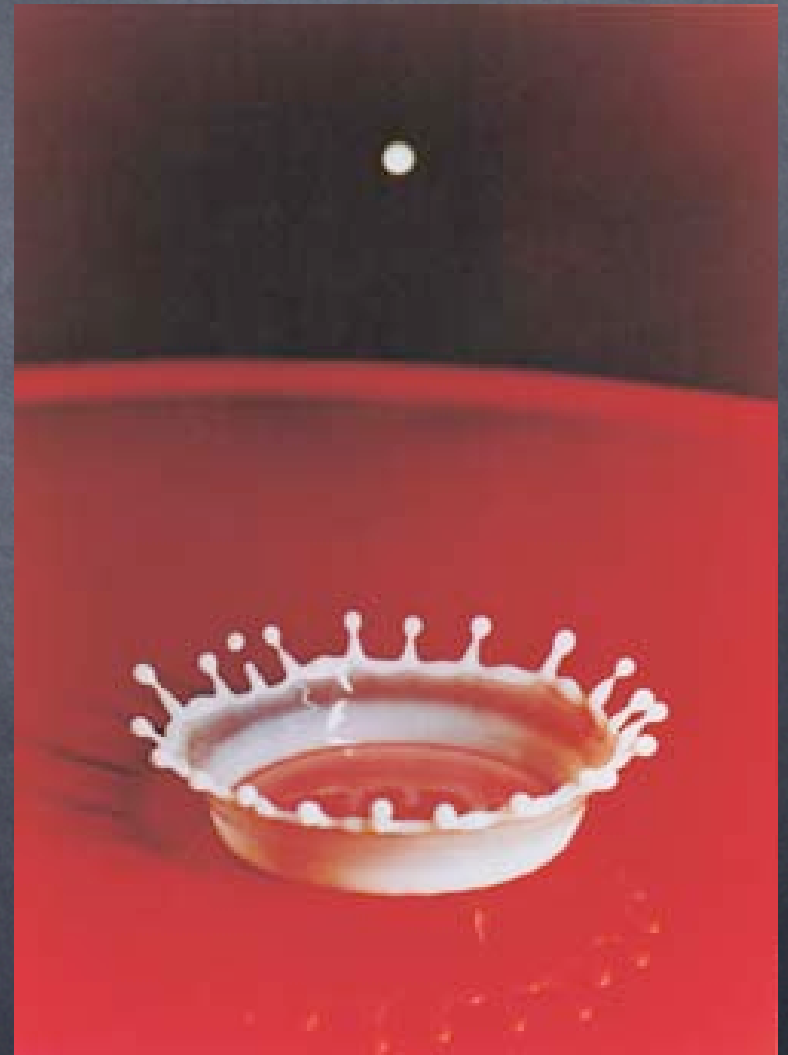


Singular behaviors in drop impacts

Christophe Josserand
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Outline

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- ① Drop impacts dynamics form or stand numerous different singularities

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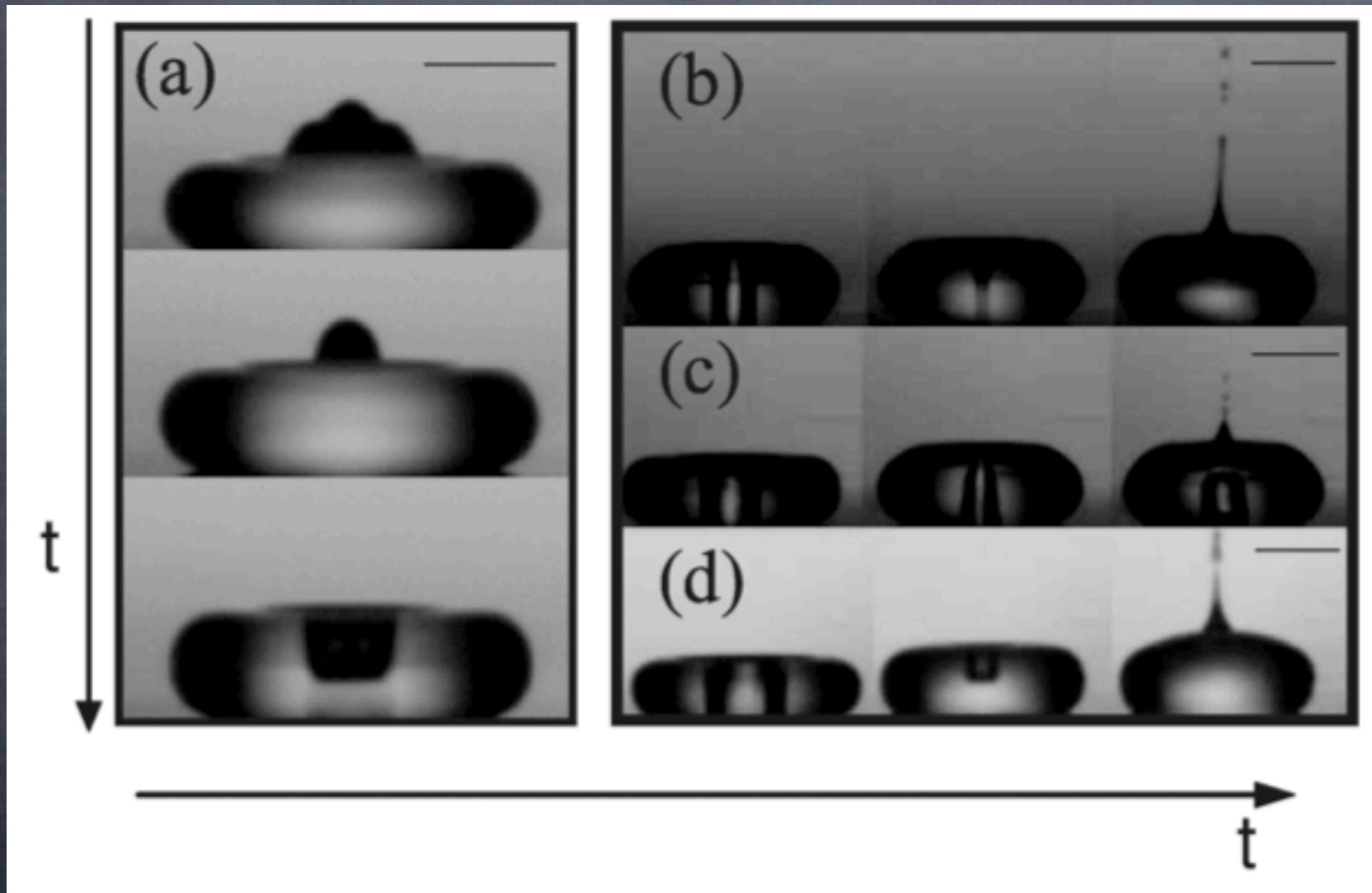
Outline

- ① Drop impacts dynamics form or stand numerous different singularities
- ① Formation of intense jets, bubble entrapments
- ① pressure field produced by the impact

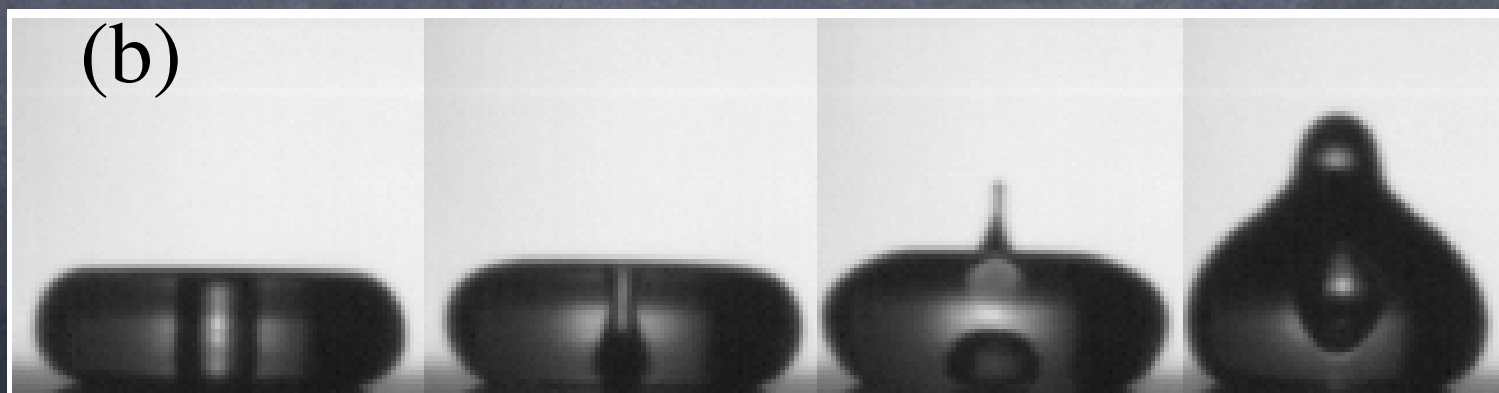
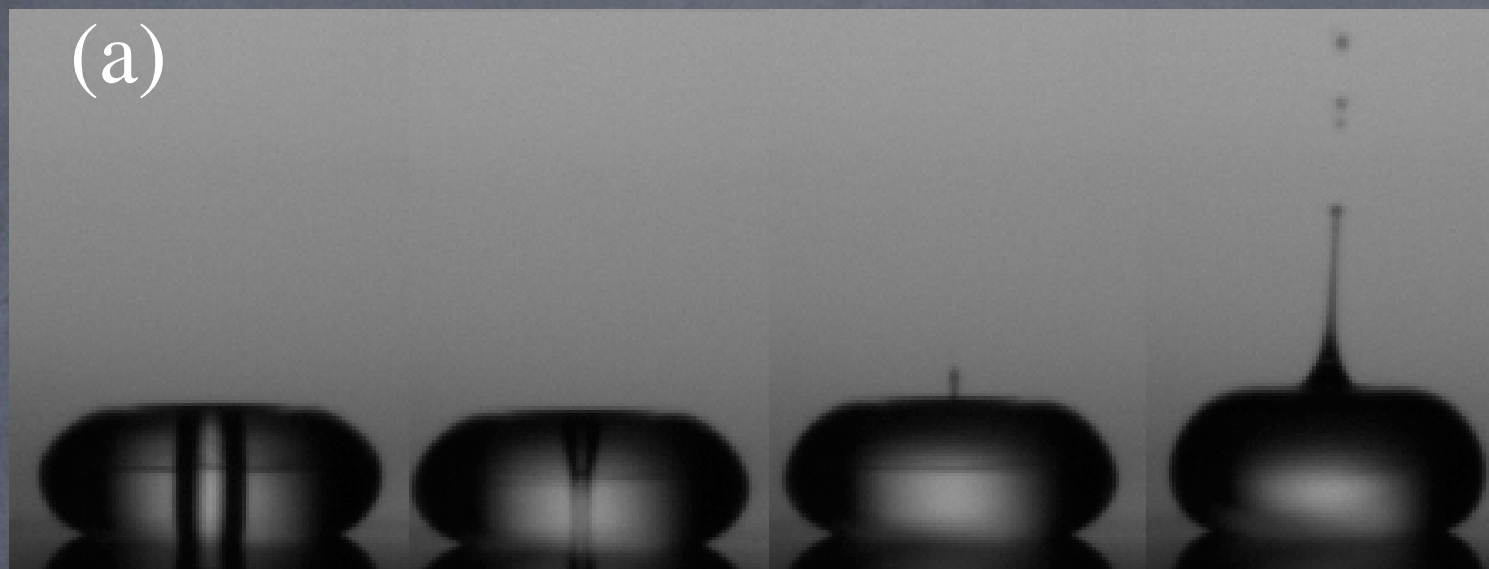
Outline

