Research Team name: European Space Agency (ESA)
Presenter name: Sébastien Vincent-Bonnieu

ESA Contact point:
Olivier Minster, olivier.minster@esa.int

Team Presentation – Annual Workshop, COST Action MP1106
Dublin, September, 2012

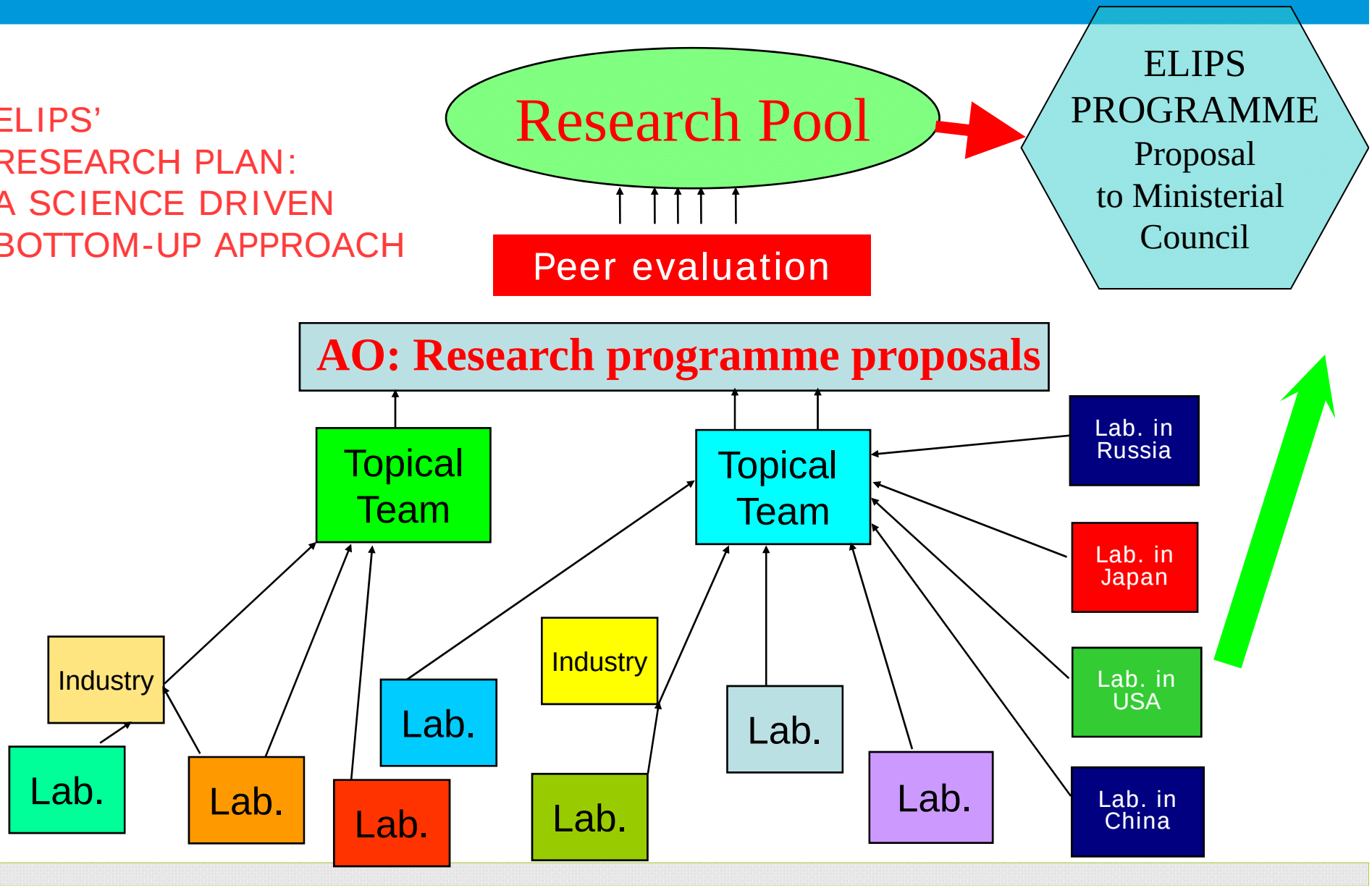
European LIfe and Physical sciences in Space

ESA has 19 Member States: 17 states of the EU (AT, BE, CZ, DE, DK, ES, FI, FR, IT, GR, IE, LU, NL, PT, RO, SE, UK) plus Norway and Switzerland.

