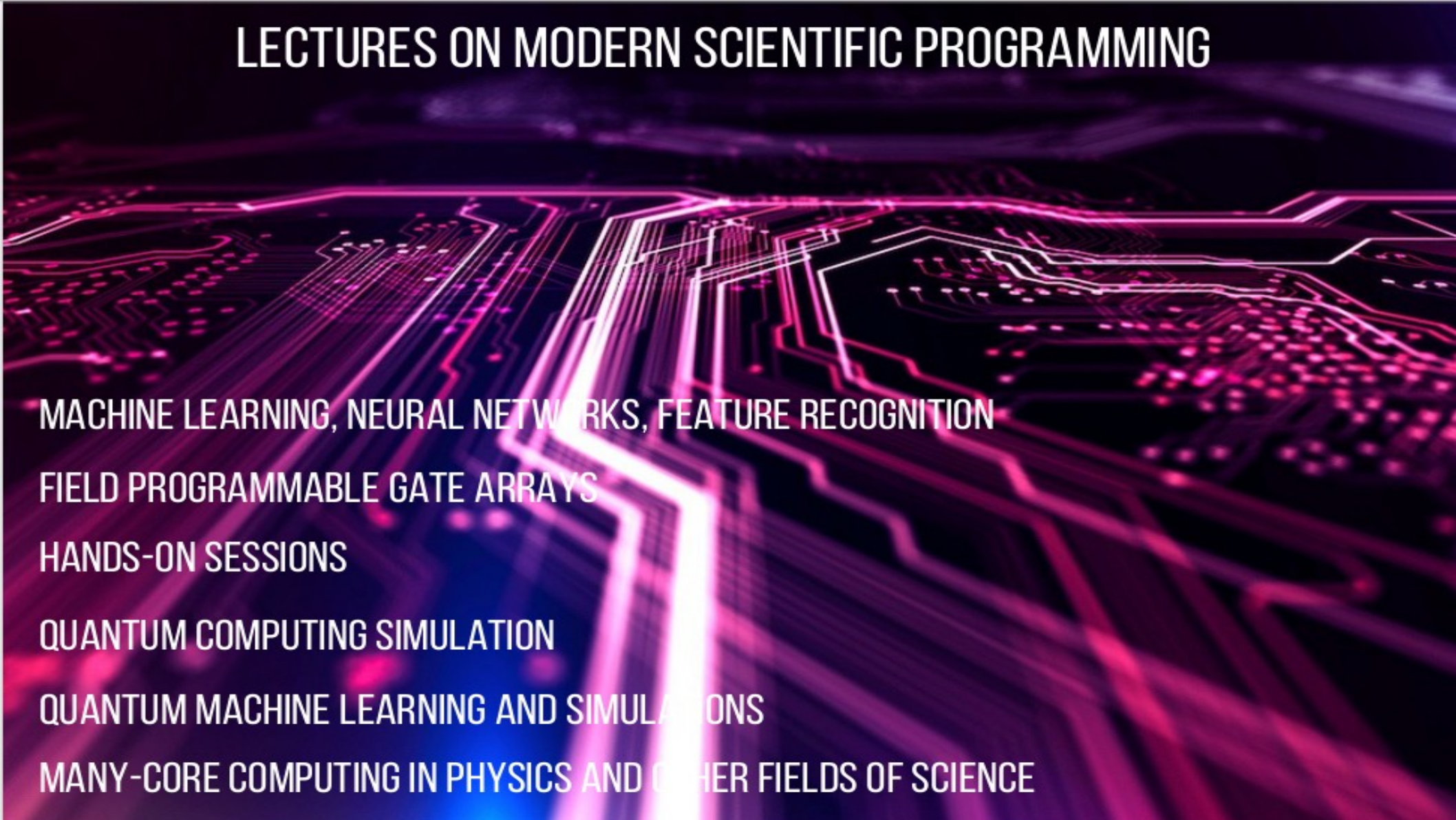
LECTURES ON MODERN SCIENTIFIC PROGRAMMING



MACHINE LEARNING, NEURAL NETWORKS, FEATURE RECOGNITION

FIELD PROGRAMMABLE GATE ARRAYS

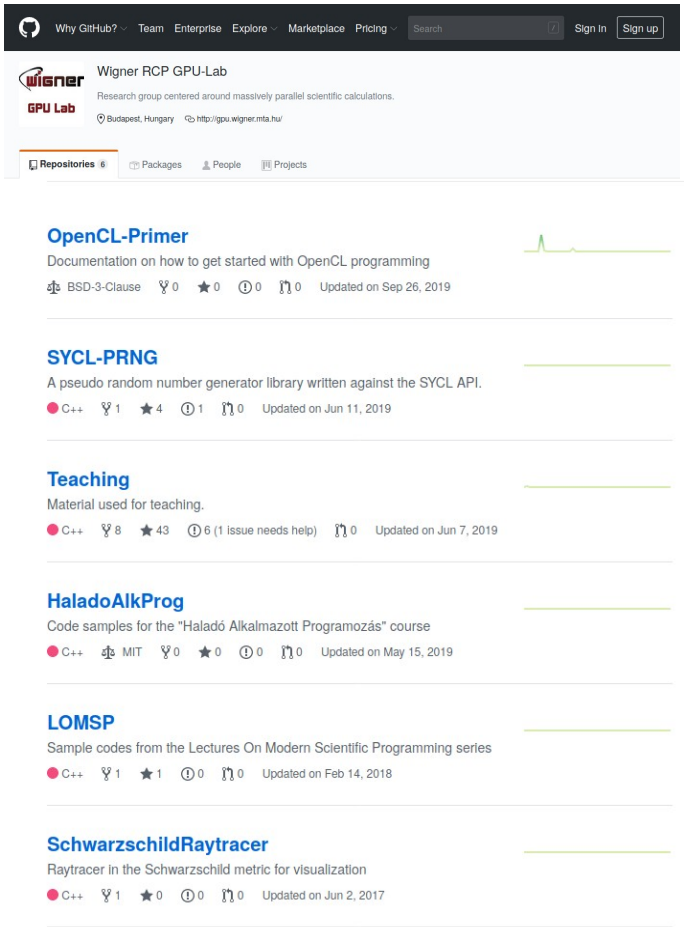
HANDS-ON SESSIONS

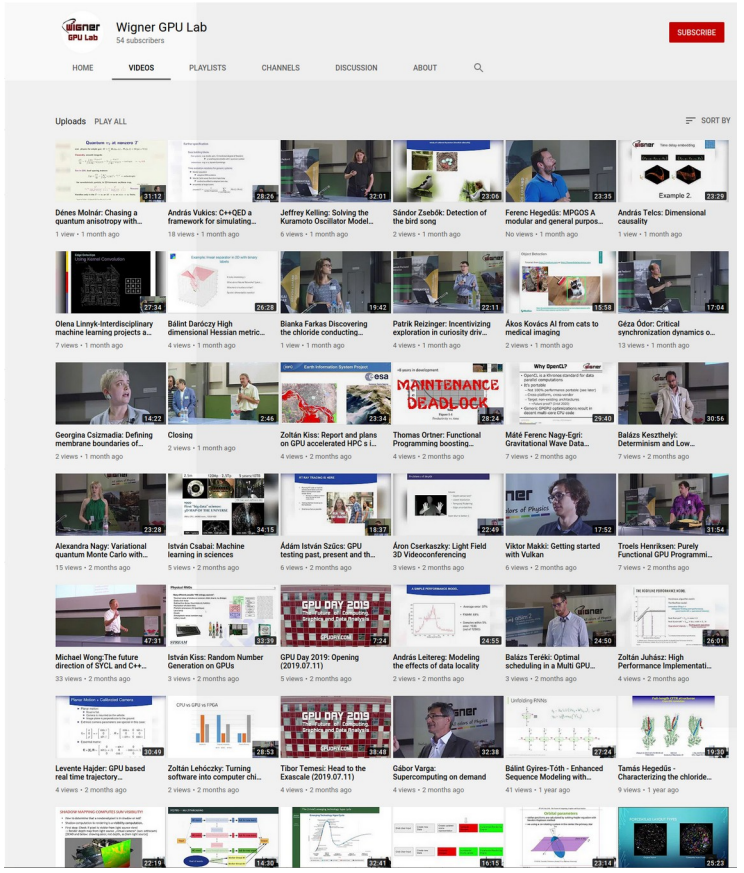
QUANTUM COMPUTING SIMULATION

QUANTUM MACHINE LEARNING AND SIMULATIONS

MANY-CORE COMPUTING IN PHYSICS AND OTHER FIELDS OF SCIENCE

WSCLAB's EDUCATIONAL MATTERS





YouTube HU

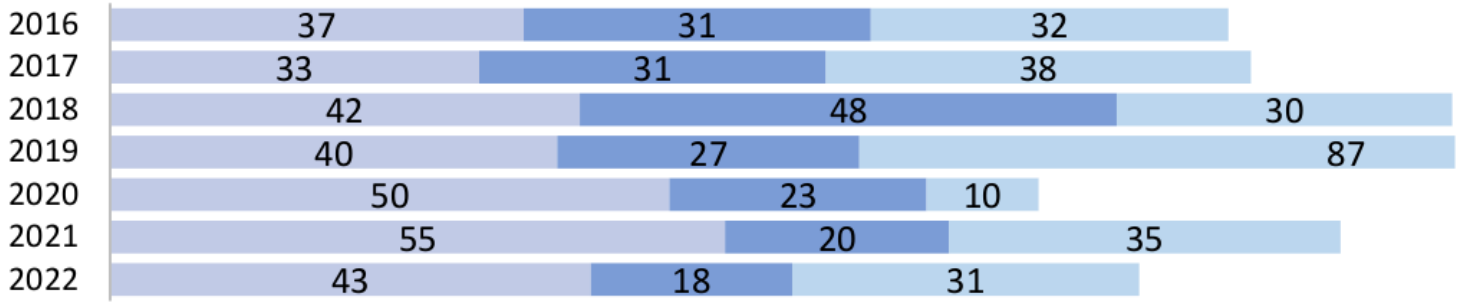
GitHub

PROJECTS>_

