

EVALUATING TENSTORRENT RISC-V ACCELERATORS FOR HIGH PERFORMANCE SCIENTIFIC COMPUTING

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June 11th, 2026

ACKNOWLEDGEMENTS



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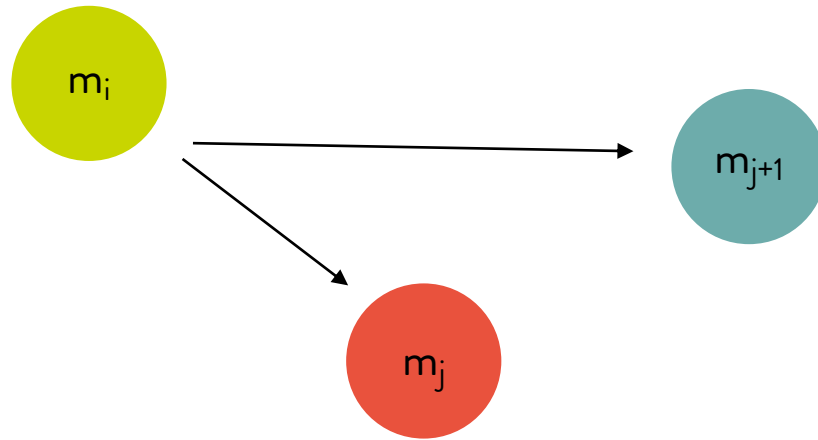


Mario Spera
Scuola Internazionale
Superiore di Studi Avanzati

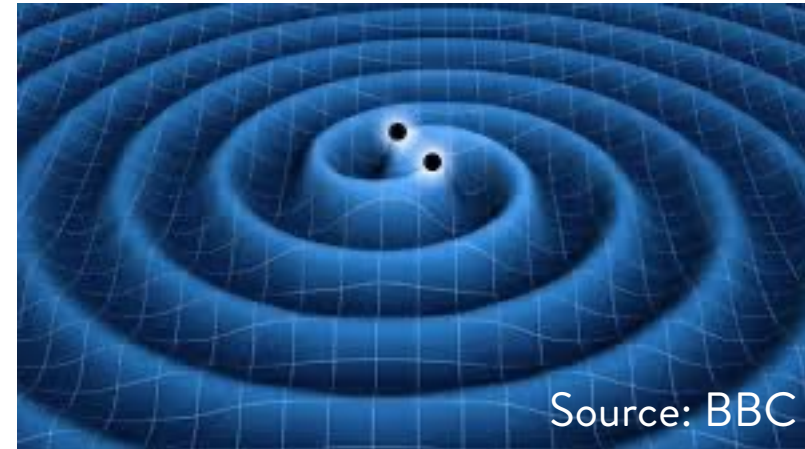
Funding



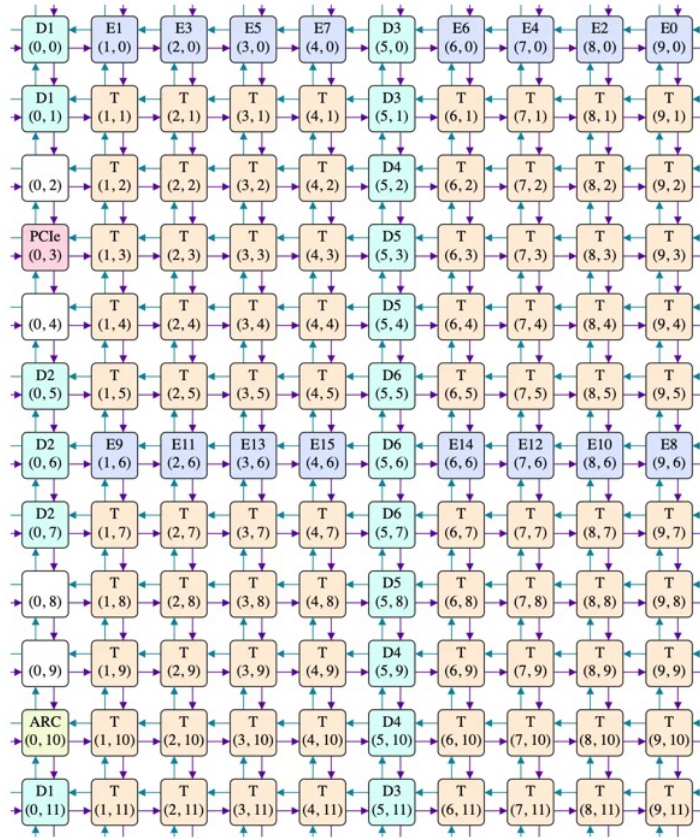
IS RISC-V READY TO HELP UNRAVEL THE PHYSICS UNDERPINNING GRAVITATIONAL WAVES?