- ① Drop impacts dynamics form or stand numerous different singularities
- ① Formation of intense jets, bubble entrapments
- ① pressure field produced by the impact
- ① singular boundary layers

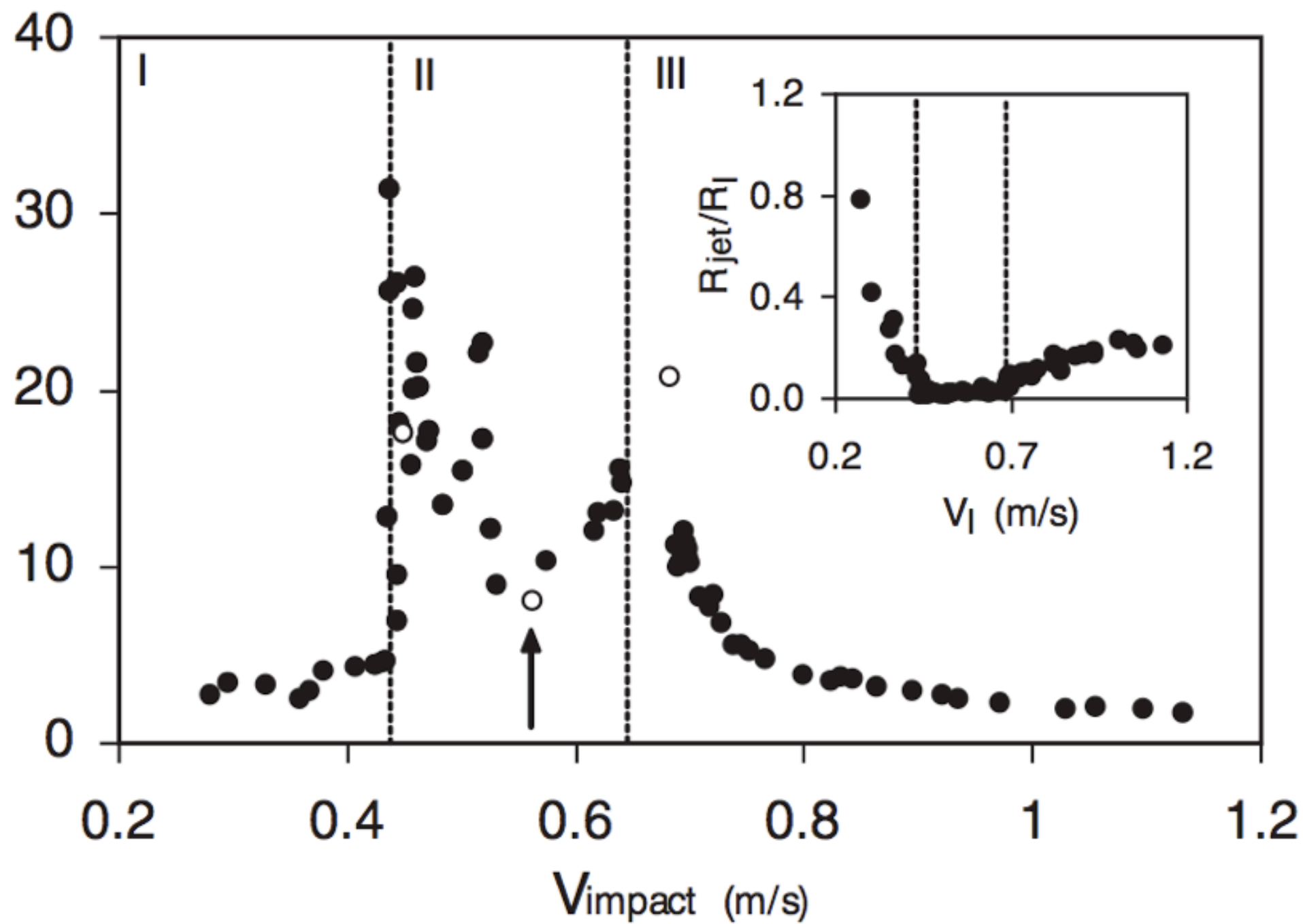
Impact on hydrophobic surface

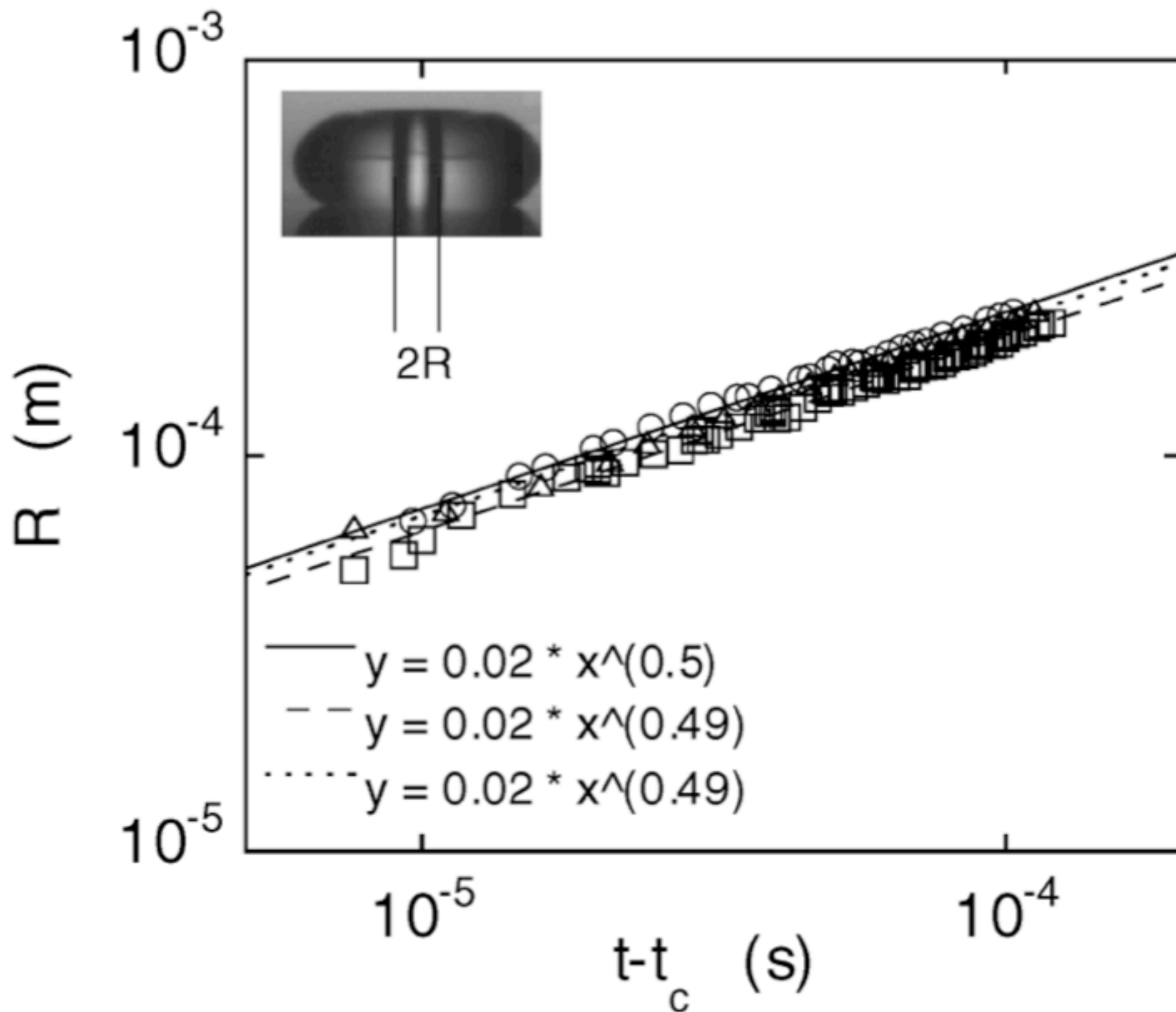


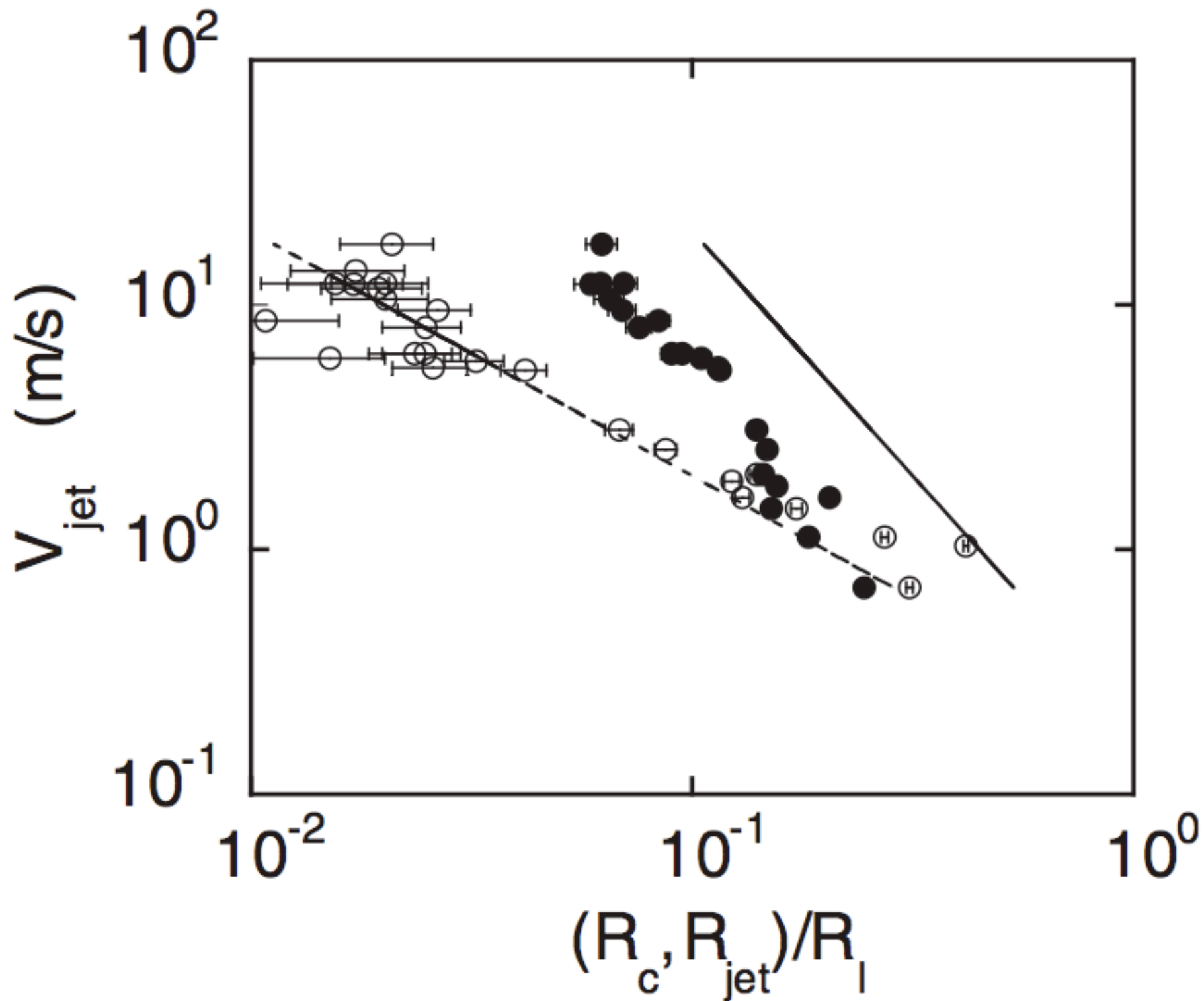
Bartolo, Josserand and Bonn, PRL 96, 124501 (2006)