Eight other EU states have Cooperation Agreements with ESA: Estonia, Slovenia, Poland, Hungary, Cyprus, Latvia, Lithuania and the Slovak Republic. Bulgaria and Malta are negotiating Cooperation Agreements.

Canada takes part in some programmes under a Cooperation Agreement.

ELIPS'
RESEARCH PLAN:
A SCIENCE DRIVEN
BOTTOM-UP APPROACH



Physical sciences in the ELIPS programme

69 projects
575 scientists
30 countries
32 multi-users instruments under study or development for the ISS

AUSTRIA	7
BELGIUM	34
CANADA	22
CZECH REP.	2
SWITZERLAND	9
GERMANY	134
DENMARK	2
SPAIN	25
FRANCE	113
GREECE	4
IRELAND	4
ITALY	42
NORWAY	5
NETHERLANDS	15
SWEDEN	4

JAPAN	36
RUSSIA	27
USA	47
HUNGARY	9
FINLAND	3
POLAND	3
ROMANIA	2
SLOVAKIA	2
UNITED KINGDOM	13
MEXICO	1
ISRAEL	1
INDIA	1
AUSTRALIA	2
CHINA	5
KOREA	1

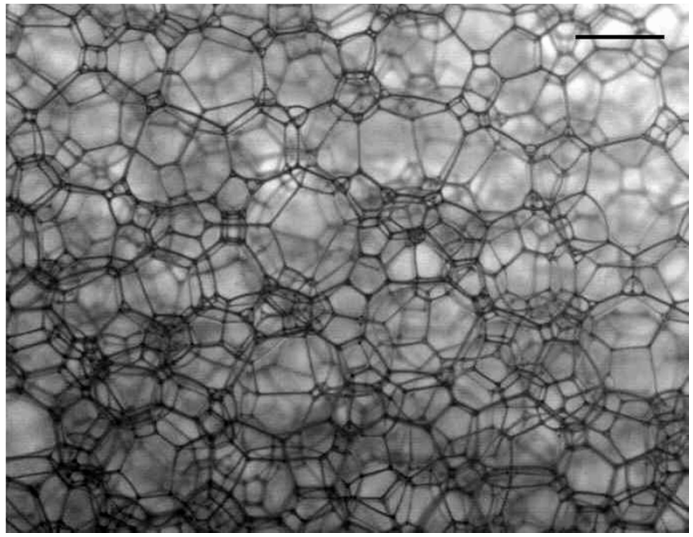
Drop Tower

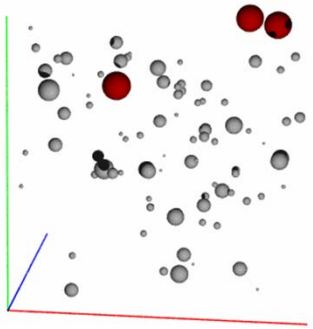
Parabolic Flight

Sounding rocket

International Space station

Foams and Emulsions





Coarsening of very wet foam:

- Diffusing Wave Spectroscopy (DWS)
- Time resolved Correlation (TRC)

EXCHANGEABILITY of the individual cell samples

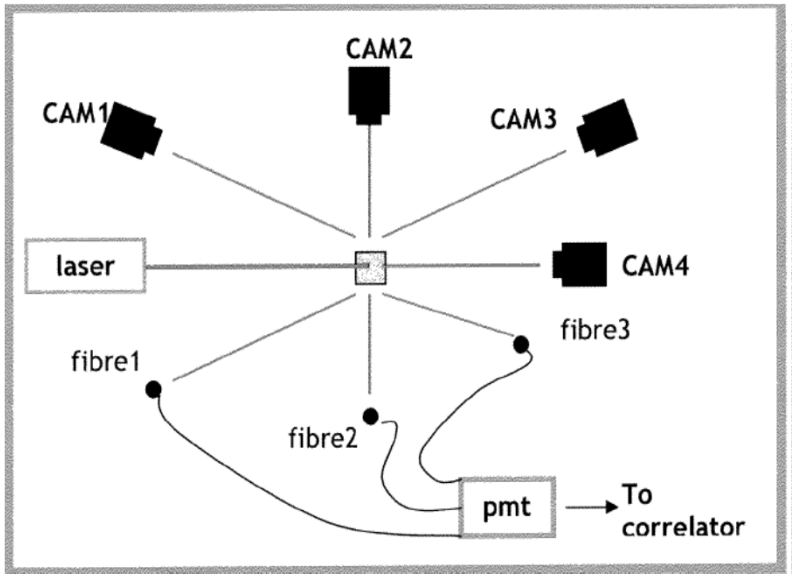
-> Launch 2015

Study the droplets size distribution and dynamics:

- Optical tomography
- Differential calorimetry
- Drop tensiometer

-> Launch 2013

Colloids



- DLS+SLS at two (three) angles: (near)backscattering (fibre1), 90º (fibre2) and a low angle in the range 35º-70º (fibre 3)
- SALS in homodyne configuration with a CCD or CMOS camera (CAM4);
- TRC at two (three) angles with CCD or CMOS (CAM1, CAM2, CAM3).

•EXCHANGEABILITY of the individual cell samples

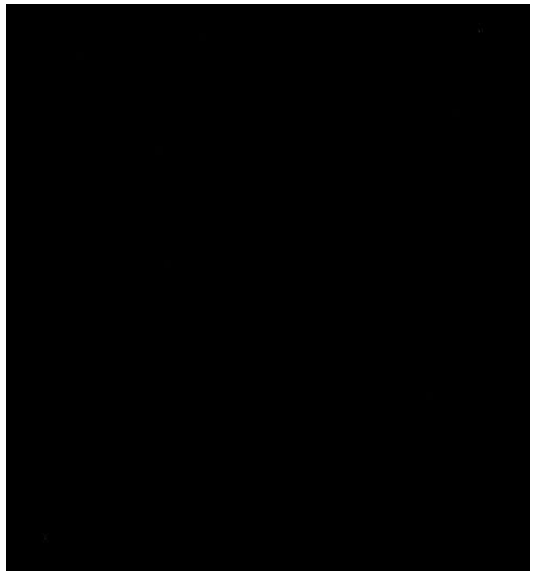
Metallic foams

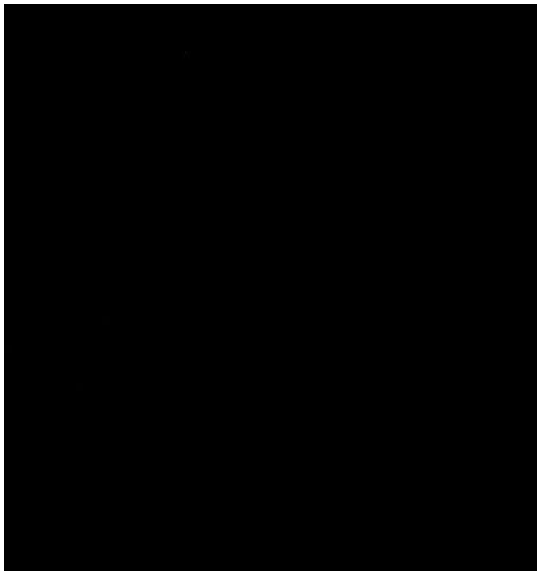
Ground

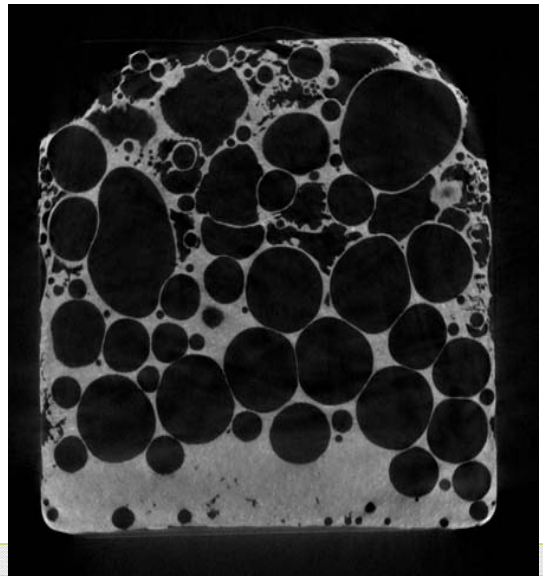
Space