$$\mathbf{F}_i = \sum_{\substack{j=1 \\ j \neq i}}^N G \frac{m_i m_j}{r_{ij}^3} (\mathbf{r}_j - \mathbf{r}_i)$$

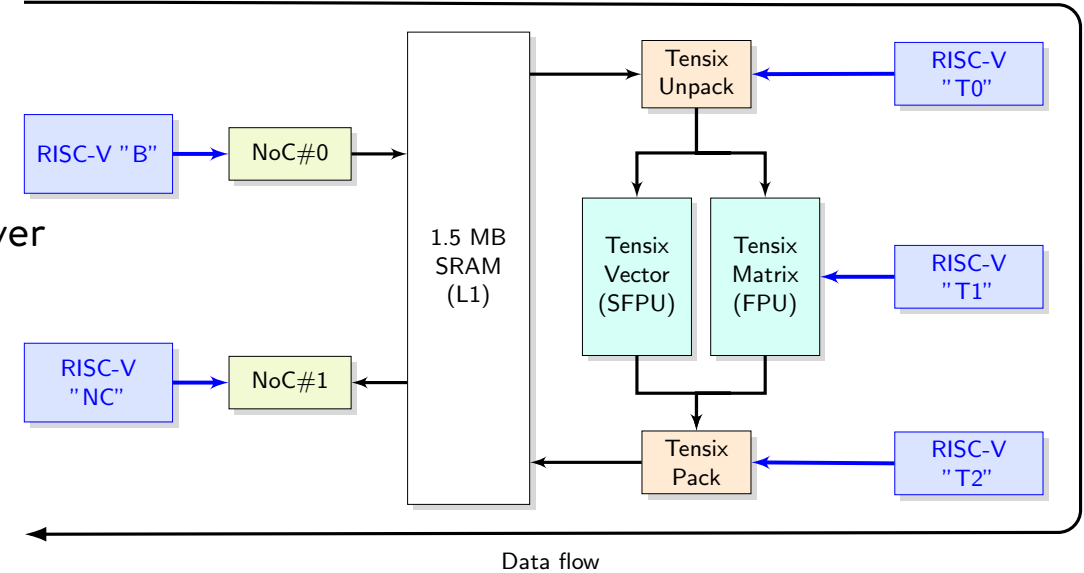