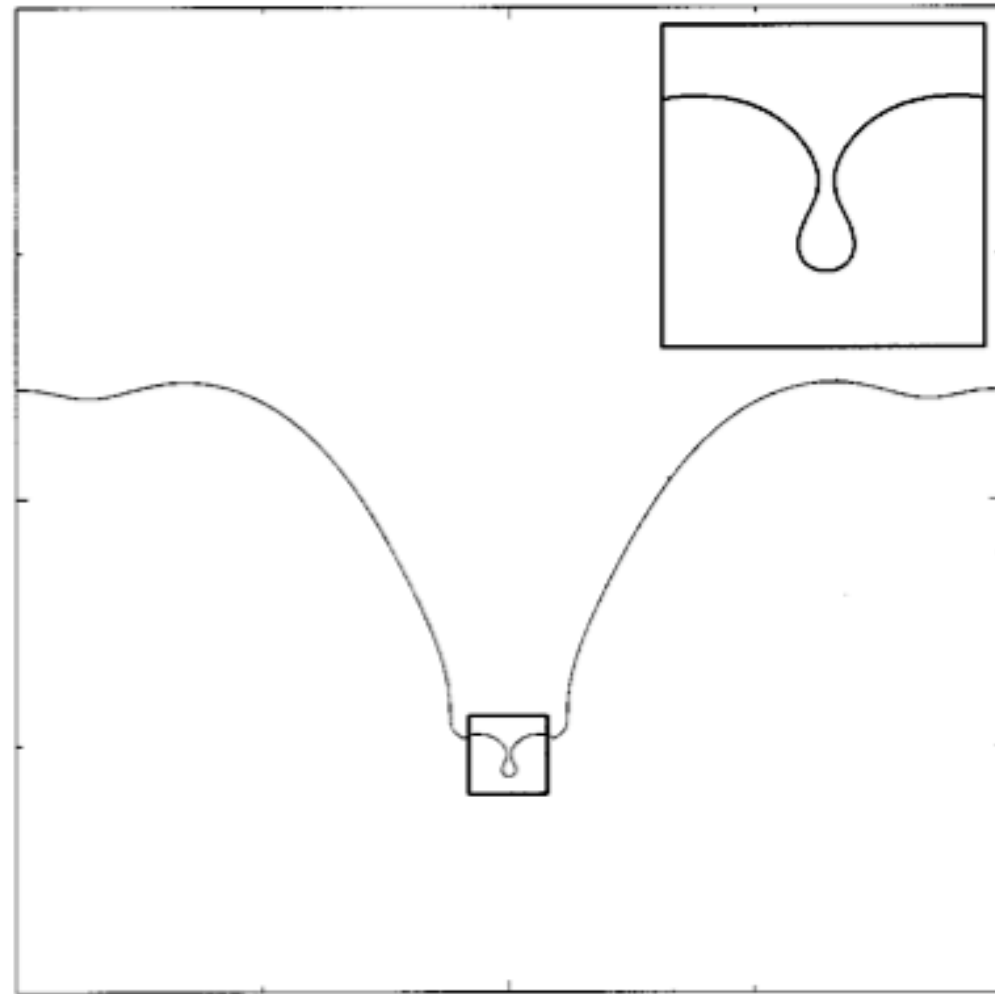
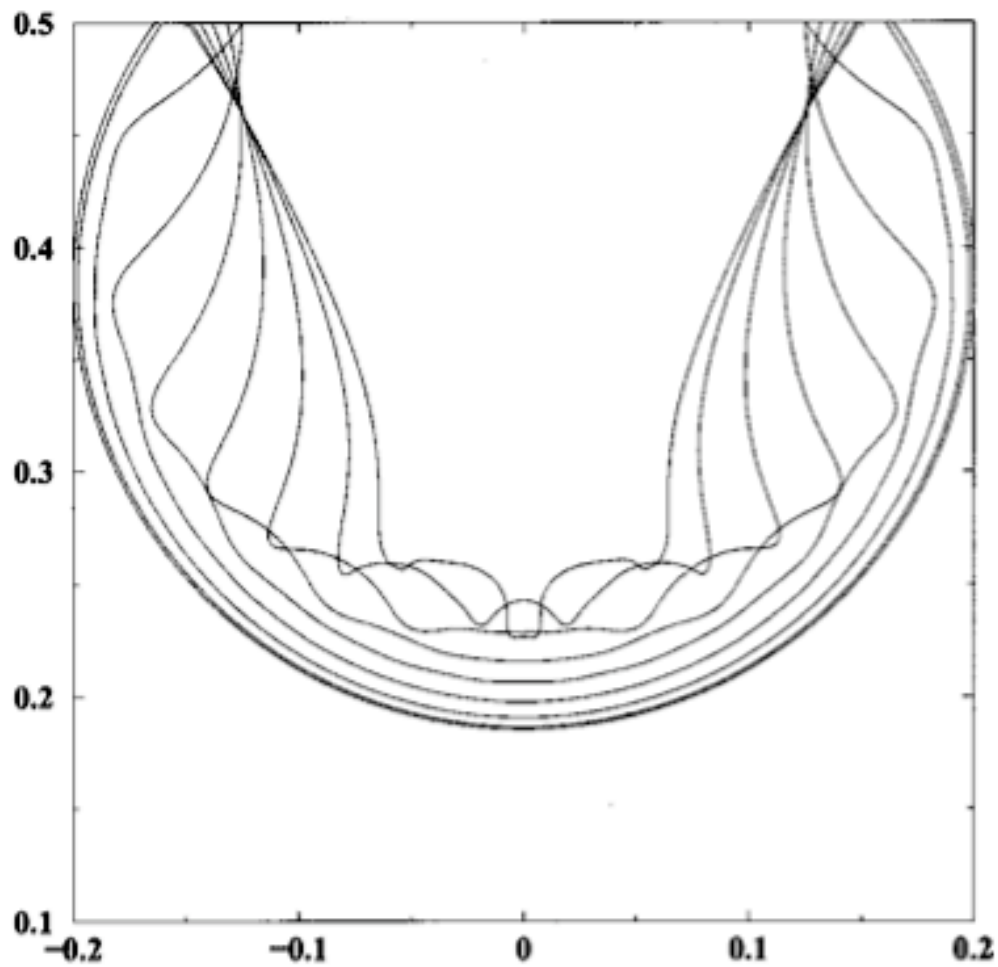