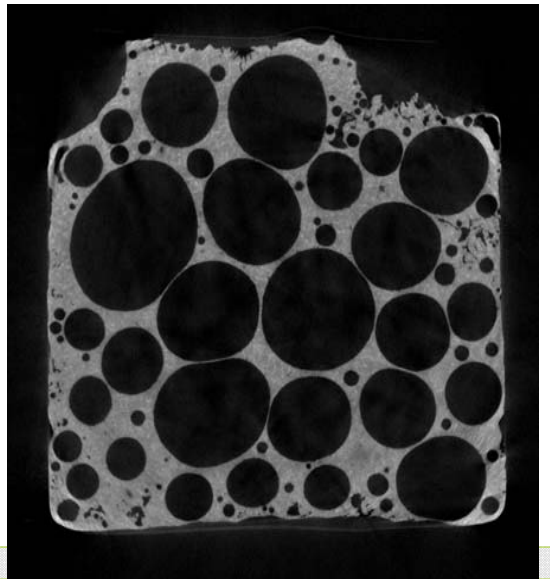
Observation of metallic foam formation by the ‘bread process’.
Unexpected observation of foam destabilisation even without drainage.
Coarsening comparable with or without drainage

-> New knowledge-based process patented





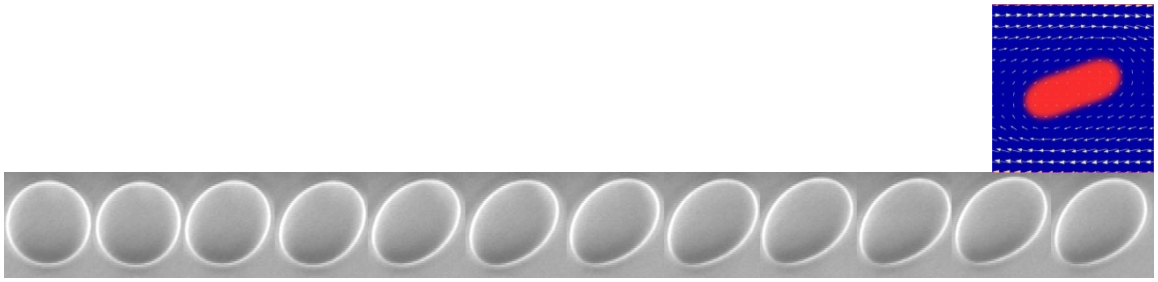




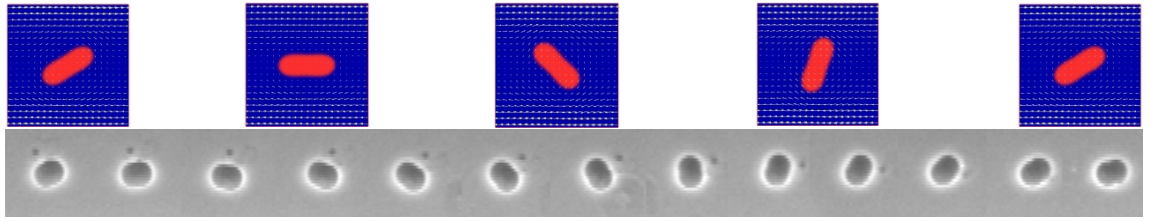
BIOMIMETIC LIQUIDS

Physics:
Rheology of non-newtonian fluids, complex hydrodynamic interactions

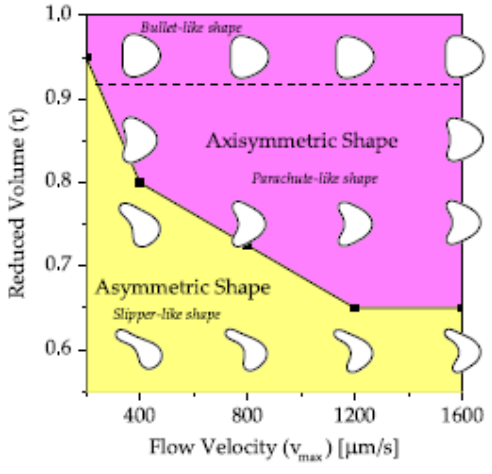
Biology:
blood flow, cell function, may ultimately result into mechanical effect, stiffness…