WORMHOLE N300: RISC-V ACCELERATOR FOR OPTIMISED SCALABILITY AND DATA MOVEMENT



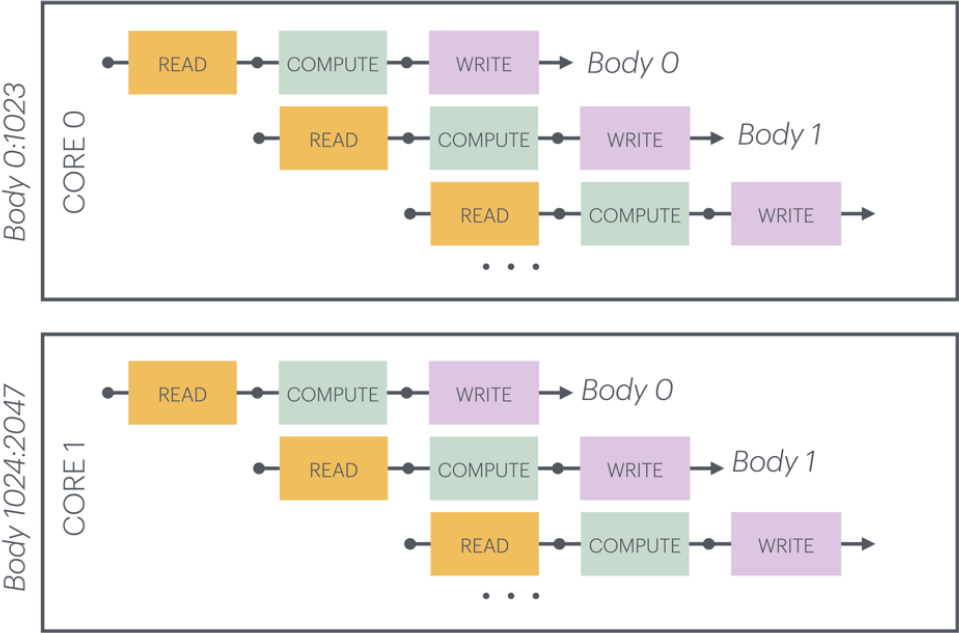
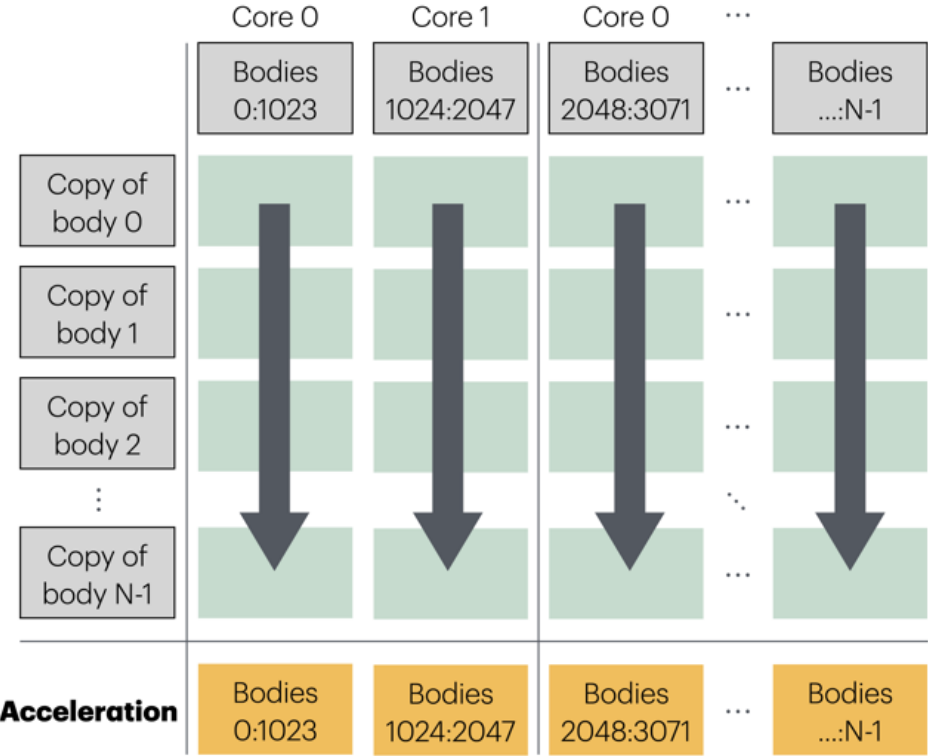
Tensix core: the n300 compute horsepower