V_{jet}/V_{impact}





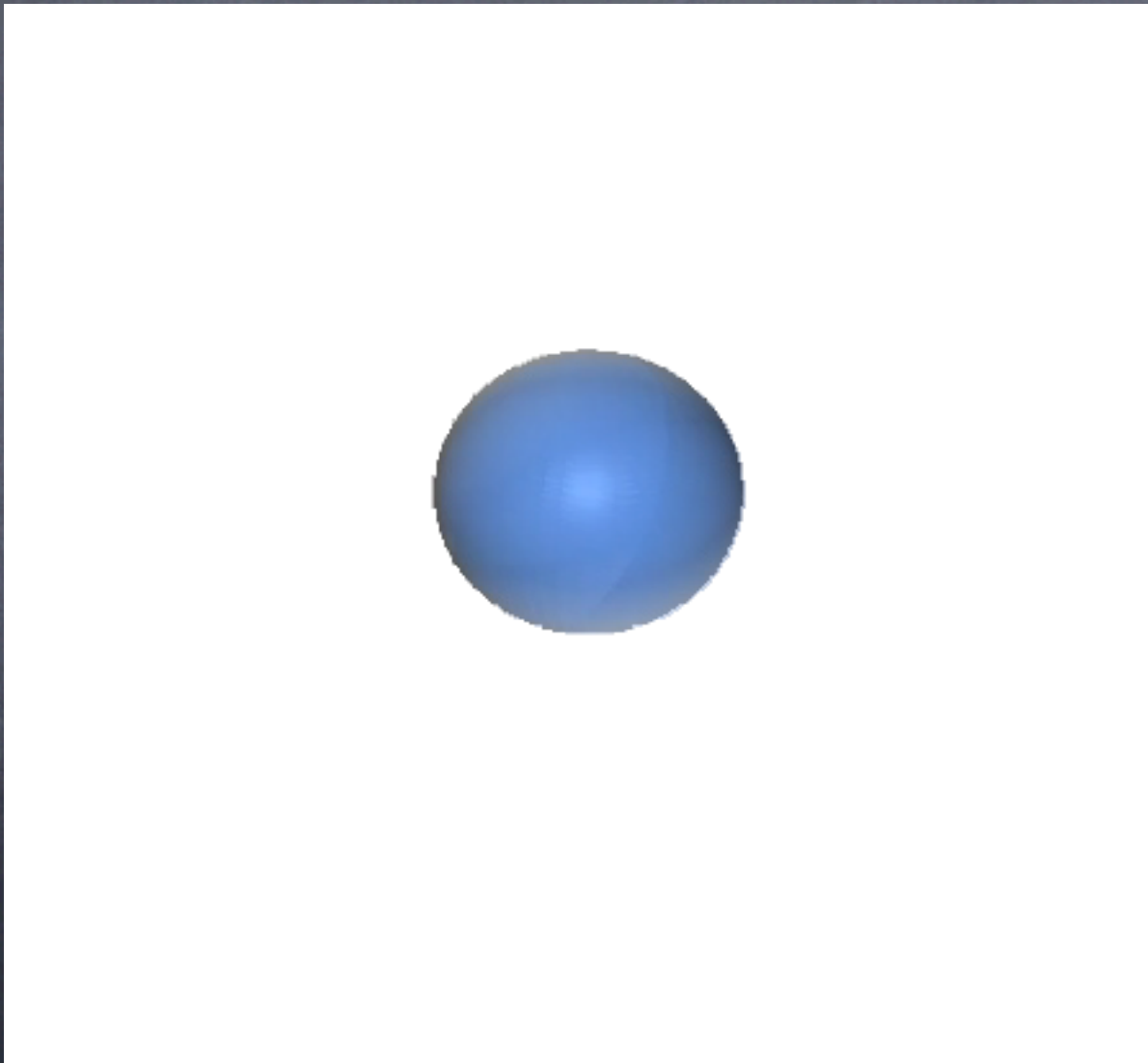


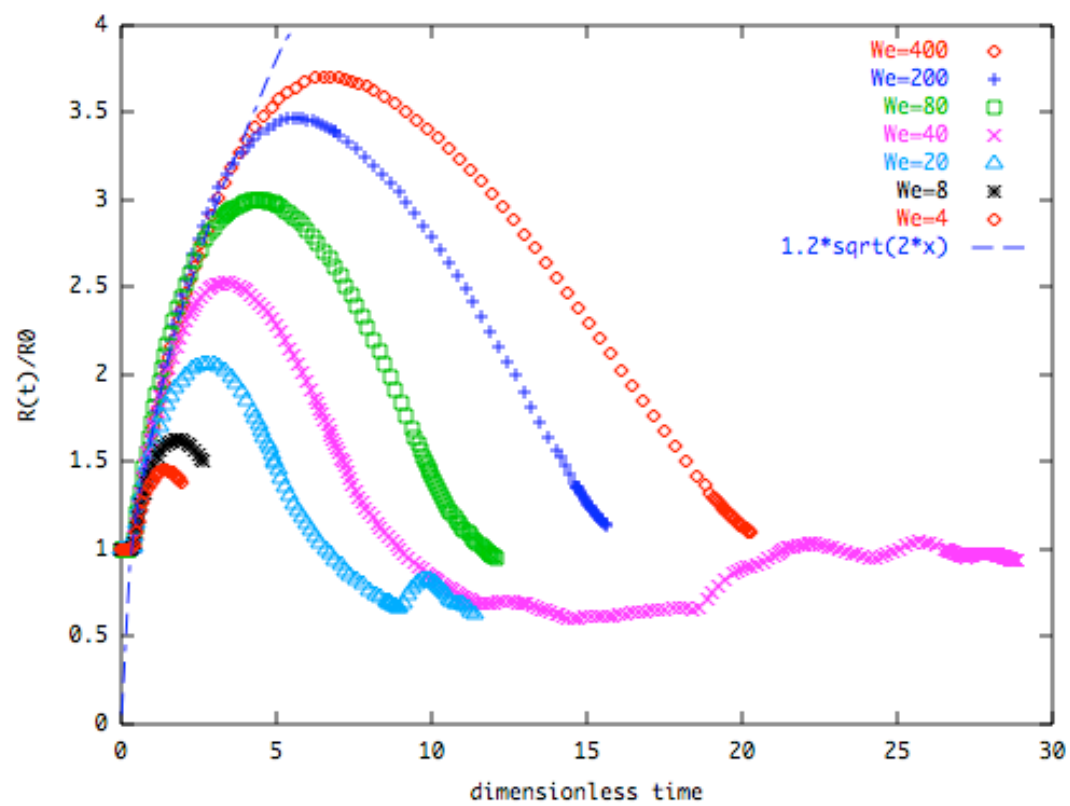
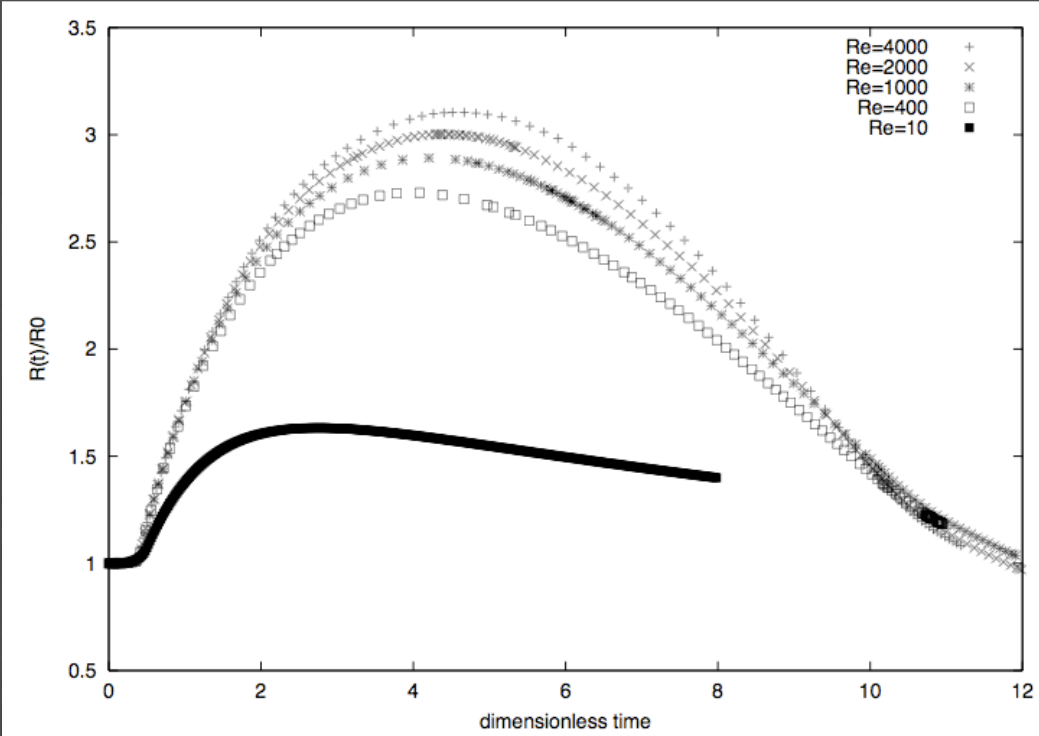


Bubble collapse

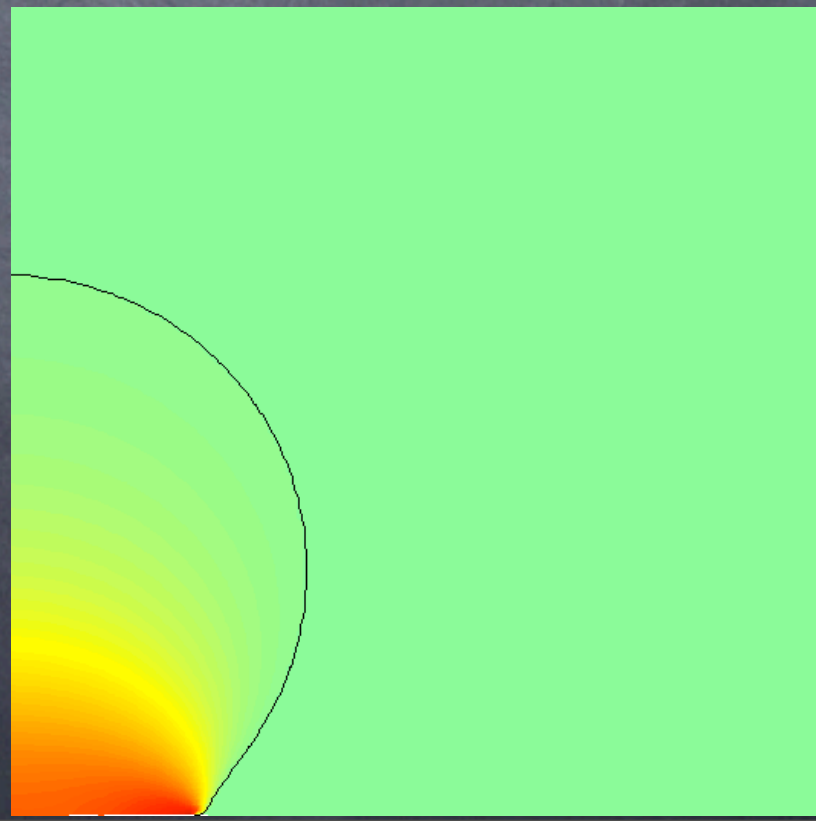
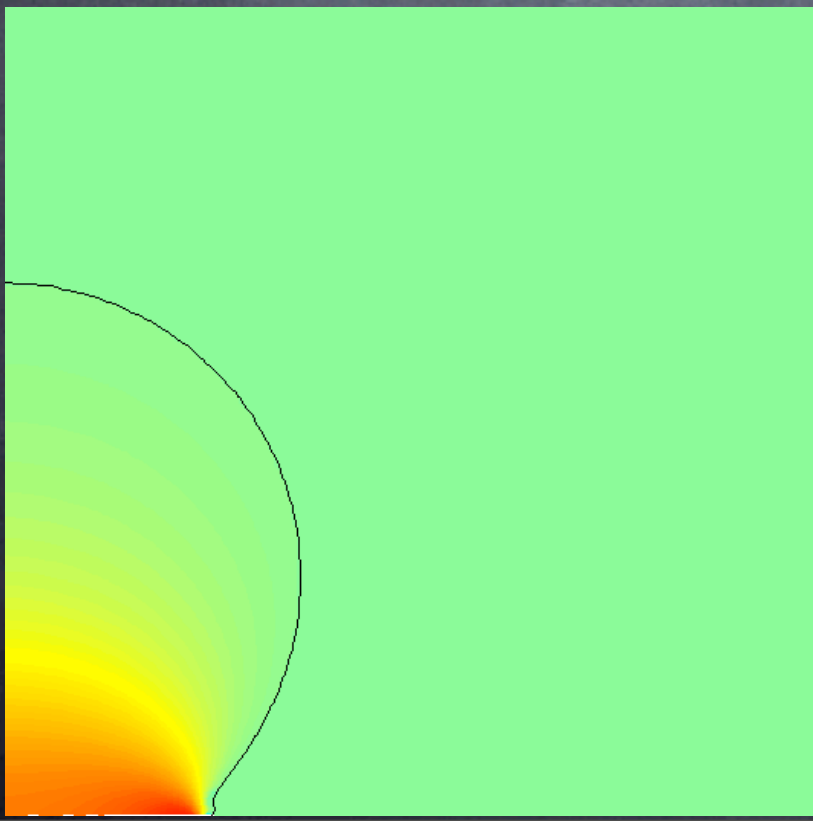
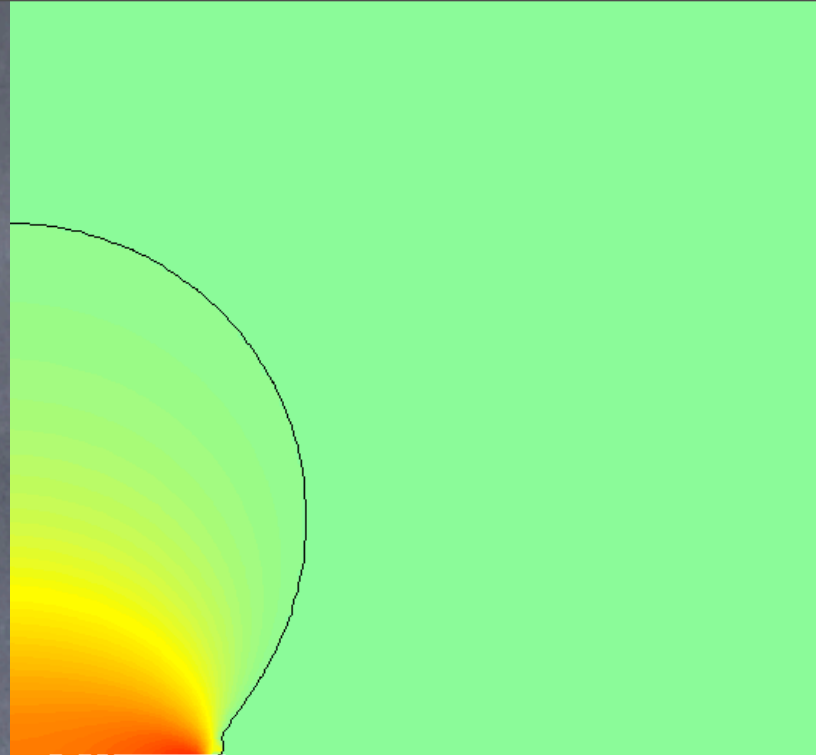
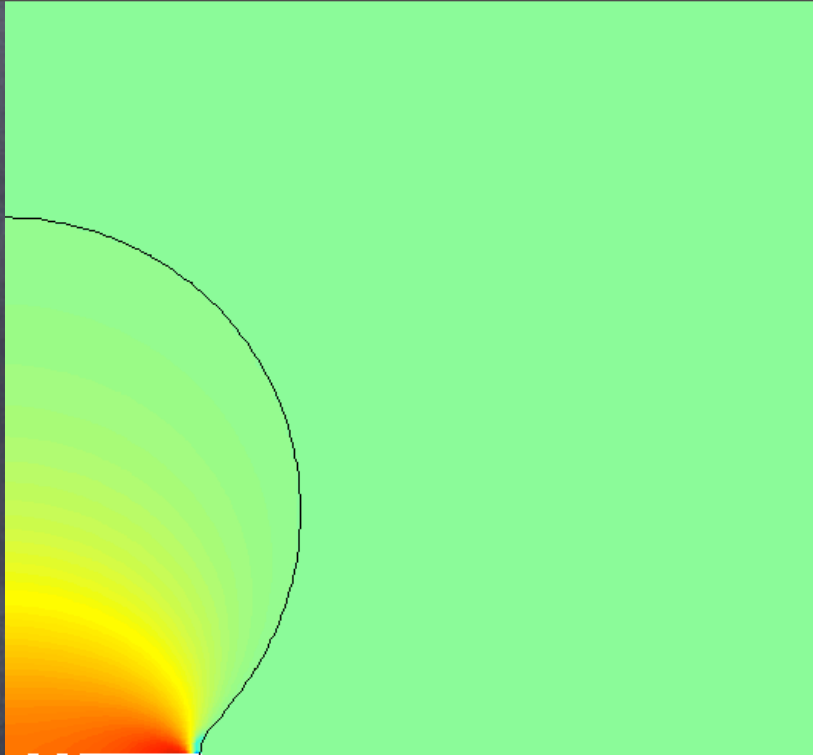
Duchemin, Popinet, Josseland and Zaleski, POF 14, 3000-3008 (2002)

