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Amanda Bienz

Research Interests

High performance computing, sparse matrix operations, collective algorithms, numerical methods, linear solvers, iterative methods

Education

August 2018 **PhD in Computer Science**, *University of Illinois at Urbana-Champaign*, Scientific Computing and High-Performance Computing, Dissertation: *Reducing Communication in Sparse Solvers*

May 2012 **B.S. in Computer Science, B.S. in Mathematics**, *Elon University*

Positions

Aug 2020 - Present **Assistant Professor**, *University of New Mexico*

Aug 2018 - June 2020 **Postdoctoral Researcher**, *University of Illinois at Urbana-Champaign*

Awards and Achievements

2012-2017 **National Science Foundation Graduate Research Fellow**

2015 **National Science Foundation GROW Awardee**

2014 **First Place in Student Research Competition, Graduate Division**, *Supercomputing 2014*

Current Grant Support

2024-2028 **CAREER: Towards Exascale Performance of Parallel Applications**, *PI*, CCF2338077
Total award $324 734

2023-2025 **Cybersecurity and Data Science Education and Workforce Development**, *co-PI*, P116Z230032
PI Patrick Bridges, Total award $1 500 000

2021-2025 **PSAAP-III (FIC):Center for Understandable, Performant Exascale Communication Systems (CUP-ECS)**, *Senior Investigator*, DE-NA0003966
PI Patrick Bridges, Total award $4 409 788, UNM Portion $3 967 218. Co-investigators Anthony Skjellum (TNTech) and Purushotham Bangalore (UA)

Submitted Grant Proposals

Proposed 2025 - 2027 **Collaborative Research: CIRC: New: Next Generation Message-Passing Parallel Programming for Heterogeneous Architectures**, *Lead PI*
UNM Portion $689 686, co-investigator Anthony Skjellum (TNTech)

Proposed 2025 - 2027 **ASCEND: Applied mathematics and Scientific Computing Ecosystem for the New Digital Era**, *co-PI*
UNM Portion $200 000, UNM PI Jacob Schroder)

Journal Publications

2023 **Characterizing the performance of node-aware strategies for irregular point-to-point communication on heterogeneous architectures**, S. Lockhart, **A. Bienz**, W. Gropp, and L. Olson
Parallel Computing, Vol. 116, 2023

2023 **Performance analysis and optimal node-aware communication for enlarged conjugate gradient methods**, S. Lockhart, **A. Bienz**, W. Gropp, and L. Olson
ACM Transactions on Parallel Computing 10 (1), 1-25

2022 **Tausch: A halo exchange library for large heterogeneous systems using MPI, OpenCL and CUDA**, L. Spies, L. N. Olson, A. Reisner, **A. Bienz**, and D. Moulton. Parallel Computing, Vol. 114, 2022

2020 **Reducing Communication in Algebraic Multigrid with Multi-step Node-Aware Communication**, **A. Bienz**, L. N. Olson, and W. D. Gropp. The International Journal of High Performance Computing Applications, 34(5), pp. 547–561.
10 Citations

2019 **Node-Aware Sparse Matrix Vector Multiplication**, **A. Bienz**, L. N. Olson, and W. D. Gropp. Journal of Parallel and Distributed Computing, vol. 130, pg 166-178.
26 Citations

2016 **Reducing Parallel Communication in Algebraic Multigrid through Sparsification**, **A. Bienz**, R. Falgout, W. D. Gropp, L. N. Olson, and J. B. Schroder. Siam Journal on Scientific Computing, vol. 38, no. 5, pg. S332-S357
39 Citations

2013 **Magic Polygrams**, **A. Bienz**, K. A. Yokley, and C. Arangala. Involve: A Journal of Mathematics, vol. 6, no. 2, pg. 169-189.