Data mover
cores

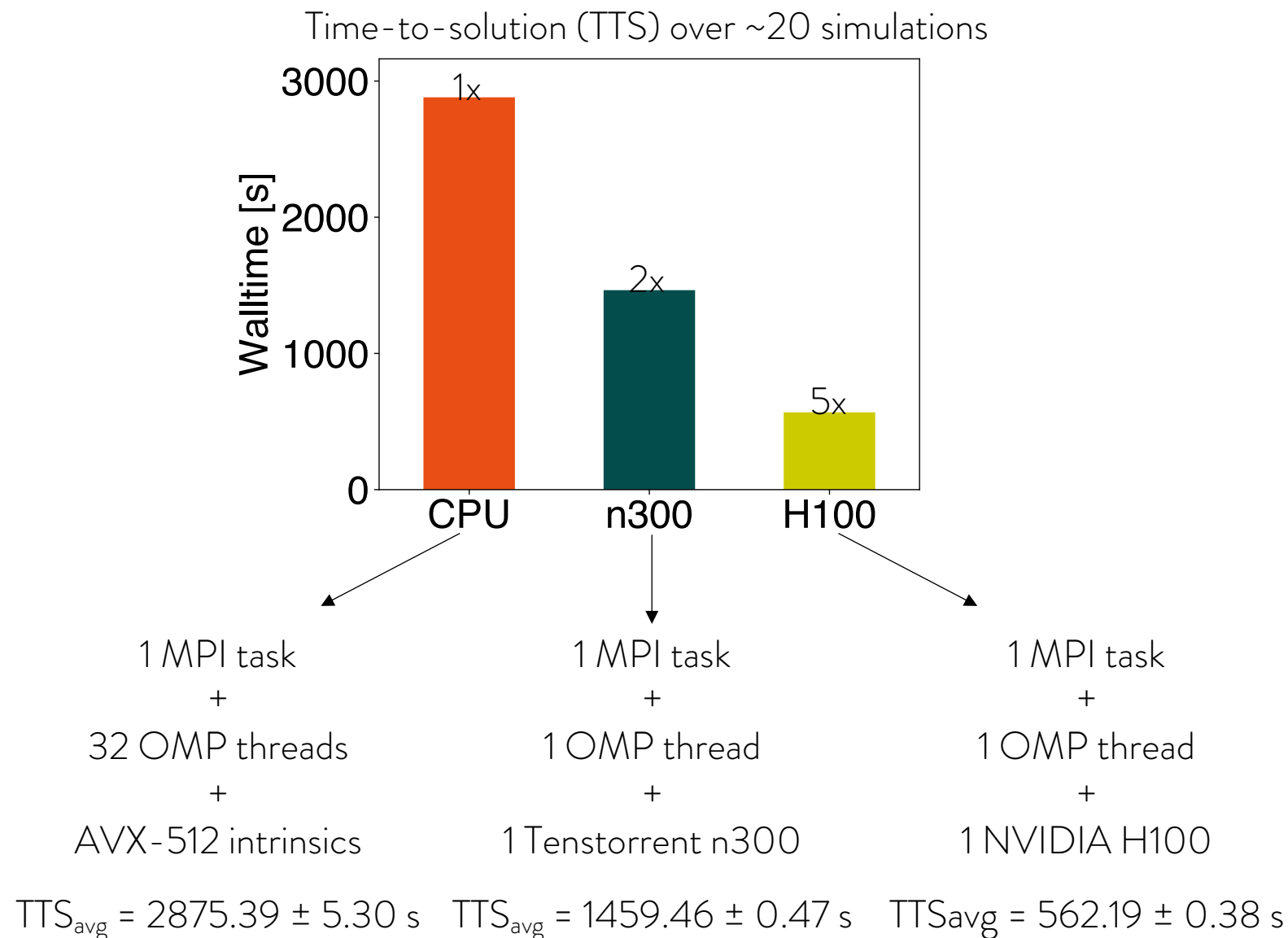


Compute
cores

ACCELERATING N-BODY SIMULATIONS WITH N300

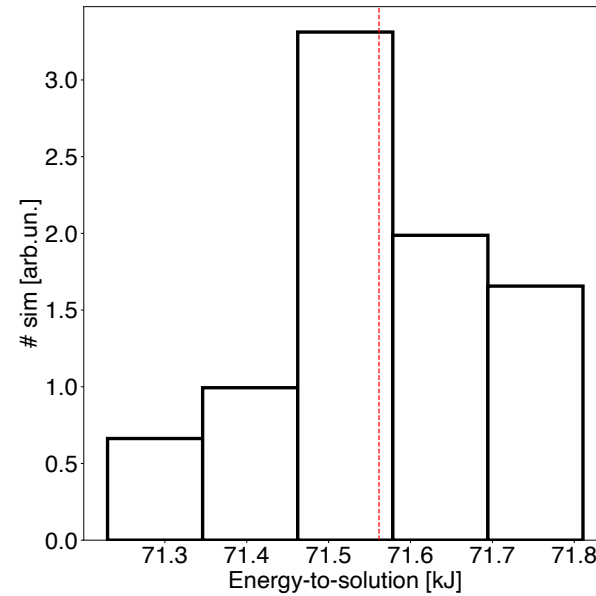


N300 PERFORMANCE: 2× FASTER THAN CPU



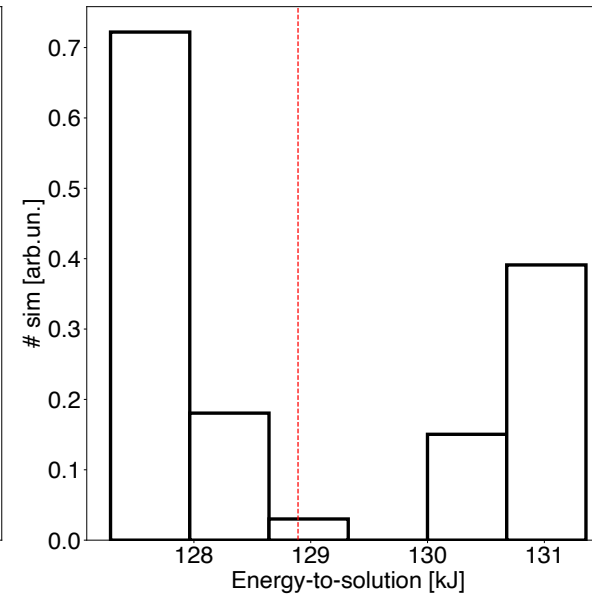
N300 HALVES TOTAL ENERGY PER SIMULATION

Energy-to-solution (ETS) over ~50 simulations



1 MPI task +
1 OMP thread +
1 Tenstorrent n300

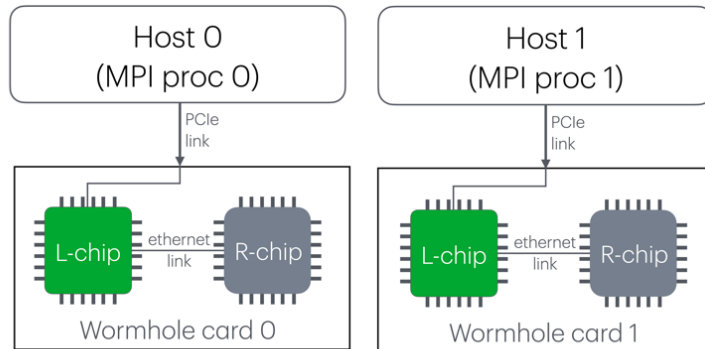
$$ETS_{avg} = 71.56 \pm 0.13 \text{ kJ}$$