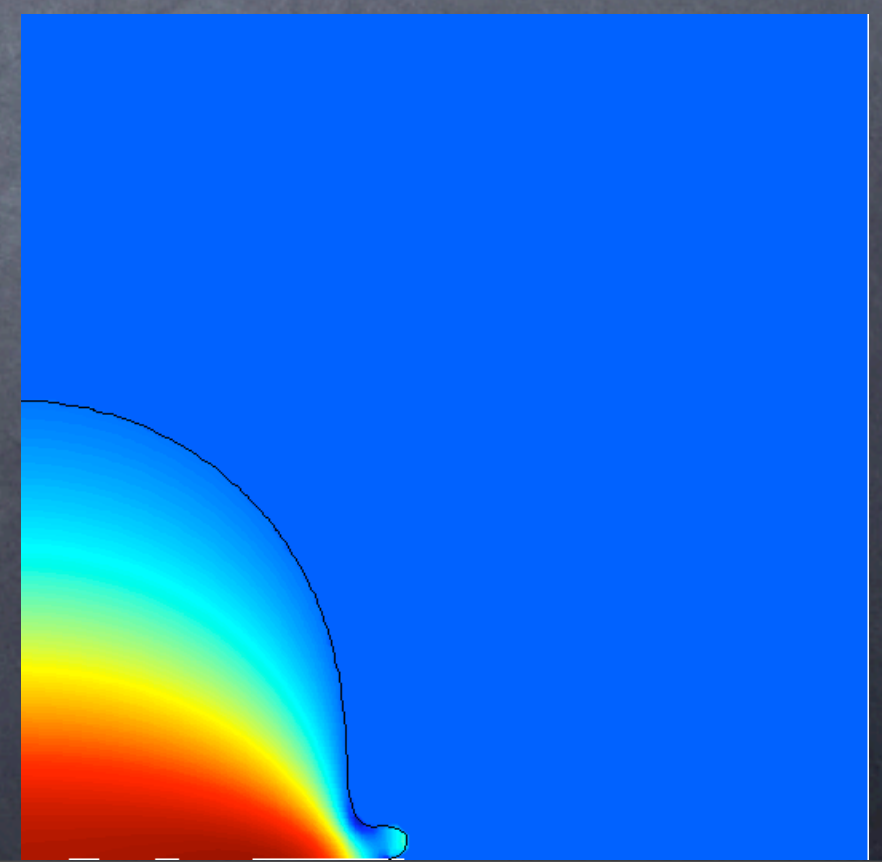
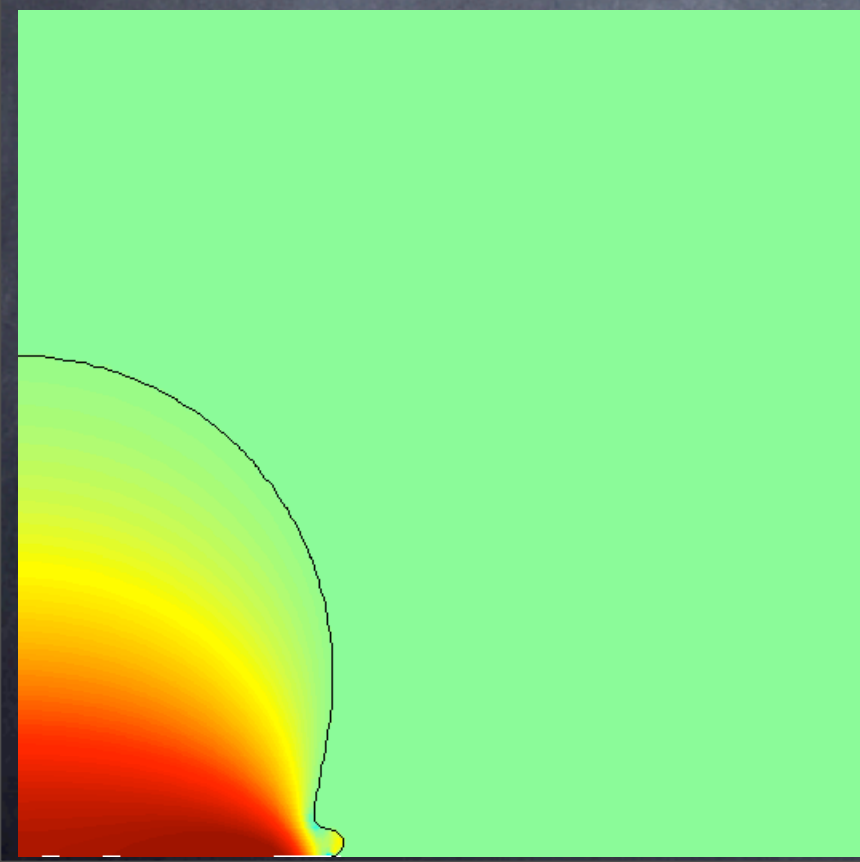
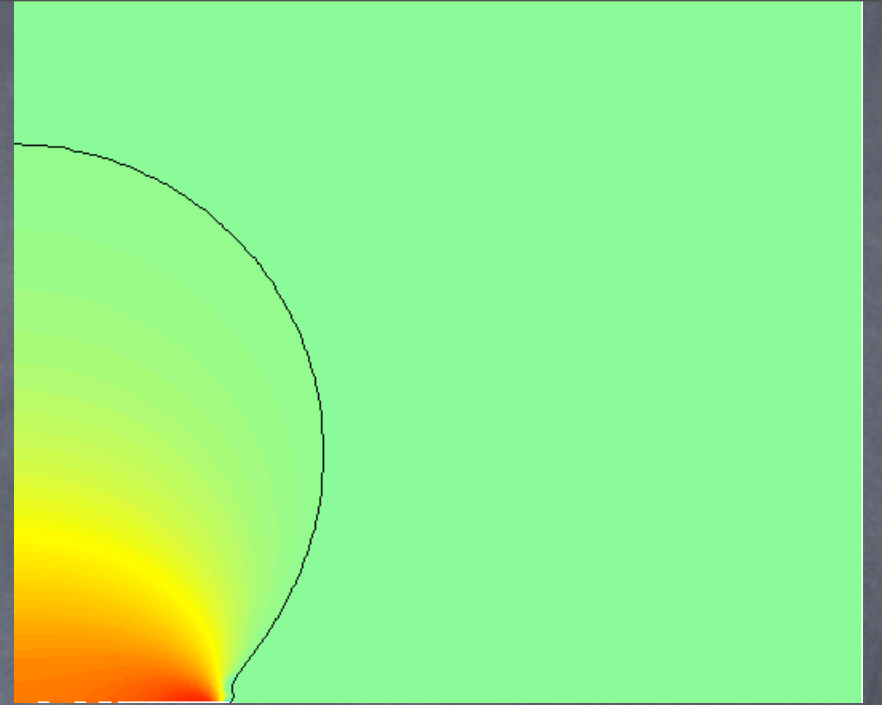
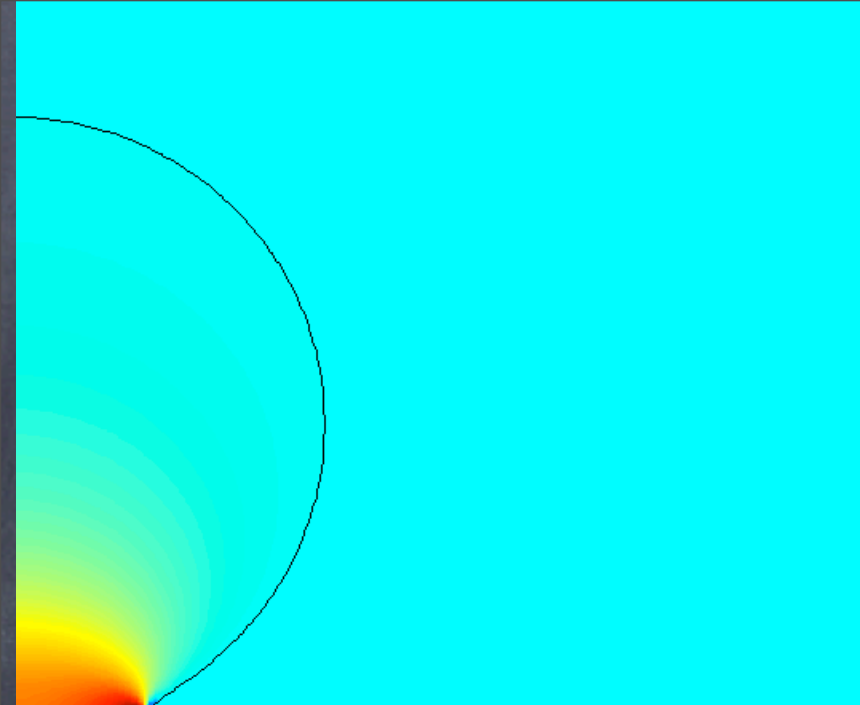
Pressure field: numerical simulation