Tank treading

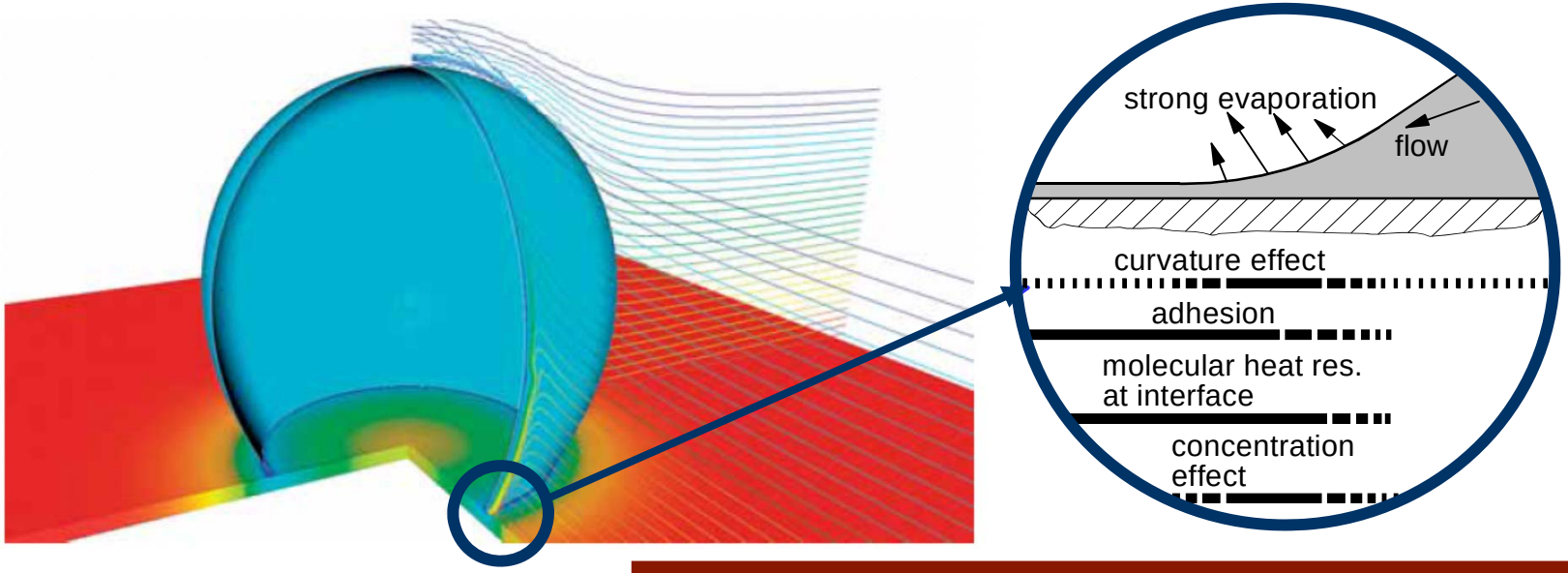


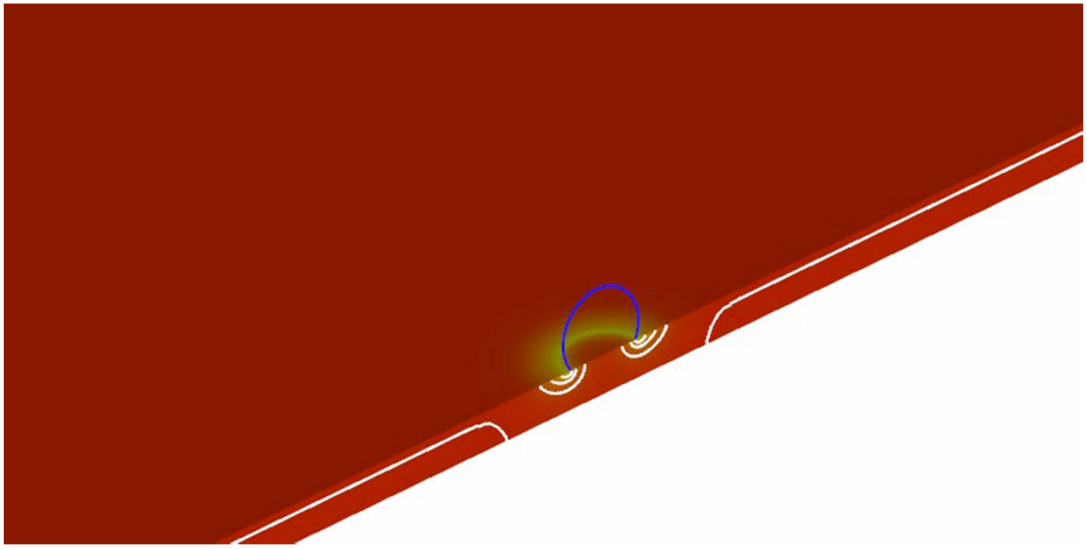
Tumbling



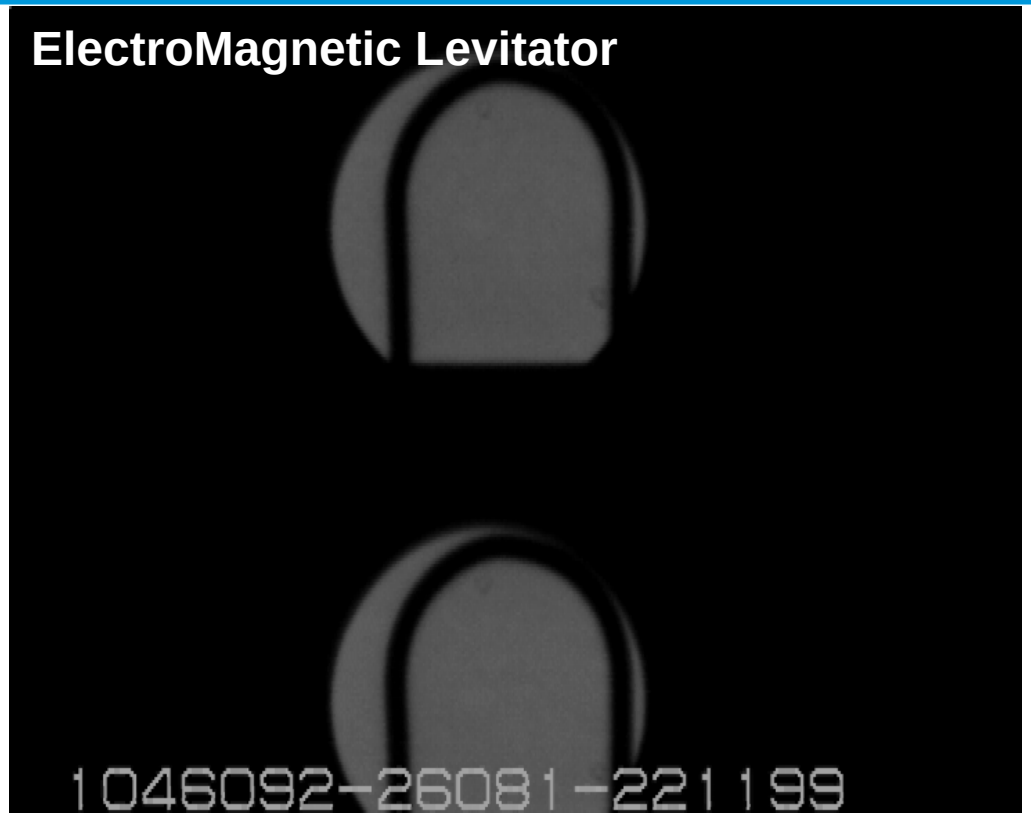
Misbah et al, PRL 2009

