Postdoctoral & Research Faculty Positions

Computational Aerosciences Laboratory (CASLAB)
University of Michigan

Four positions at the intersection of computational physics, applied mathematics, and AI

About CASLAB

The Computational Aerosciences Laboratory (CASLAB) at the University of Michigan, directed by Karthik Duraisamy (Arthur B. Modine Professor of Engineering; Director of the Michigan Institute for Computational Discovery & Engineering, MICDE) is a full stack computational science group. We build models of the physical world, and develop theory, mathematics, algorithms underpinning these models. Our work spans physics-based modeling, mathematical formalisms statistical inference, machine learning, and numerical methods, and it spans analysis of fundamental physical phenomena all the way to system-level digital twins.

You can see a selection of our work here. Recent publications can be found here.
The caveat to the above is that we are always evolving our research.

The group sits at the center of a rich ecosystem: MICDE and several of its centers including SciFM.ai and C-PRIME; partnerships with national laboratories (including SPARC which is the home of Los Alamos scientists in Ann Arbor) and leading AI and industry research labs.

We have 4 positions open, but 5 distinct but deeply connected topics, and we welcome candidates whose interests cut across more than one of them.

These are very exciting times for our field. Outside of these positions, several more will open up in CASLAB and across MICDE in the near future, so stay tuned!!

Position 1. Formal Verification for Scientific Computing

This position builds the verification layer for scientific computing: machine-checkable guarantees for the numerical algorithms, solvers, and, ultimately the AI-generated reasoning that increasingly drives science. The work brings rigorous numerical analysis and formal methods into the core of computational science.

Depending on your background, your work could include formalizing numerical linear algebra and core scientific-computing primitives in a proof assistant such as Lean or Coq; deriving and machine-checking error bounds and stability guarantees for solvers; developing AI-assisted formalization and autoformalization pipelines that scale proof effort; and designing the verification-in-the-loop infrastructure that lets autonomous scientific agents be trusted.

Experience in mixed-precision arithmetic and rounding error quantification will be greatly appreciated.

We're looking for a candidate with strong expertise in at least one of:

- numerical linear algebra and rigorous numerical analysis;
- formalization in Lean or Coq (or a comparable proof assistant);
- AI-assisted formalization.

Some work related to these topics can be found here https://verinum.org/

Position 2. Data-Driven Turbulence Modeling for Hypersonic Flows

Classical RANS and LES closures, calibrated largely on low-speed flows, generalize poorly to the hypersonic regime, and the high-fidelity and experimental data we do have are sparse, expensive, and often mismatched between ground test and flight.

This work includes the development of turbulence models from the ground up and using modern inference and learning techniques to improve these models. Of particular emphasis is ensuring that the models satisfy hard and soft constraints, so they generalize well; quantifying predictive uncertainty in regimes where data are scarce.

We're looking for a candidate with strong expertise in:

- turbulence modeling in the RANS setting, ideally for compressible or high-speed flows;
- data-driven or machine-learning-augmented closure modeling.

A solid foundation in computational fluid dynamics and numerics of compressible flows is essential. We will be collaborating with Prof. Paul Durbin (Iowa State)

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3. Feature-based modeling for Turbulent Systems

This position pursues a fundamentally different route to turbulence. Rather than partitioning the flow by scale or introducing generic averaging or filtering operations, it treats the large coherent structures that actually control the dynamics as the first-class objects of the model. One candidate is *exact coherent structures* (ECS).

Your work could include computing ECS for complex flows; introducing effective closures and developing predictive feature-based models; constructing emulator ROMs; and wrapping these into operational digital twins with data assimilation.

We're looking for a candidate with strong expertise in at least one of:

- exact coherent structures / invariant solutions and dynamical-systems approaches to turbulence;
- reduced-order modeling and modal decompositions, ideally combined with data assimilation or control.

Strong PDE and scientific-computing skills are essential; experience with geophysical flows, plasma/MHD, is a plus.

The work is part of a collaboration with Los Alamos National Laboratory, anchored by two demanding demonstration applications: ocean dynamics and magnetic-confinement fusion.

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4. Generative AI for Spatio-Temporal Dynamics

Diffusion models and flow matching offer probabilistic, physically structured surrogates that generate entire fields rather than point estimates: fast, uncertainty-aware, and naturally suited to the multimodal, multiscale character of physical systems.

Your work could include building diffusion- and flow-matching-based models for spatio-temporal physical systems: turbulence, multiphysics, materials, and geophysical-scale fields; conditional and guided generation; designing generative models that respect physical constraints; and coupling generative surrogates tightly with classical simulation and statistical inference.

We're looking for a candidate with strong expertise in:

- diffusion models and/or flow matching, or operator learning with demonstrated application to spatio-temporal dynamics (or a strong generative-modeling background and a clear desire to apply it to physical systems).

Solid foundations in probability, and large-scale model training are highly valued.

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5. Agentic AI for Science

The most consequential shift in scientific AI is from systems that predict to systems that reason and act. This position builds AI agents for science: systems that reason, plan, run computations, call tools, critique their own outputs, and drive end-to-end scientific and engineering workflows. It is central to the group's and C-PRIME's vision of a "persistent computing" paradigm: a system grounded in trusted physical primitives that runs continuously and can be queried like an oracle, compressing the time from a scientific question to a reliable answer.

Your work could include designing and engineering agent harnesses and scaffolds for scientific computing; tool use, orchestration, and inner-/outer-loop architectures that couple agents to simulators, solvers, and verification systems; multi-agent designs for exploration and design; and the reasoning traces, evaluation suites, and verification-in-the-loop mechanisms that make agentic science trustworthy rather than merely impressive. You would help turn a compelling vision into working, reliable infrastructure.

We're looking for a candidate with:

- hands-on experience building harnesses or scaffolds for AI agents (LLM tool use, orchestration, evaluation, and related infrastructure).

Strong software engineering is essential, paired with enough mathematical and scientific literacy to ground agents in real physics. Experience with reasoning models, RL, or large-scale evaluation is a plus.

In addition to the work in C-PRIME, this is part of an exciting University – Frontier AI Lab – National Lab collaboration. Stay tuned.

Application Details

All positions require:

- a PhD (completed or near completion) in Applied Mathematics, Physics, or Engineering, or a closely related field;
- strong computational and mathematical training,
- a track record of rigorous research;
- the position-specific expertise described above.

Above all, we value curiosity, depth, intellectual ambition, and the ability to move fluidly between mathematical theory, physical insight, and computations. If your interests span more than one of these areas, say so in your application.

Apply by clicking this link to a google form

The google form will ask for a link to 1 file that contains :

- a short cover letter describing your background, the position(s) you are applying for
- a CV, including a list of publications;
- a brief (1–2 page) research statement and how your work connects to the lab's directions;
- the names and contact information of 2–3 references;
- links to representative work: papers, code repositories, formalization projects, or model demos as relevant.

Please indicate clearly which position(s) you are interested in; cross-cutting applications are welcome.

Review of applications will begin immediately and continue until the positions are filled.
Enquiries can be directed to kdur@umich.edu

Note: Assistant Research Scientist, Associate Research Scientist and Research Scientist positions are research faculty equivalents of tenure track/tenured faculty positions. Appointments require the assembly of a casebook, departmental, college and university approvals.

About Ann Arbor

Ann Arbor is a vibrant city, and consistently ranked among the very best places in the US to live and do research. Michigan (particularly in summer and fall ;) is home to incredible natural beauty. Of course, December through February is quite cold, but we think that the rest of the year more than makes up for it!