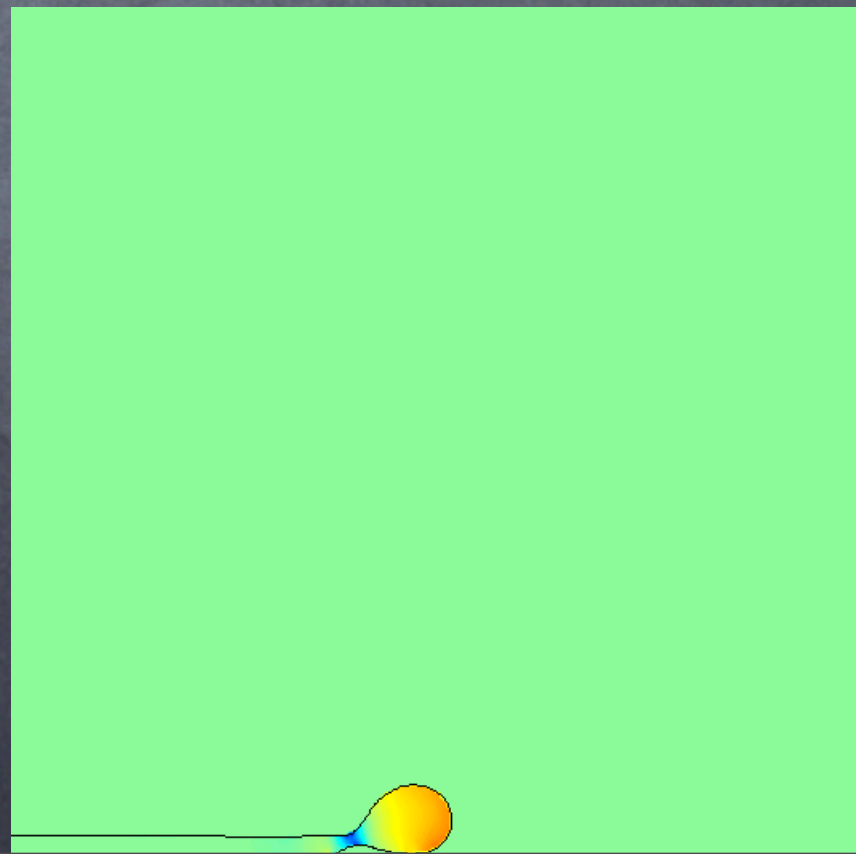
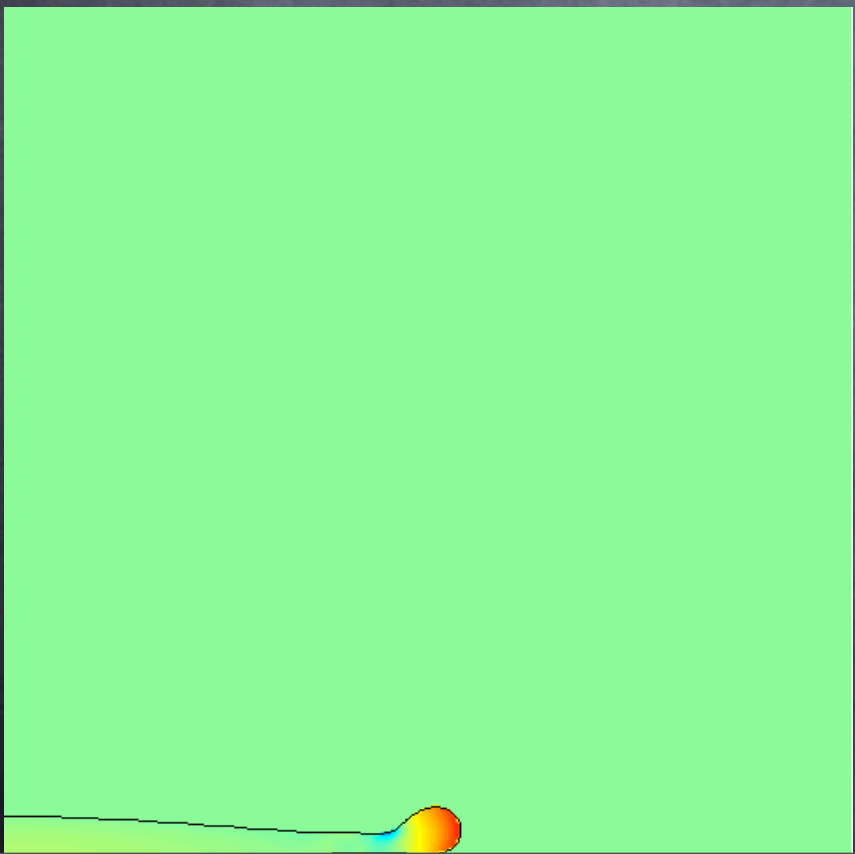
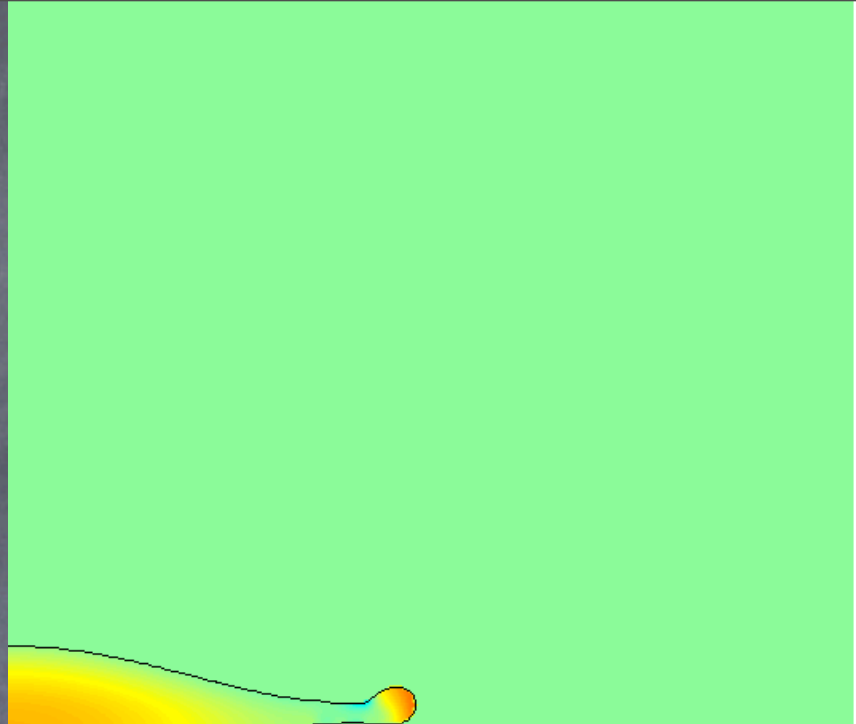
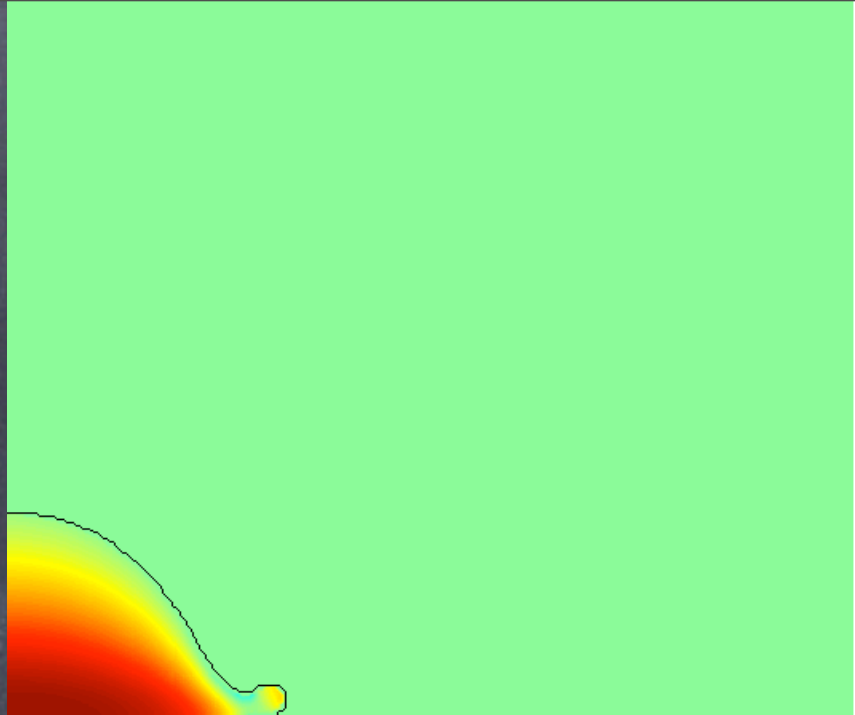




- ⑥ Pressure field at short time?
- ⑥ Self-similar structure can be identified
- ⑥ Pressure impact theory
- ⑥ Pressure decreases like $1/\sqrt{t}$
- ⑥ Parabolic profile near the center
- ⑥ Pressure impact decreases dramatically for large time as expected by the theory
- ⑥ Film thin equation in cylindrical geometry