Conference Publications

2024 **A More Scalable Sparse Dynamic Data Exchange**, Andrew Geyko, Gerald Collom, Derek Schafer, Patrick Bridges, and **Amanda Bienz**
31st IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC 2024, To Appear)

2024 **Compressed Cannon's Algorithm**, Louis Jencka and **Amanda Bienz**
28th Annual IEEE High Performance Extreme Computing Virtual Conference

2024 **Persistent and Partitioned MPI for Stencil Communication**, Gerald Collom, Jason Burmark, Olga Pearce, and **Amanda Bienz**
28th Annual IEEE High Performance Extreme Computing Virtual Conference

2024 **Optimizing Neighbor Collectives with Topology Objects**, Gerald Collom, Derek Schafer, **Amanda Bienz**, Patrick Bridges, Galen Shipman
2024 IEEE International Conference on Cluster Computing (CLUSTER)

2023 **Optimizing Irregular Communication with Neighborhood Collectives and Locality-Aware Parallelism**, Gerald Collom, Rui Peng Li, **Amanda Bienz**
SC-W '23: Proceedings of the SC '23 Workshops of The International Conference on High Performance Computing, Network, Storage, and Analysis

2023 **MPI Advance: Open-Source Message Passing Optimizations**, **Amanda Bienz**, Derek Schafer, Anthony Skjellum
EuroMPI 2023

2023 **Evaluating the Viability of LogGP for Modeling MPI Performance with Non-contiguous Datatypes on Modern Architectures**, Nicholas H Bacon, Patrick Bridges, Scott Levy, Kurt Ferreira, **Amanda Bienz**
Proceedings of the 30th European MPI Users' Group Meeting

2023 **Invited Paper: Benchmarking and Optimizing Data Movement on Emerging Heterogeneous Architectures**, **A. Bienz**
2023 IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW)

2022 **A Locality-Aware Allgather**, **A. Bienz**, S. Gautam, A. Kharel, and S. Singh. EuroMPI/USA'22: 29th European MPI Users' Group Meeting, Chattanooga, TN, USA, September 2022

2021 **Partitioned Collective Communication**, D. J Holmes, A. Skjellum, J. Jaeger, R. E. Grant, P. V. Bangalore, M. GF Dosanjh, **A. Bienz**, D. Schafer
2 Citations

2021 **Modeling Data Movement Performance on Heterogeneous Architectures**, **A. Bienz**, L. N. Olson, and W. D. Gropp, and S. Lockhart. 2021 IEEE High Performance Extreme Computing Conference (HPEC), 2021, pp. 1-7
5 Citations

2019 **Node-Aware Improvements to Allreduce**, **A. Bienz**, L. N. Olson, and W. D. Gropp. Proceedings of 2019 IEEE/ACM Workshop on Exascale MPI (ExaMPI), Denver, CO, November 17, 2019.
12 Citations

2018 **Improving Performance Models for Irregular Point-to-Point Communication**, **A. Bienz**, L. N. Olson, and W. D. Gropp. Proceedings of the 25th European MPI Users' Group Meeting, Barcelona, Spain, September 23-26, 2018.
11 Citations

2011 **A Generalized Parallel Genetic Algorithm in Erlang**, **A. Bienz**, K. Fokle, Z. Keller, E. Zulkoski, and S. Thede. MCURCSM, Granville, OH, September 2011.
6 Citations

Teaching

Assistant Professor at University of New Mexico:

Fall 2024 **CS108L CS4ALL**, Introduce non-majors to simple python programming concepts, ∼25 students

Fall 2021 **CS491/591 Parallel Numerical Algorithms**, Elective undergraduate and graduate course, ∼25 students

Spring 2021, 2023 **CS481/ECE437 Operating Systems**, Required undergraduate course, ∼60 students

Fall 2020, 2022, 2023 **CS442/542 Introduction to Parallel Processing**, Elective undergraduate and graduate course, ∼30 students

Advising

Graduate student advisor, University of New Mexico:

2023 - Present **Jackson Wesley**, PhD student, pre-proposal, expected graduation 2027

2023 - Present **Michael Adams**, PhD student, pre-proposal, expected graduation 2027

2023 - Present **Louis Jencka**, PhD student, pre-proposal, expected graduation 2027

2023 - Present **Shannon Kinkead**, PhD student, pre-proposal, expected graduation 2027

2020 - Present **Gerald Collom**, PhD student, pre-proposal, expected graduation spring 2025

Mentoring

Graduate student mentor, University of New Mexico:

2020 - Present **Evelyn Namugwanya**, PhD student at TNTech

Undergraduate student mentor, University of New Mexico:

Fall 2020 **Shreeman Gautam**, Computer science BS student

Fall 2020 **Amun Kharel**, Computer science BS student

Selected Invited Talks

Oct 2019 **SPPEXA Final Symposium, Dresden, Germany**, Node-Aware Communication for Multigrid Methods

Jun 2018 **PETSc User Meeting 2018, London, UK**, A Parallel Algebraic Multigrid Solver with Reduced Communication Costs

Selected Contributed Talks

Feb 2022 **SIAM Conference on Parallel Processing for Scientific Computing (PP22), Virtual**, Sparse Neighborhood Collectives on Heterogeneous Architectures

Feb 2020 **SIAM Conference on Parallel Processing for Scientific Computing (PP20), Seattle**, Towards Efficient Communication on Heterogeneous Architectures

Oct 2019 **Rising Stars in EECS, Urbana, IL**, Scalable Sparse Solvers and Graph Algorithms

Apr 2019 **Rising Stars in CSE, Austin, TX**, Reducing Parallel Communication Costs in Sparse Matrix Operations

Feb 2019 **SIAM Conference on Computational Science and Engineering (CSE19), Spokane, WA**, RAPtor: Parallel Algebraic Multigrid with Node-Aware Communication

Nov 2017 **Doctoral Showcase at Supercomputing 2017, Denver, CO**, Reducing Communication Costs in Parallel Algebraic Multigrid

Feb 2017 **SIAM Conference on Computational Science and Engineering (CSE17), Atlanta, GA**, Reducing Parallel Communication Costs in Algebraic Multigrid

Apr 2016 **SIAM Conference on Parallel Processing for Scientific Computing (PP16), Paris, France**, Topology-Aware Performance Modeling of Parallel SpMVs

Nov 2014 **ACM Student Research Competition at Supercomputing 2014, New Orleans, LA**, Reducing Network Contention Associated with Parallel Algebraic Multigrid

Software

2022 **MPI Advance**, *A lightweight optimization library that sits on top of MPI*

2019 **BenchPress**, *Benchmarking for heterogeneous architectures*

2017 **RAPtor: parallel algebraic multigrid solver**, *A parallel algebraic multigrid solver with node-aware communication*

Service Leadership Positions

2023-Present **Tutorial Program co-Chair for Hot Interconnects**, *Co-chair for tutorials at HotI*

2022-2023 **Workshop Chair for ISC23**, *Chair for all workshops at ISC 2023*

2022-Present **Technical Program co-Chair for ExaMPI Workshop at SC**, *Co-chair for technical program of the ExaMPI workshop at SC*

2022 **Tutorial Chair for EuroMPI/USA'22**, *Chair for tutorials at EuroMPI/USA'22.*

2021-2022 **Workshop Deputy Chair for ISC22**, *Deputy chair for all workshops at ISC 2022.*

Technical Committees and Peer Reviews

2022 **IPDPS 2022-2024 Technical Program Committee Member**

2022 **SC 2022-2024 Technical Program Committee Member**

2021 **ICPP 2021 Technical Program Committee Member**

2021 **EuroMPI 2021 Poster Program Committee Member**

2021 **ExaMPI Workshop at SC21 Technical Program Committee Member**

2020 - Present **Journal Peer Reviewer**, *Parallel Computing, JPeer, TOPC, Cluster Computing, SISC, IEEE Micro, Transactions on Computers*

Additional Service

2022-Present **UNM CS Faculty Search Committee**

2022-Present **Faculty Advisor for UNM Women in Computing Organization**

2021-Present **Faculty Advisor for CSGSA**

2018 **JLESC Student Committee**, *University of Illinois's student representative for the joint laboratory on extreme scale computing.*

2015-2017 **CS Graduate Academic Council**, *Committee for improving the graduate student experience*

2013-2017 **CS Graduate Student Ambassador**, *Helped run visit weekend for prospective graduate students*

2016 **CS Graduate Application Review Student Volunteer**, *Reviewed prospective graduate student applications.*

2014-2015 **SIAM Student Chapter President**, *President of UIUC's student chapter*

2013-2014 **SIAM Student Chapter Treasurer**, *Treasurer of UIUC's student chapter*

Memberships

Institute of Electrical and Electronics Engineers

Associated for Computing Machinery

Society for Industrial and Applied Mathematics