BOILING

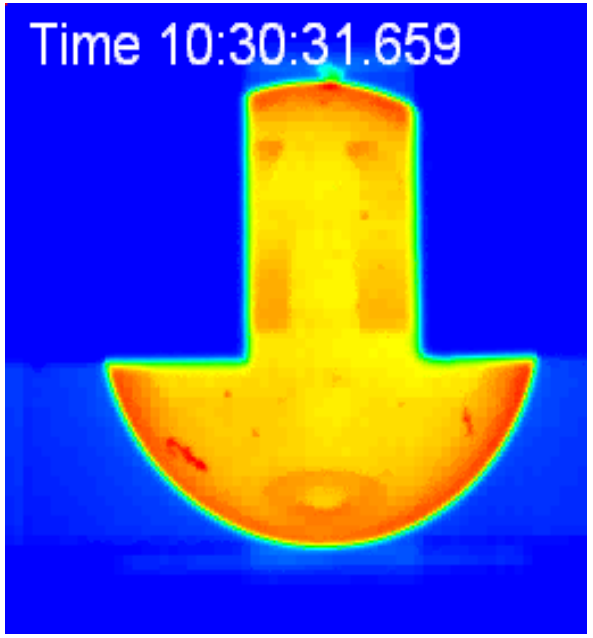

strong evaporation
flow
curvature effect
adhesion
molecular heat res.
at interface
concentration
effect