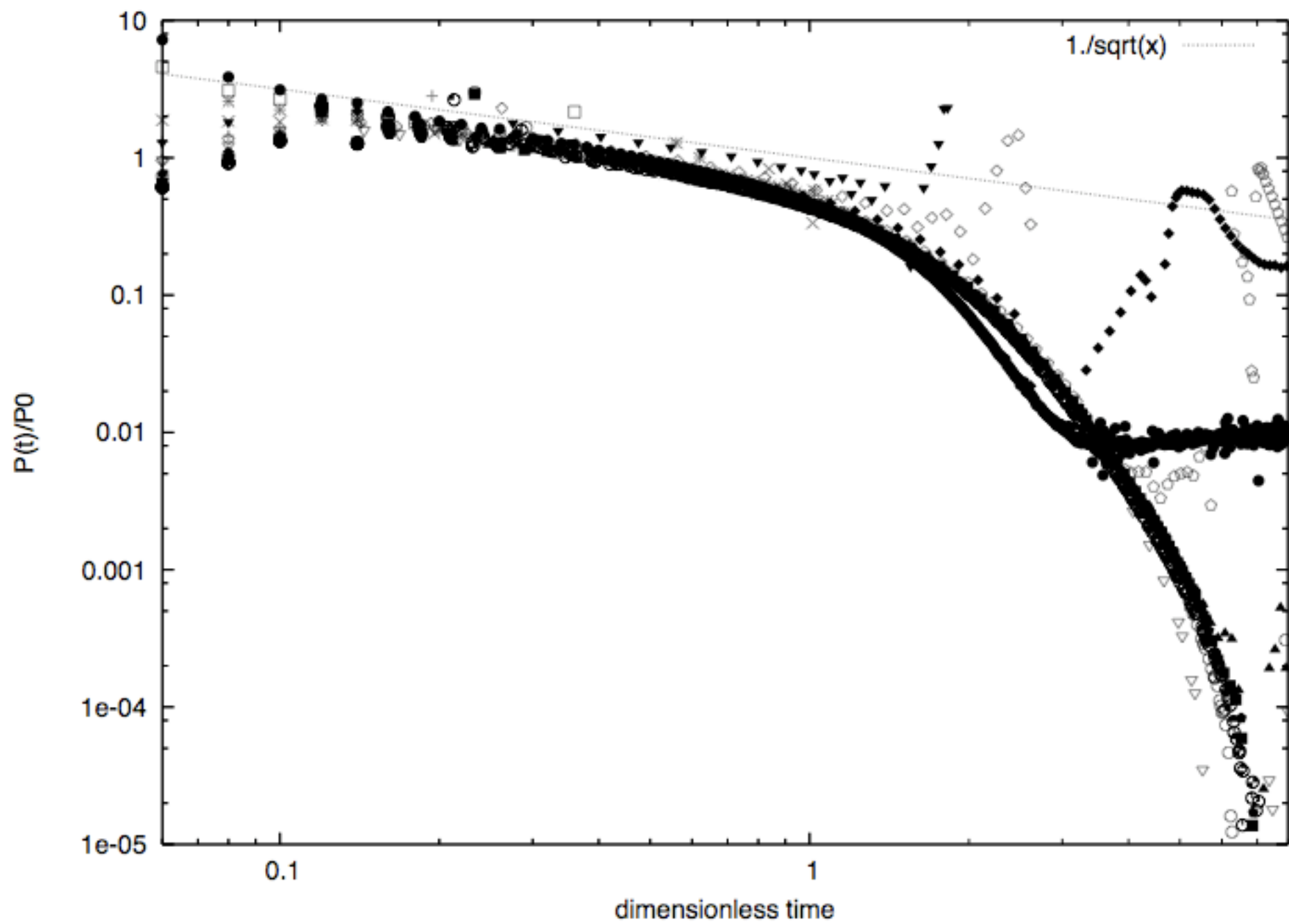


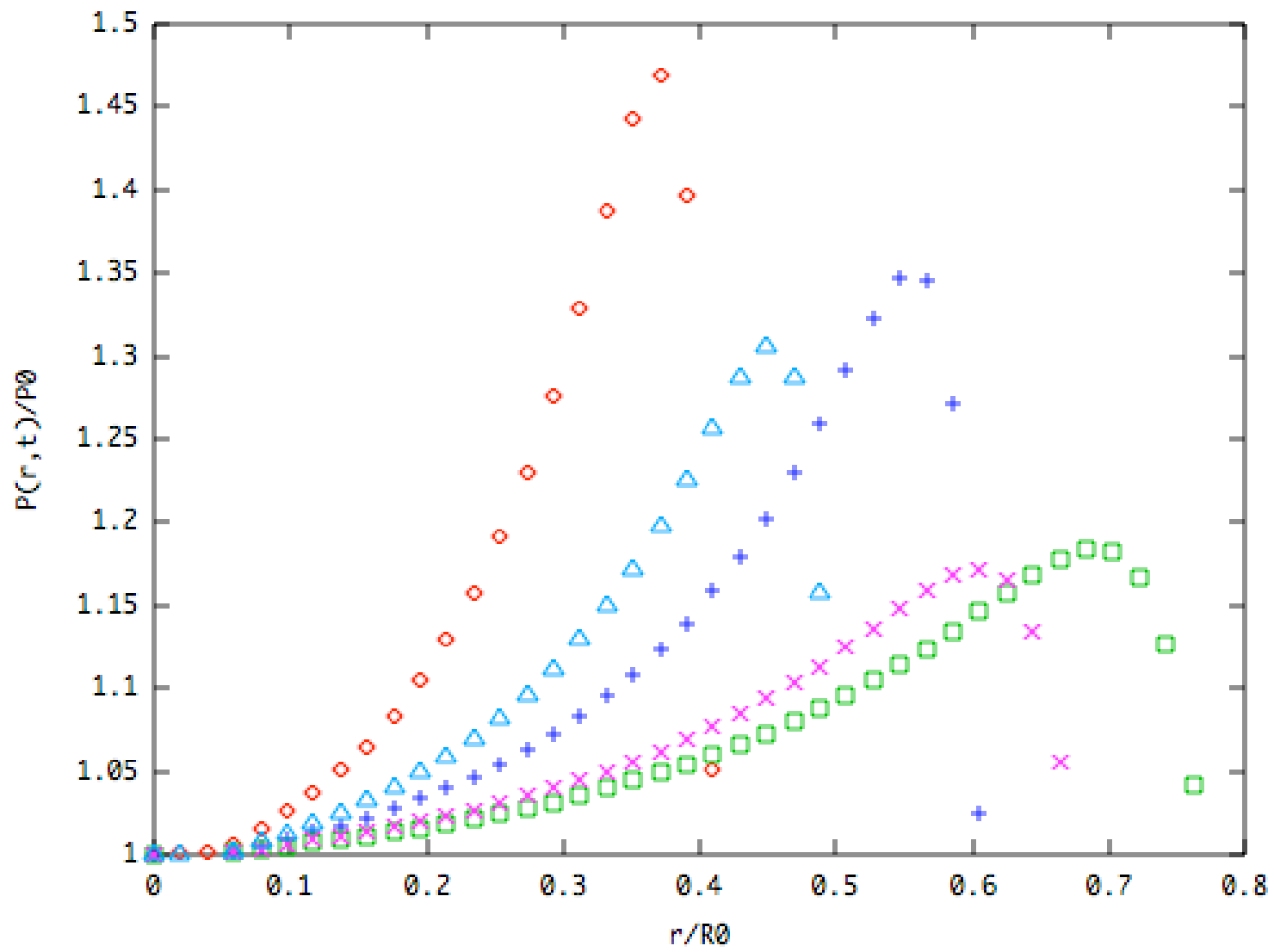


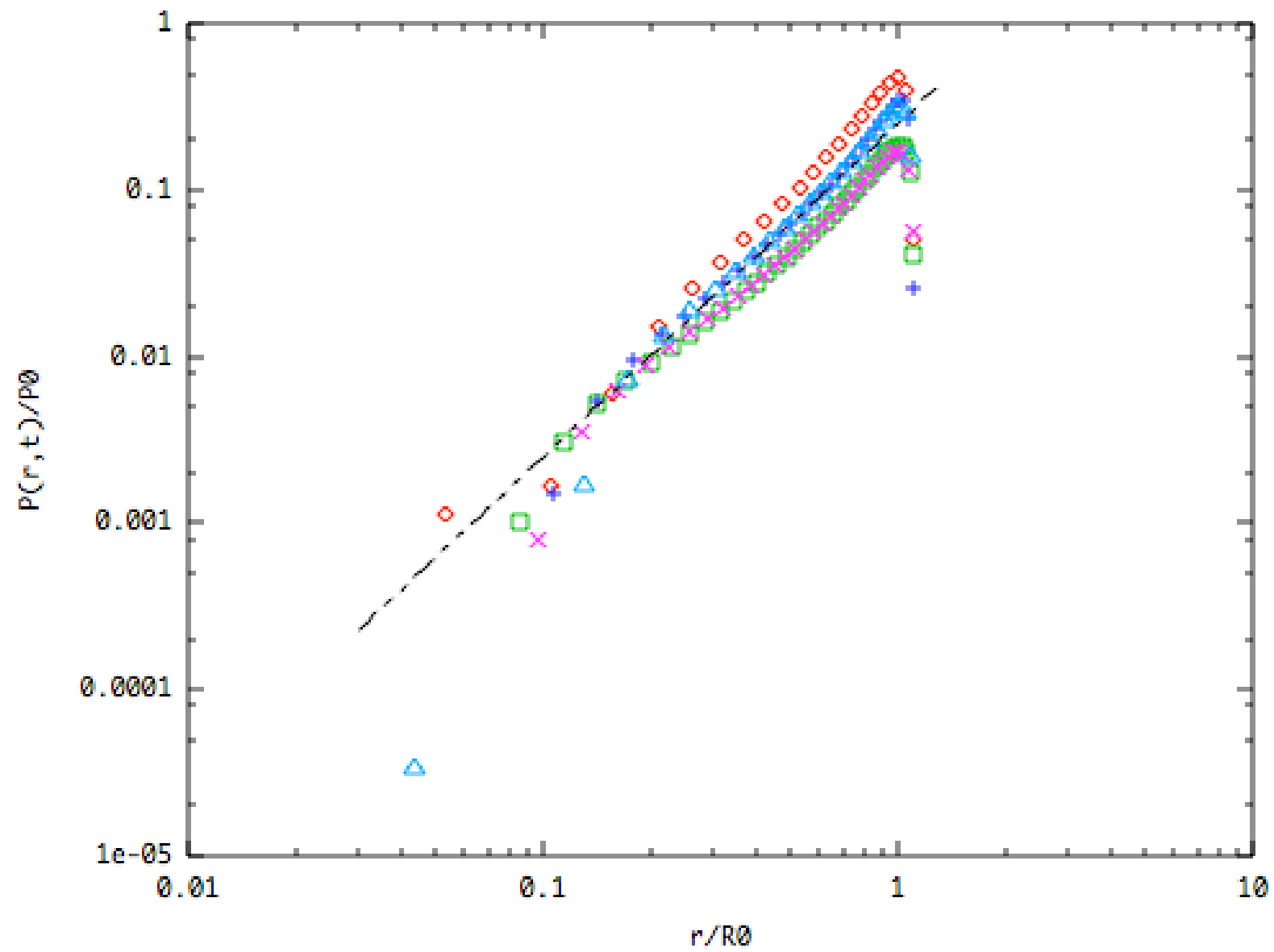


- ⑥ Pressure field near the bottom
- ⑥ deviates the velocity field from vertical to horizontal directions
- ⑥ self-similar zone of deviation with intersection radius

