LUMI

Rozstrzygnięcie konkursu na pilotażowe granty obliczeniowe realizowane na superkomputerze LUMI (zasoby GPU)

Zgodnie z *Regulaminem konkursu na pilotażowe granty obliczeniowe dla naukowców z Polski realizowane na superkomputerze LUMI* (zasoby GPU) na podstawie przedstawionych recenzji Panel Ekspertów zakwalifikował do realizacji projekty 1 i 2 z poniższej listy. W związku z wysoką oceną trzeciego wniosku z listy rankingowej, który uzyskał tylko 1 pkt mniej od wniosku na miejscu 2 (również dodatkowe recenzje wniosków z miejsc 2 i 3 wykazały różnicę 1 pkt) Panel Ekspertów zarekomendował, aby ten wniosek również mógł zostać zrealizowany w ramach grantu pilotażowego na superkomputerze LUMI. Do rekomendacji Panelu Ekspertów pozytywnie odniósł się organizator konkursu.

Lp.	Projekt	
1.	Tytuł projektu	***Turbulent dynamics in superfluid Fermi systems***
	Wnioskodawca	prof. dr hab. Gabriel Wlazłowski, Politechnika Warszawska
	Suma punktów	109
	Streszczenie projektu	*Superfluidity is a generic feature of most (electrically neutral) systems at low temperatures. Superfluids can support circulation only in the form of quantum vortices. Typically, quantum vortices are arranged in regular lattices, corresponding to a laminar flow. Under certain conditions, the quantum vortices may become "tangled". The system exhibits then chaotic dynamics, analogous to the turbulent flow. Within this project, we will use the largest European supercomputer (LUMI) to perform numerical simulations that will shed new light on the phenomenon of quantum turbulence in strongly interacting Fermi systems. We will use a fully microscopic approach based on the density functional theory and provide deeper insight into the energy transfer process from macroscopic to microscopic scales. At the technical level, this project will be exploring capabilities that offer AMD GPUs in the context of solving non-linear and time-dependent 3D PDEs , and diagonalization of large matrices.*

EuroHPC Joint Undertaking

The acquisition and operation of the EuroHPC supercomputer is funded jointly by the EuroHPC Joint Undertaking, through the European Union's Connecting Europe Facility and the Horizon 2020 research and innovation programme, as well as the of Participating States FI, BE, CH, CZ, DK, EE, IS, NO, PL, SE.

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2.	Tytuł projektu	***Calculating hadron structure functions at small Bjorken-x using GPGPU processors***
	Wnioskodawca	dr hab. Piotr Korcyl, Uniwersytet Jagielloński
	Suma punktów	97
	Suma punktów (dodatkowa recenzja)	43
	Streszczenie projektu	*The study of hadron internal structure has a long history. First Deep Inelastic Scattering (DIS) experiments were conducted in 1968 at SLAC, where electrons were scattered off protons and neutrons to investigate the internal structure of the latter. Further experiments at other facilities, extended in the energy range, provided important test of Quantum Chromodynamics and prompted for the development of many phenomenological models and effective theories of hadrons. In DIS processes, the internal structure of hadrons is described by the so-called structure functions which depend on momentum transfer and the longitudinal momentum fraction x of exchanged elementary particles -- quarks and gluons. The project concerns solving high energy evolution equations that relates structure functions at different values of x. Using the lattice methods we solve numerically a nonlinear version of the evolution equation, the so-called JIMWLK equation, including many phenomenologically important improvements, most notably the kinematical constraint, which lifts some of the assumptions utilized in nonlinear equations in the past. Using the computer time allocation we will perform all necessary calculations needed to theoretically describe experimental DIS data and provide, for the first time, fit results for the initial condition of the JIMWLK equation with kinematical constraint. The latter can be used for predictions for various processes measured at Electron-Ion Collider.*

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3	Tytuł projektu	***High resolution and high performance simulations of porous media flows using lattice Boltzmann method***
	Wnioskodawca	dr Michał Dzikowski, Interdyscyplinarne Centrum Modelowania Matematycznego i Komputerowego UW
	Suma punktów	96
	Suma punktów (dodatkowa recenzja)	42
	Streszczenie projektu	*The numerical simulations proposed in this project will be focused on the reactive-infiltration instabilities, which occurs during the rock dissolution process. Flow and reactant transport become localised in so-called wormholes, leading to a positive feedback loop and the creation of preferential flow paths. Karst, caves and pits created by acidic water dissolving rocks, is a spectacular example of such processes occurring in nature. From the industrial perspective, an in-depth understanding of the underlying physics is necessary for the risk assessment for underground permanent CO2 storage sites in Carbon Capture and Storage technology. Our goal is to numerically recover the time evolution of the 3D wormhole shape registered using X-ray tomography in laboratory experiments. We will use an in-house, high-performance Lattice Boltzmann code (TCLB). The high-resolution simulations are required to gain adequate insight into the length and time scales which govern the wormholing process.*

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