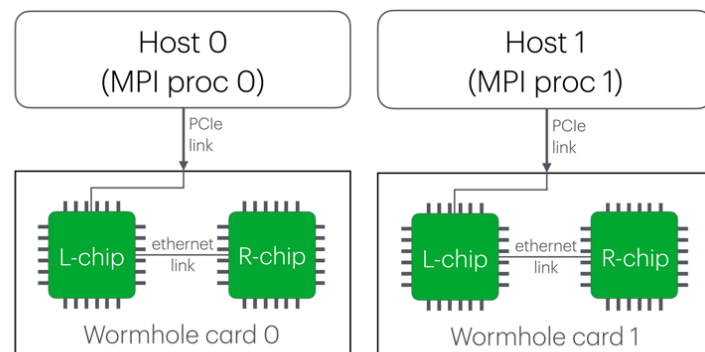
1 MPI task +
32 OMP threads +
AVX-512 intrinsics

$$ETS_{avg} = 128.89 \pm 1.52 \text{ kJ}$$

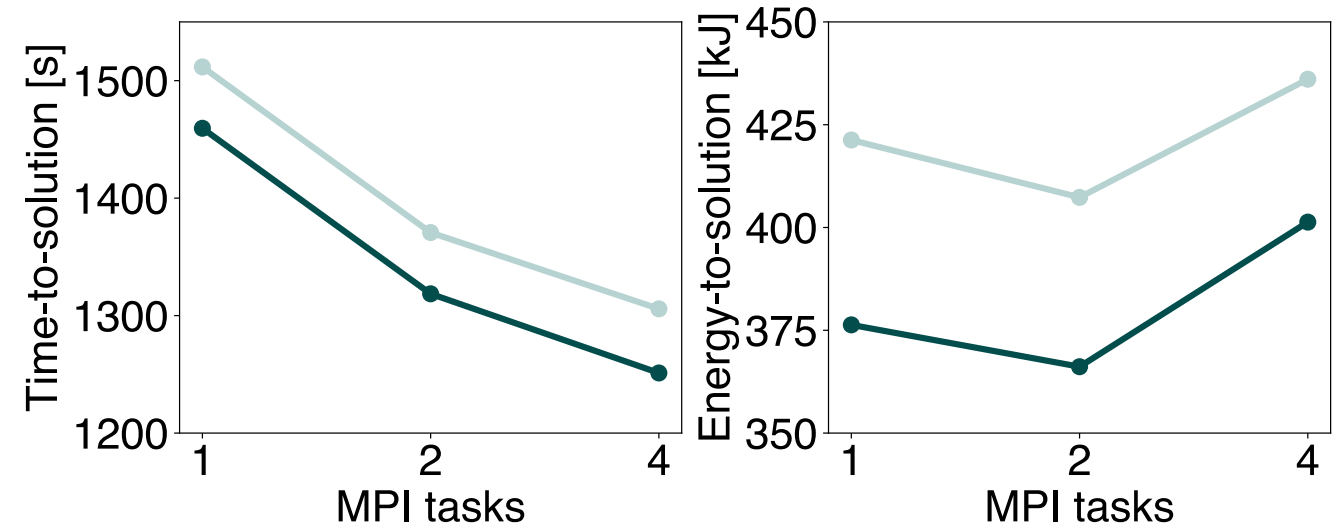
BEST EFFICIENCY-PERFORMANCE TRADE-OFF WITH TWO CARDS



Multi-Host Single-Chip



Multi-Host Multi-Chip



SUMMARY & PERSPECTIVES

- We ported a N-body code to the RISC-V-based Tenstorrent Wormhole accelerator.
- We assessed the accelerated implementation by measuring time-to-solution and energy-to-solution, benchmarking it against highly optimised CPU and CUDA versions of the same application.
- RISC-V accelerators achieve impressive results, with over 2× faster execution and about 2× higher energy efficiency compared to x86.
- We explored multi-accelerator scaling strategies and, to our knowledge, present the first scientific code to leverage multiple Tenstorrent cards.
- Next steps:
 - Further code optimisation to improve parallel performance;
 - Tests on the p150.