WSCLAB in numbers

KNOWLEDGE HUB: GPUDAY.COM

- ✓ 15 GPU Days



- ✓ 9 Lectures in Modern Computing in Science
- ✓ 65+ WSCLAB (Wigner GPU Lab) Fellowship
- ✓ 40+ industrial & academic partners (Lombiq LTD, Ericsson, 999999, Khronos, CERN…)
- ✓ 80+ scientific publications and program codes

WSCLAB in numbers

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- ✓ 15 GPU Days
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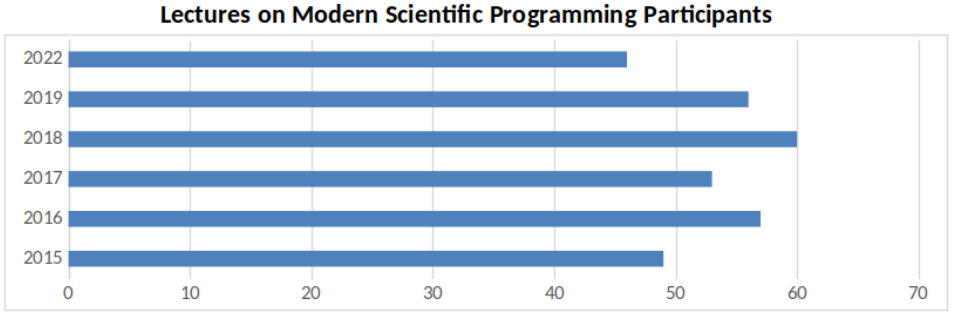

