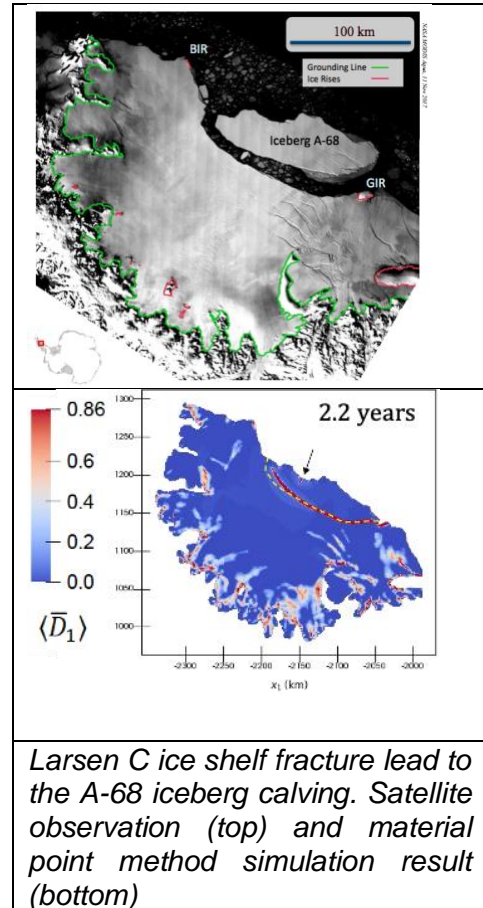


## Open PhD and Postdoc Positions at Vanderbilt University

The Computational Mechanics and Physics Laboratory (<https://my.vanderbilt.edu/cpml/>) at Vanderbilt University has open PhD and postdoc positions in the area of computational mechanics with applications to ice sheet-shelf modeling.

### Overview:

Dynamic mass loss from the Antarctic ice sheet is significantly controlled by ice shelf buttressing and changes near the grounding line. Some Antarctic ice shelves provide resistance to ice flow into the ocean from upstream grounded glaciers, and the loss of this resistance or buttressing due to fracture, thinning, or enhanced damage to the ice-shelf margins could cause an increased flux of grounded ice flow into the ocean, thereby contributing to sea level rise. A key challenge is to understand how ice shelf weakening and fracture are influenced by complex ice-ocean-atmosphere feedback. Our research focuses on simulating the flow and fracture mechanics associated with ice shelf weakening and fracture using hybrid Lagrangian-Eulerian formulations and finite-element/material-point methods. The project also involves tuning and validating computational models with observational data from satellite imagery. The aim is to provide new scientific understanding on how evolving damage fields affect the large-scale force balance in the ice shelf, and how fractures (i.e. rifts and crevasses) grow in response to a changing stress field. The research outcomes will potentially provide insights on the specific processes and boundary conditions leading to iceberg calving and ice shelf stability.



*Larsen C ice shelf fracture lead to the A-68 iceberg calving. Satellite observation (top) and material point method simulation result (bottom)*

### Tasks:

- Employ continuum damage mechanics and Stokes flow models to simulate rift propagation in open-source Python-based finite element code FireDrake/ICEPack
- Use the FireDrake/ICEpack for data assimilation and inverse modeling for quantifying ice rheology
- Investigate the role of hydrofracture and mélange-ice interactions on fracture propagation in Antarctic ice shelves
- Generate useful datasets from remote sensing techniques using machine learning and perform statistical analysis

### Qualifications:

- PhD applicants should have a Master's or Bachelor's degrees in Engineering, Engineering Mechanics, Physics, Applied Mathematics, or a relevant field. The student must have a deep interest in mathematics, mechanics, computing, and climate/earth sciences.
- Postdoc applicants should have a PhD degree with experience in Computational Fracture Mechanics, including phase field method, damage mechanics and finite elements.
- Essential are strong quantitative and analytical skills, experience in scientific programming (with Python, C++ or Fortran), and a good command of English in writing and speaking.

### **Timeline and contact:**

The starting date can be in Spring2021 or Fall 2022. PhD position is for 4-5 years and postdoc position is for 1-2 years. Please contact Prof. Ravindra Duddu [ravindra.duddu@vanderbilt.edu](mailto:ravindra.duddu@vanderbilt.edu) with CV and a personal statement of research interests and career goals.

### **Vanderbilt Campus and Nashville**

Vanderbilt University, located in Nashville, Tennessee, is a leading research-intensive university in the United States in engineering, science and technology. Vanderbilt faculty and researchers are recognized for their pioneering research, scholarship, and leadership in higher education.

Nashville is the capital of the U.S. state of Tennessee and is a major center for the music industry, especially, country music. It's the 23<sup>rd</sup> most-populous city in the United States.

[https://en.wikipedia.org/wiki/Nashville,\\_Tennessee](https://en.wikipedia.org/wiki/Nashville,_Tennessee)

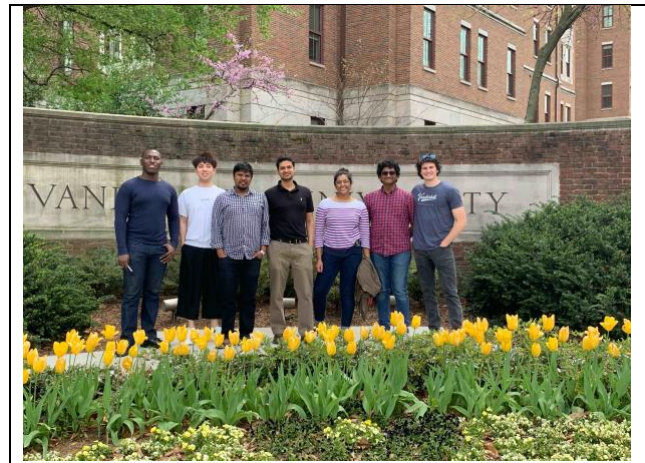


*A panoramic view of Vanderbilt Campus with Nashville downtown*

### **Computational Physics and Mechanics Laboratory (CPML)**

<https://my.vanderbilt.edu/cpml/>

The overarching research goal is to better understand and predict material degradation fracture, and failure using data-informed physics/mechanics-based computational modeling and simulation. A major research theme is to study fracture propagation and iceberg calving in glaciers and ice shelf in order to improve the projections of sea level rise exacerbated by climate change and atmospheric/ocean warming. The lab members are funded by US federal agencies (e.g. NASA, NSF, ONR, and DOE) and industry (e.g. 3M Company)



*Group members of CPML on a beautiful spring day on campus*