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RPPR Final Report
as of 14-Aug-2017

Agency Code:

Proposal Number: 68465MARIP **Agreement Number: W911NF-16-1-0307**
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Report Date: 15-Aug-2017 Date Received: 14-Aug-2017
Final Report for Period Beginning 16-May-2016 and Ending 15-May-2017
Title: Portland Institute for Computational Science Research at Scale PICSRS
Begin Performance Period: 16-May-2016 **End Performance Period:** 15-May-2017
Report Term: 0-Other

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Distribution Statement: 1-Approved for public release; distribution is unlimited.

STEM Degrees: 1 **STEM Participants:** 4

Major Goals: To support the creation of Portland Institute for Computational Science by providing funds for high performance cluster which will enable research in the broad area of computational mathematics, in particular the solution of partial differential equations (PDEs), both discretization by finite elements and associated scalable solvers (such as multigrid). One main research direction is time-dependent PDEs in the space-time domain formulated as first order systems least-squares with conservation constraints (CFOSLS) important for conservation laws. Additionally, the equipment (will) support education of graduate students and train postdocs in the broad area of high-performance computational algorithms.

Accomplishments: The DURIP grant was instrumental for the creation of the new Portland Institute for Computational Science (PICS), http://www.pi4cs.org/ which is acknowledged at the home page of the institute (see, “Our Sponsors” at http://www.pi4cs.org/about).
Combined with the support from a MRI NSF grant, PICS acquired and hosts the Coeus cluster which consists of 128 compute nodes, 12 KNL Xeon Phi processor nodes (768 cores), 2 large-memory nodes (768GB each), 2 login nodes, 2 management nodes, and 2 storage servers, all connected using a new Omni-Path interconnect fabric marketed by Intel. In total, the compute nodes provide with 2560 cores and 16,384GB RAM.

Some specific research directions enabled by the HPC capabilities of PICS that the PI and collaborators are pursuing on and developing are:
- new space-time discretization techniques based on novel finite elements for a whole de Rham sequence of spaces and variety of time dependent partial differential equations in 4D (space-time domains) which are feasible only with HPC capability provided by PICS (funded in part by DURIP). Several publications are in progress.
- Developing new scalable solvers for the space-time discretization problems with several publications in progress.
- Studying variety of space-time discretization techniques (Constrained first order systems least-squares or CFOSLS), ‘tent pitching’ for hyperbolic equations, and various discontinuous (Petrov-) Galerkin methods.

One publication is available online: http://pdxscholar.library.pdx.edu/pics_pub/2/

RPPR Final Report
as of 14-Aug-2017

Training Opportunities: Additionally, the supported in part Portland Institute for Computational Science (PICS) is/was the host of the “2017 High School and Undergraduate Research Apprenticeship Program (HSAP/URAP),” (www.usaeop.com) supporting the project “Computational Graph Algorithms: Research Opportunity for High School Students” with support for the HASP students provided by ARO.
The 2017 HSAP Scholars (see http://www.pi4cs.org/student-interships) are:

Jacob Chvatal
Westview High School

Alexander Caughman
Jesuit High School

Benjamin Quiring
Jesuit High School

The high schools are from Portland, Oregon area.

Results Dissemination: We started a web-site to host publications that have benefited from use of the PICS resources. Stay tuned for future publications hosted here:

http://pdxscholar.library.pdx.edu/pics_pub/

Honors and Awards: As already mentioned, PICS is/was the host of the “2017 High School and Undergraduate Research Apprenticeship Program (HSAP/URAP),” (www.usaeop.com) supporting the project “Computational Graph Algorithms: Research Opportunity for High School Students” with support for the HASP students provided by ARO.
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Protocol Activity Status:

Technology Transfer: Nothing to Report

FINAL REPORT

DURIP Grant **#W911NF-16-1-0307**

PI: Panayot Vassilevski, Portland State University

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