**American Physical Society**
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College Park, MD 20740

# March Meeting 2023 Featured Presentations

## Geosciences

### System Models Dynamics of Arctic Ice Mélange, Helping Improve Forecasting of Sea Level Rise

March 6, 9:24 a.m. PST, Room 208

Famed for driving iceberg formation, the geophysical process known as glacial caving also creates a unique, soft material called ice mélange. Studying this granular mixture's physical dynamics is important for accurately predicting sea level rise. But because ice mélange is composed of various forms of icebergs and sea ice with different properties, it is hard to model its behavior. Here, Justin Burton and colleagues will share an experimental system that can simulate ice mélange from tidewater glaciers, like those in Greenland. The group used polypropylene as an ice mélange-like substitute and placed it in a narrow tank emulating a fjord, describing the material's fluid flow, velocity and friction under different conditions. The team's insights could inform and enhance geoscientists' efforts to characterize climate change's impact on sea level rise.

### Researchers Contextualize the Varying Properties of Layers in an Important Oceanic Arctic Staircase

March 6, 12:06 p.m. PST, Room 414

Arctic staircases are sets of oceanic layers that differ in temperature and salinity and that transport heat towards sea ice. These phenomena can be used to track ocean heat in the Arctic Basin, including the Beaufort Gyre. But it is not clear exactly how Arctic staircases develop or what influences their layers' thickness. Here, Nicole Shibley and colleagues will explain that the Beaufort Gyre's Arctic staircase and its layers' thickness — or thinness — likely depends on the way that warmer water crosses the cooler Gyre, dissipating heat and salt. Based on their findings, the team hypothesizes that this staircase's properties may be applied to better understand changing water properties in the Arctic Basin.

### Scientists Develop a Way to Disentangle Energy of Enormous Ocean Currents

March 6, 3:36 p.m. PST, Room 414

Much like atmospheric circulation and weather systems, ocean currents are silos of kinetic energy that massively influence Earth's climate. Typically, scientists study ocean currents' kinetic energy by examining box-shaped regions in the sea less than 1,000 kilometers in extent. However, regional analyses are difficult to extrapolate to a global picture. Here, Hussein Aluie and colleagues will share a new coarse-graining technique that can finally evaluate the energy of ocean currents of all sizes, both smaller and larger than 1,000 kilometers. During their analyses, the researchers discovered that the Antarctic Circumpolar Current — which is 9,000 kilometers in diameter — is the most energetic current. The group says that their methodology will enable better contextualization of the impact that the ocean's circulation has on the planet's climate system.

### The Mixing of Water and Rock Layers During Water World Planet Formation

March 8, 8:48 a.m. PST, Room 212

Researchers believe that water worlds — exoplanets about Earth's size or larger with lots of water — have rocky mantles beneath their watery surfaces. In smaller planets, the rock and water layers should be distinct. But in larger planets, the higher temperatures and pressures at the rock-water interface could lead to interaction between these layers. In this talk, Tanja Kovacevic and colleagues will explain how they simulated a rocky silicate interacting with water at extreme temperature and pressure conditions. They found that when the rock and water get hot enough, like when the rock melts, the two materials fully mix together. Through further simulations, the team showed that these high temperatures are reached during the collisional growth of these water worlds, which are thought to be part of the planet formation process. The findings suggest that water worlds have mixed rock-water layers during their initial formation, furthering researchers' understanding of the structure, formation and evolution of water worlds.

### New Machine Learning Approach Makes Modeling Extreme Matter, Like in Planet Cores, More Feasible

March 8, 12:42 p.m. PST, Room 301

Researchers have had great success using machine learning approaches to model properties of matter in various situations. But since these models are usually trained on cases where electrons are in their ground state, they cannot effectively simulate matter under extreme, high-temperature conditions, like those in the cores of giant planets where electrons tend to be in excited states. In this talk, Federico Grasselli and colleagues will present a new machine learning-based method for predicting the behavior of excited electrons based on their ground-state counterparts. The researchers showed that their method lets them simulate the properties of matter in extreme conditions much more cost-effectively than conventional approaches and demonstrated this by modeling metallic hydrogen within a young Jupiter-like planet.