Metallic drops



Growth velocity of Fe-10Ni
High Speed Camera (on Parabolic Flight)

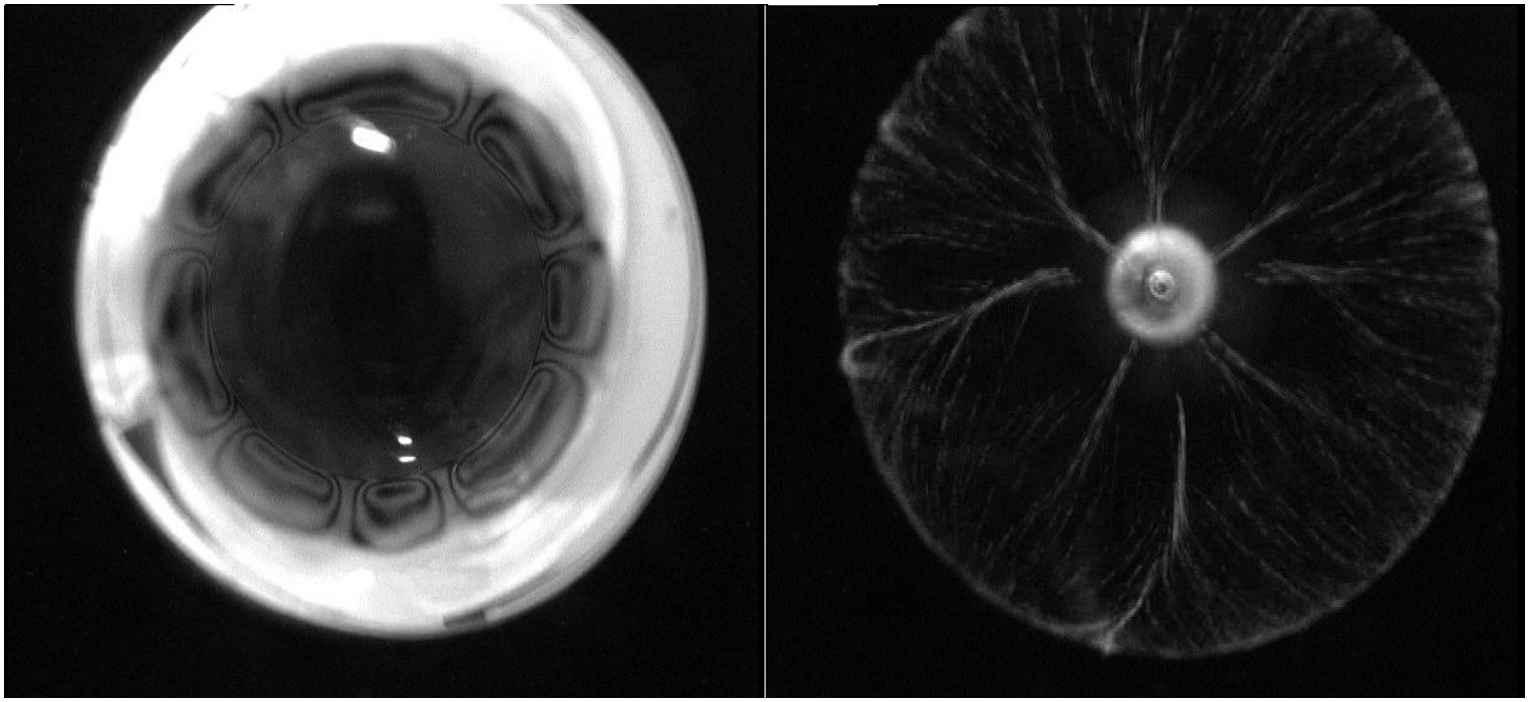


Courtesy: MAGNEPHAS team

Thermal expansion (optical metrology), surface tension and viscosity (surface oscillation), heat capacity (temperature response to heat pulse), total emissivity (pyrometry), electrical resistivity (electric coupling with the coil)

Undercooling and nucleation (triggered or spontaneous) -> growth velocities by optical observation

Polarized and charged droplets



Topical Team on polarized and charged droplets

Study of problems related to atmospheric electricity, including collisional induced charging, interaction between charged droplets, effect of charging on surface tension, coupling to evaporation and condensation.

Thank you for your attention

Koichi Wakata