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WSCLAB's SCIENTIFIC RESULTS

BASED ON THE PROJECTS

✓ **Finished Projects from various fields**

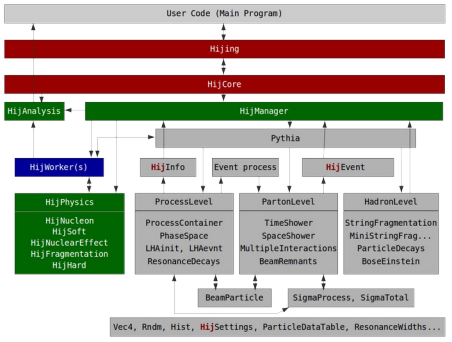
- Astronomy & Astrophysics (18)
- Physics (34)
- Biochemistry (7)
- Life & Medical Sciences, Etology/Ornitology (8)
- Computational Sciences, Imaging, Simulations (16)
- Quantum Computing (11)

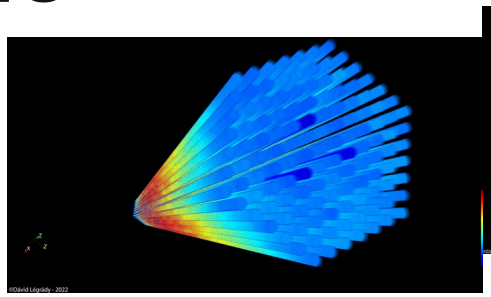
✓ **List of Publications**

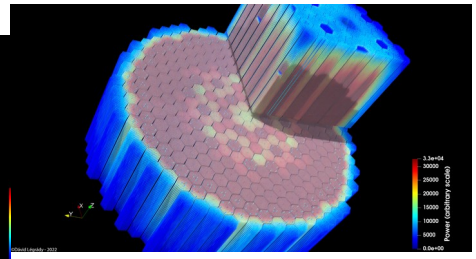
- More than 80 publications & public codes

