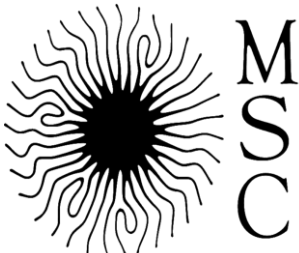


# Self-propulsion of floating ice blocks by melting



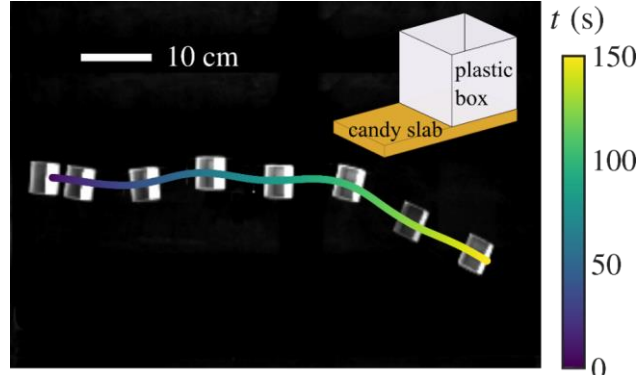
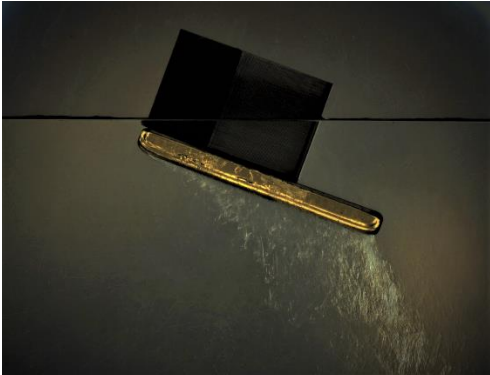
Martin Chaigne (MSC, UPC),  
Jérôme Jovet (UFR Phys., UPC),  
**Michael Berhanu** (MSC, CNRS, UPC),  
Amit Dawadi and Arshad Kudrolli (Clark University, USA)



Previously, we investigated how solutal convection can be used to generate self-propulsion

## Dissolution-driven propulsion of floating solids

Martin Chaigne, Michael Berhanu and Arshad Kudrolli  
**PNAS** 120 (32), e2301947120 (2023) 31/07/2023



Propulsion mechanism, valid for other kinds of convection flows, as shown for thermal convection by Mercier, Aderkani, Allshouse, Doyle and Peacock **PRL** (2014)

Case of convection flows associated to melting ?

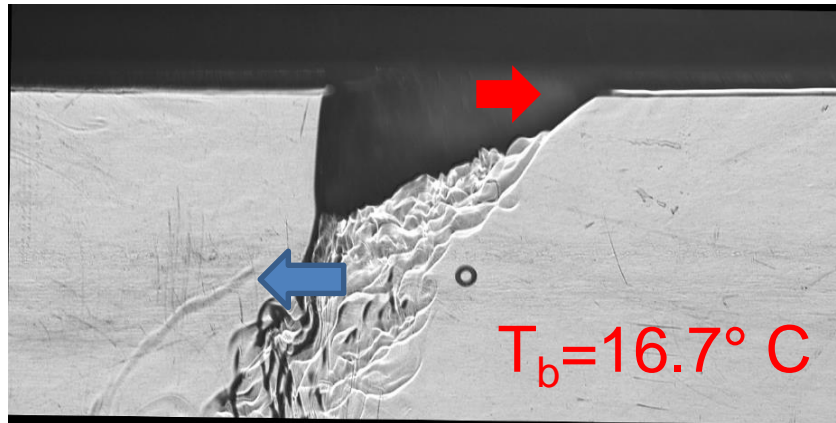
Rotation of ice disks reported by Dorbolo, Adami, Dubois, Caps, Vandewalle and Darbois-Texier **PRE** (2016), but no translational motion.

# Experimental demonstration of self-propulsion for asymmetric melting ice blocks

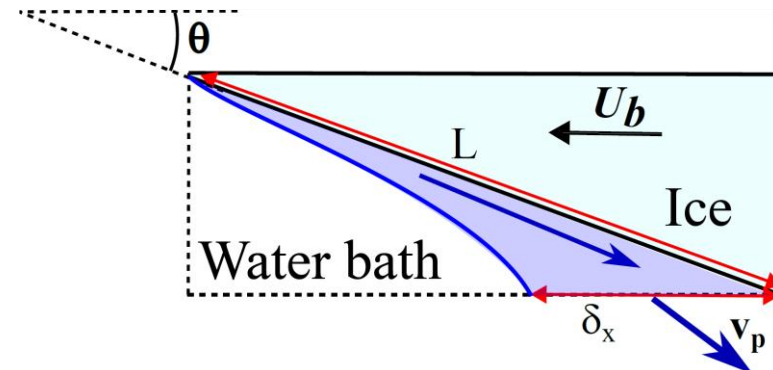
- Melting of wedge ice blocks  
Typically  $10 \times 10 \times 5$  cm  
Inclination  $\theta \approx 26.6^\circ$ .  
In water bath  
at ambient temperature



- Shadowgraph imaging with a parabolic mirror.



- Theoretical model, propulsion due to the cooling of the water bath, which becomes denser, generates directed convection current.



Contribution to **iceberg drift**  
in addition to wind and sea currents.



Credits: Andreas Weith, Wikipedia

Mechanism valid for bath temperature  $> 4^\circ\text{C}$ .  
Influence of salinity, for water bath  $0 < T_b < 4^\circ\text{C}$  ?