$$\frac{P(r, t)}{\rho U_0^2} = \frac{R_0}{\sqrt{2R_0 U_0 t - r^2}}$$

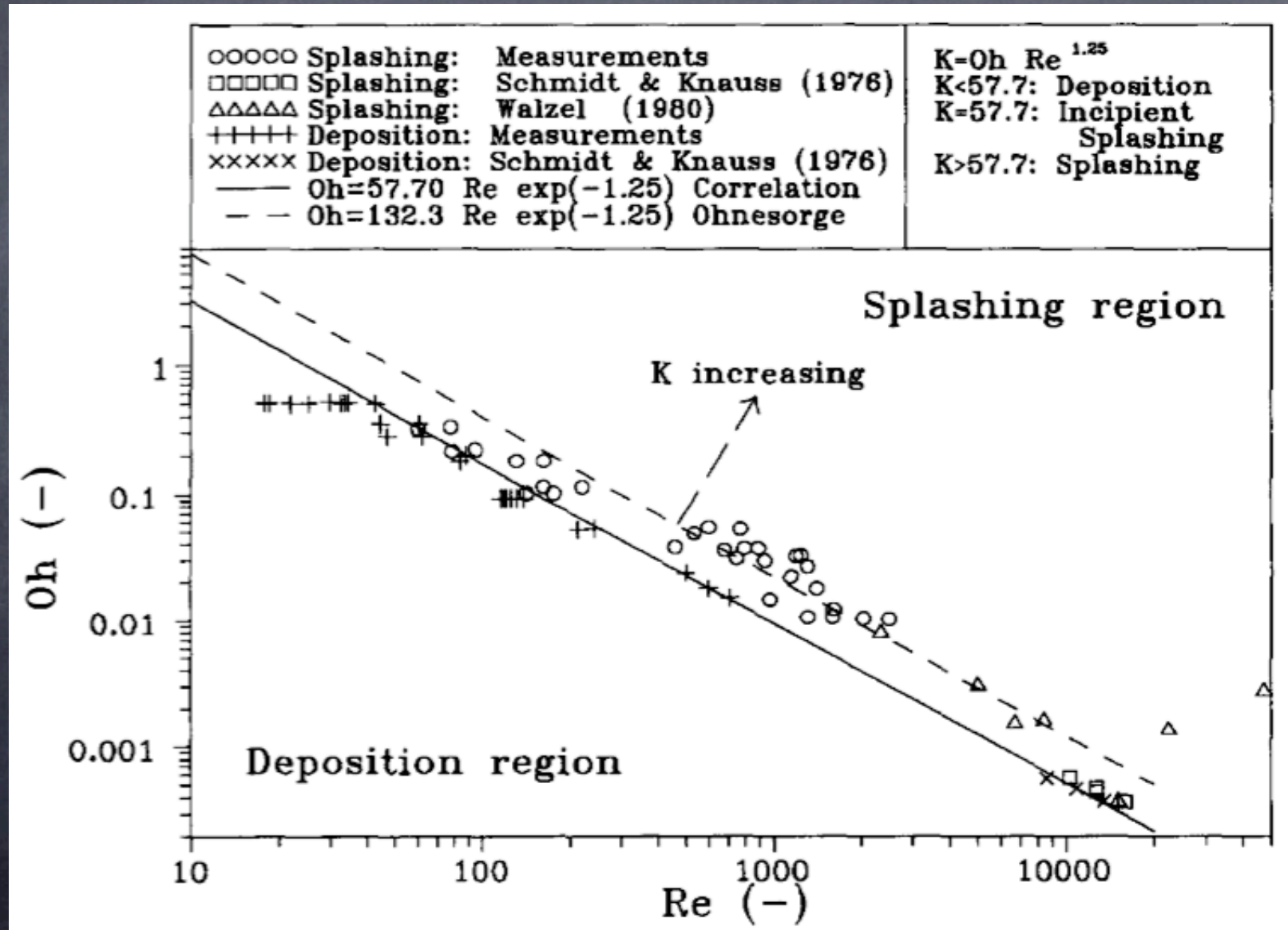






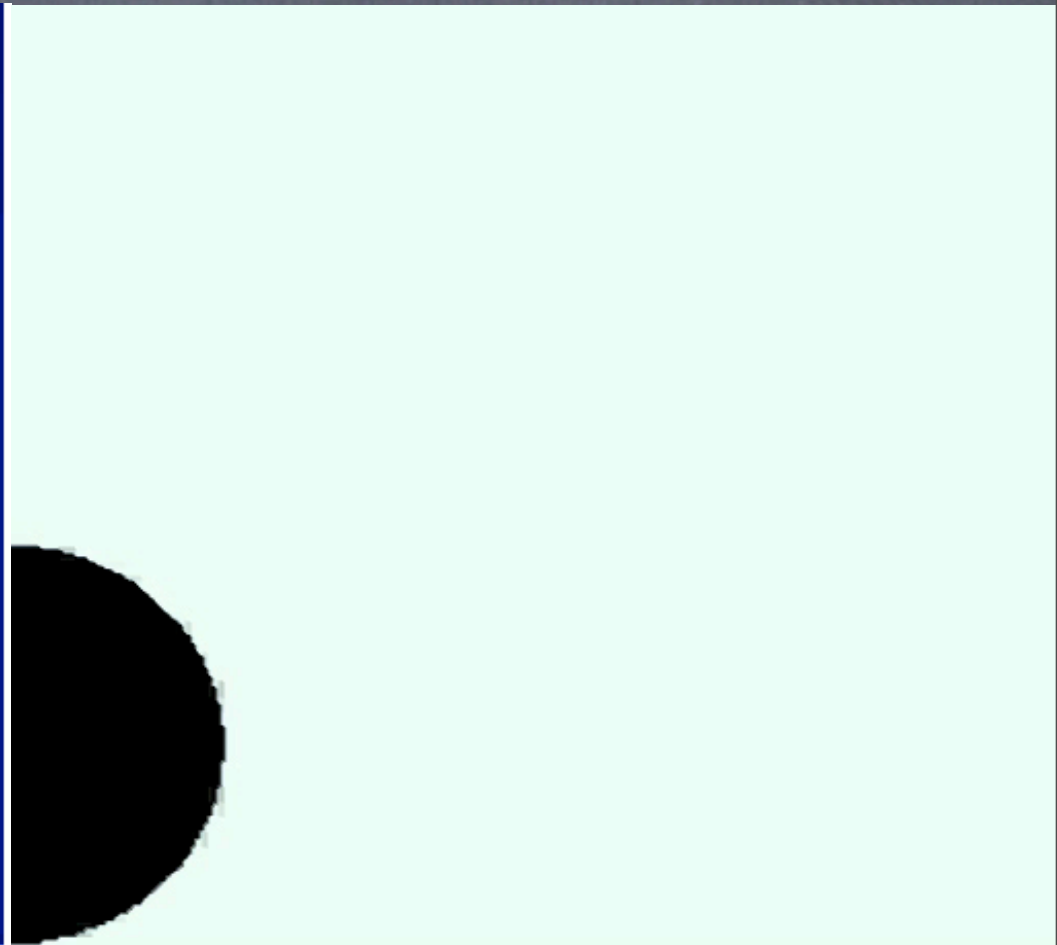
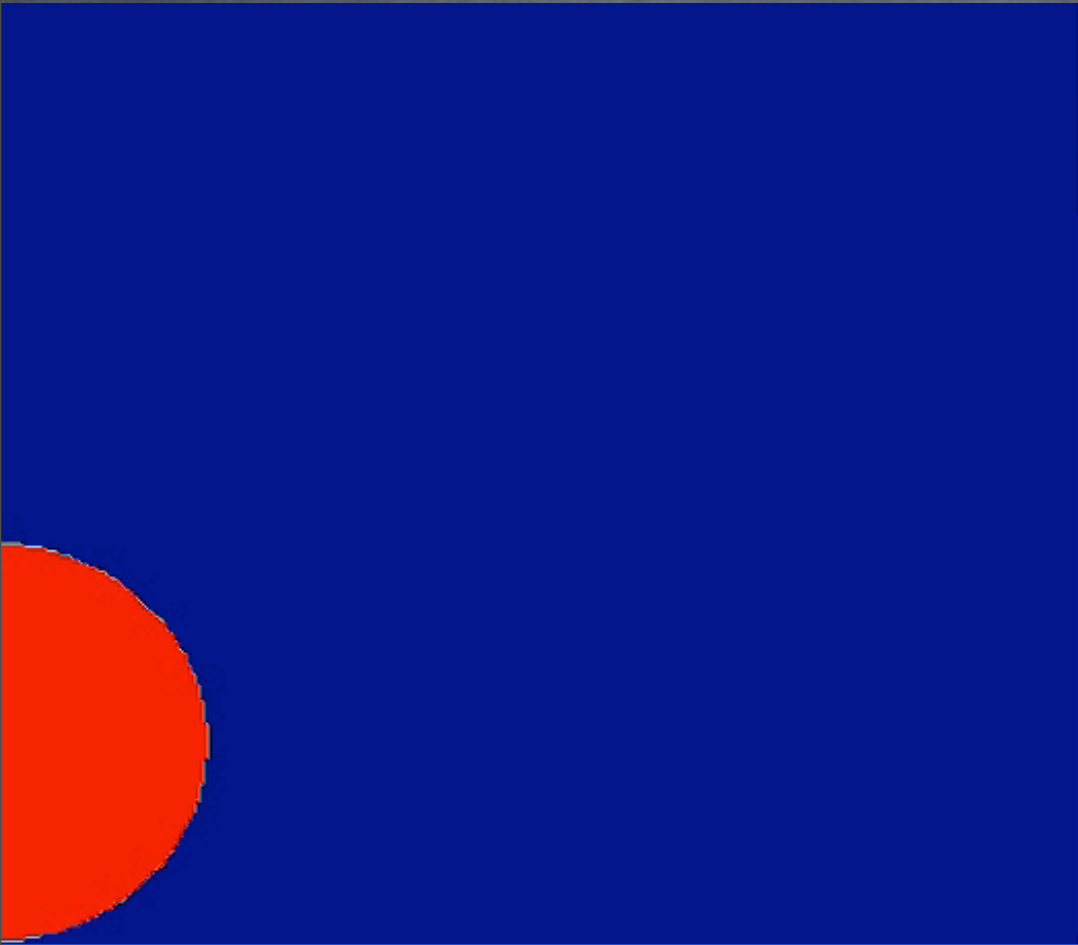
Pressure peak near the edge --> boundary layer?

Impact on thin liquid film

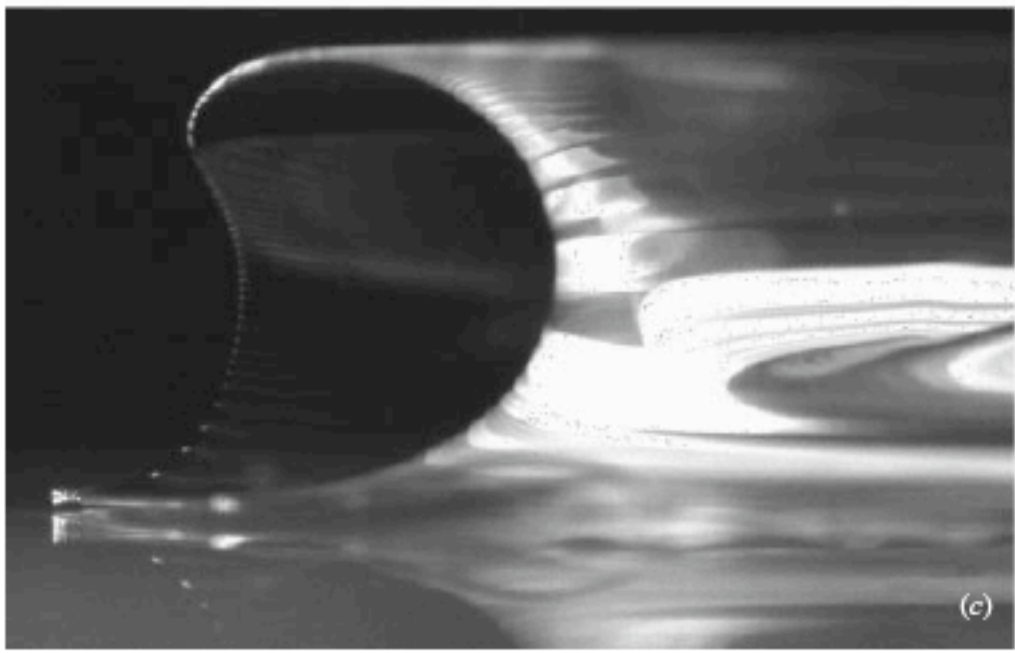
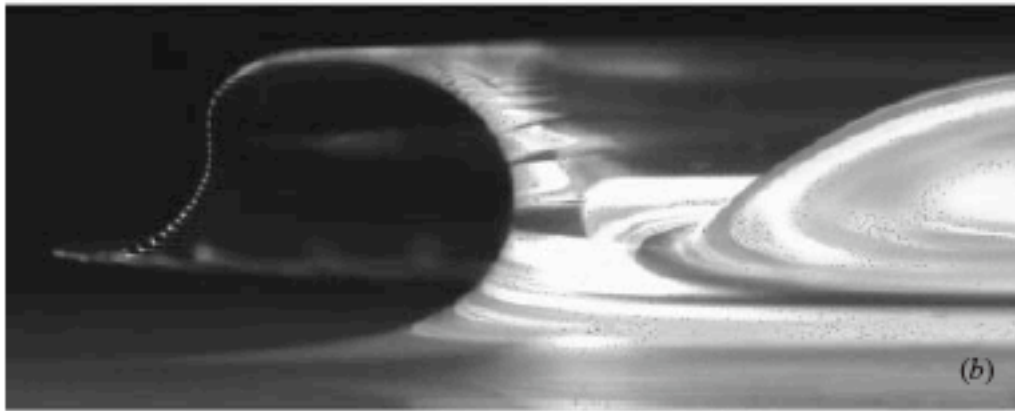
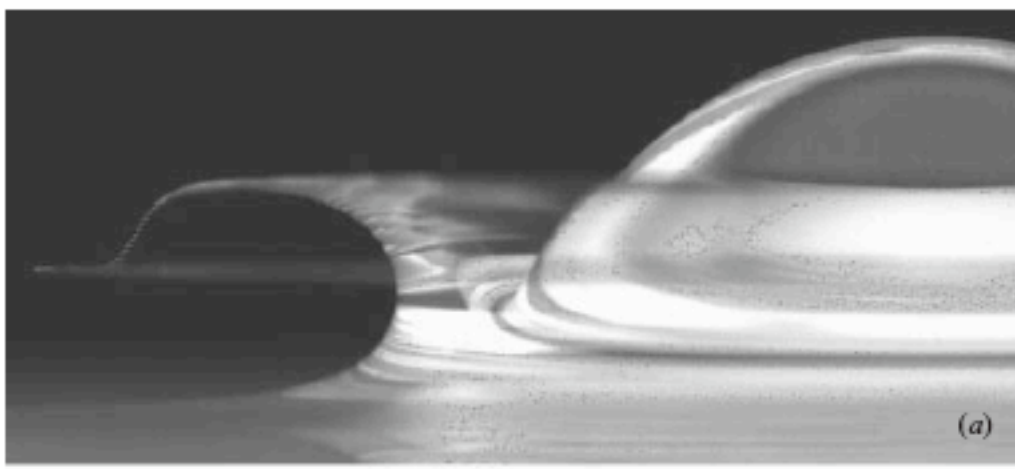


Splahs–spreading transition: $We\sqrt{Re}$
Influence of the viscosity

Splahs–spreading transition: $We\sqrt{Re}$
Influence of the viscosity



- ⑥ Viscous boundary layer near the edge
- ⑥ high pressure peak and vorticity creation
- ⑥ balance between ejection of liquid through the thin liquid sheet and capillary retraction
- ⑥ jet velocity scales like squareroot of the Reynolds number



S.T. Thoroddsen, JFM
451, 373 (2002)

