Information and Guidelines for the Final Project of the *Modern Computing for Physics* Exam

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General information

- The goal of the project is to implement and benchmark a computational task by developing a complete workflow: starting from a plain sequential CPU implementation up to a GPU-targeted version.
- The final project must be completed **individually**.
- The project code and/or other additional material must be submitted **at least 3 days before the exam date** via the course Moodle page.
- It is strongly encouraged to prepare a brief set of slides to facilitate the discussion on your results and performance analysis.

Project Guidelines

1. All projects must include the following features:
    - A sequential CPU-based implementation, required for understanding the logic of the task, identifying parallelization opportunities, and performing comparisons with GPU implementations.
    - A CPU parallel version, implemented using directives.
    - An accelerated version targeting GPU, using low-level constructs (CUDA). It is suggested to start with a plain/naive implementation before moving towards a more sophisticated one.
2. After completing the mandatory components of the task, as extras, it is possible to develop alternative directive-based GPU versions of the implementation, and/or use dedicated libraries.
3. Projects must include benchmark studies, including the comparison of the performance achieved with the different approaches, and the trend of the most important figures of merit as a function of the relevant dimensions of the task.
4. Projects can be developed and tested on any GPU (Jetson Nano, CloudVeneto VMs, students' own GPUs, etc).
5. Before submitting the final versions for evaluation, projects must be tested and documented.
6. Projects will be assessed based on their completeness, methodology, and understanding of their performance and limitations.
7. The oral exam will begin with a discussion of your project implementation. This will be followed by questions focusing on (but not limited to) the choices made and the limiting factors of the implementation.
8. A list of "default" project topics is available on the Moodle page of the course.
9. Alternatively, students are encouraged to propose their own project ideas, provided they align with the goals of the course. In this case, it is mandatory to consult with the Professors to present any "non-default" project ideas *before* commencing work.