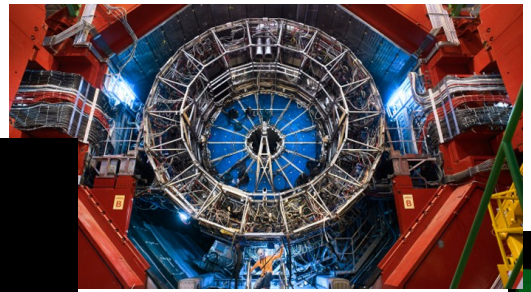
WSCLAB's SCIENTIFIC PROJECTS

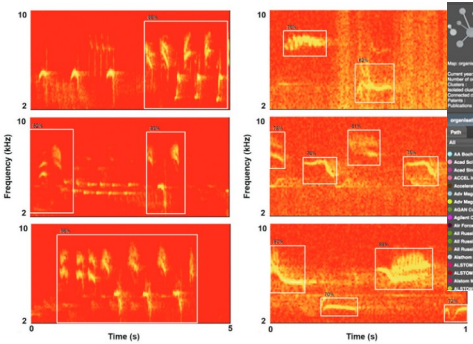
FEW SELECTED ONES

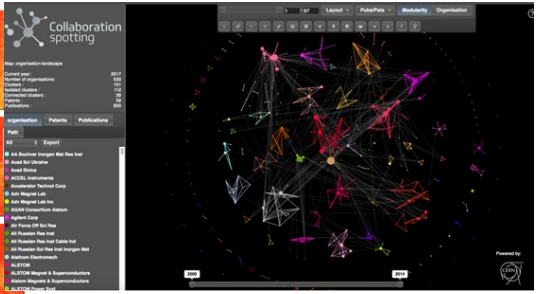


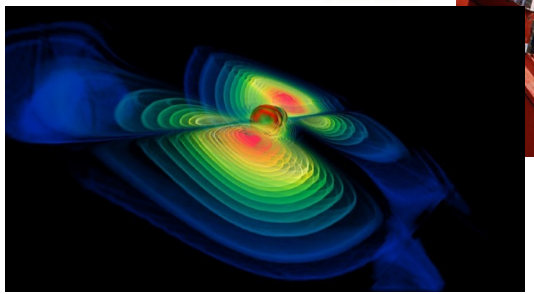


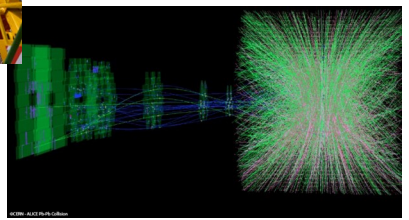


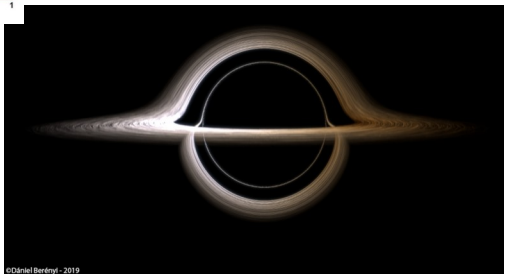












WSCLAB's SCIENTIFIC PROJECTS

FOR THE SOCIETY

FUTURE>_

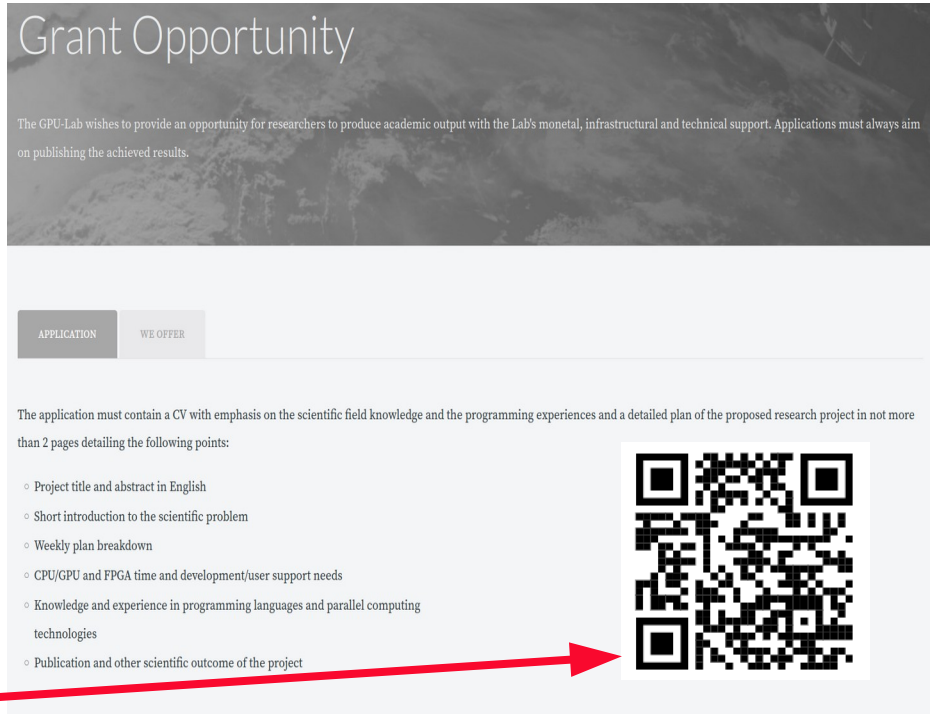
WSCLAB's FUTURE
IS IN YOUR HAND

✓ **What are the WSCLAB services**

- Knowledge hub for scientific computing solutions
- Dedicated GPU & FPGA server hosting & services
- Quantum Computing simulations
- Tutorial series & teaching
- Advising highly-parallel computing
- PhD/PostDoc projects

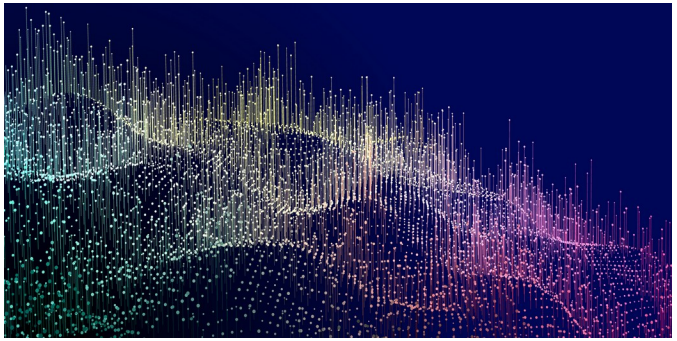
✓ **How to apply**

- Visit wsclab.wigner.hu



WSCLAB's FUTURE

PLANS FOR THE FUTURE



- ✓ **Short timescale**
  - New WSCLAB Grants for young scientists for 2024
  - GPU Day 2025 series (22-23 May 2024)
  - Lectures on Modern Computing in Science series (in fall 2025) on QML

- ✓ **Intermediate timescale**
  - Further local HW developments & cloud solutions

- ✓ **Long range plan**
  - Closely related to the EuroHPC LEVENTE project including Quantum Computing & Quantum simulations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codeplay
IFIN-HH
CERN
Cerntech
Collaboration spotting
CERN openlab
IN2P3
Institut National de Physique Nucléaire et de Physique des Particules
QNL
Quantum Information National Laboratory
HUNGARY
UNIVERSITY OF HELSINKI
KONKOLY
CAMK PAN
ALICE
epam
PURDUE
UNIVERSITY
ELKH
Eötvös Loránd Research Network
KIFÜ
l'Observatoire de Paris
KHRONOS GROUP
CONNECTING SOFTWARE TO SILICON
SZÉCHENYI 2020
ERICSSON
UNIVERSITY OF OXFORD
StatCog

WSCLAB>_

WIGNER SCIENTIFIC COMPUTING LABORATORY

HUN REN | Wigner

Excellent Research Infrastructure Hungary

THX>_

ONE MORE THING>_

ON THE VENUE BY
IS IN YOUR HAND

HUN-REN
Hungarian Research Network

- ✓ **Desigend by the Hungarian Dolphin, Alfred Hajós (1878-1955)**
  - First Hungarian olimpic games gold medal winner in 1896 Athen 100m and 1200m
  - Football player and captain
  - Great architect (ecletic & secession)

- ✓ **This building was built in 1911-1912 in premodern style.**