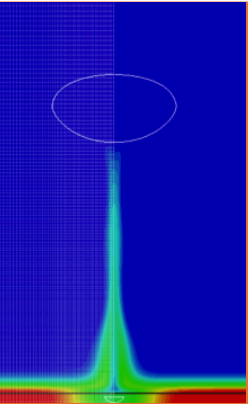
Advances in boiling simulations using ***interface tracking methods*** *and* ***microscale modeling***



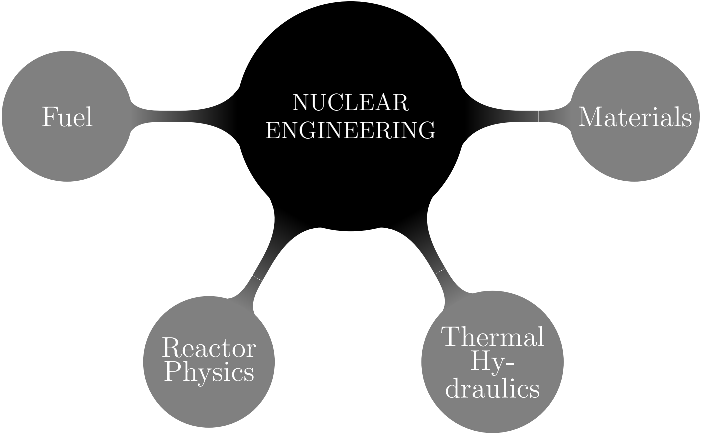
Alexandre Guion

Prof. J. Buongiorno
Prof. N. Todreas
Prof. E. Baglietto
Prof. S. Zaleski

Massachusetts Institute of Technology

November 10, 2014

THE NEED FOR PREDICTIVE SIMULATIONS



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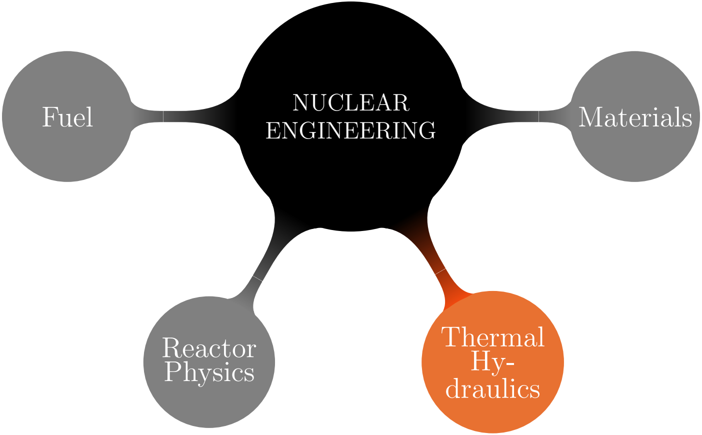
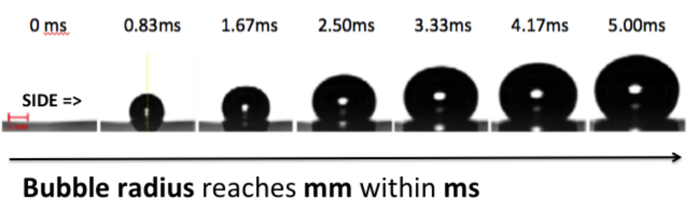


BOILING IS COMPLICATED BY THE MICROLAYER



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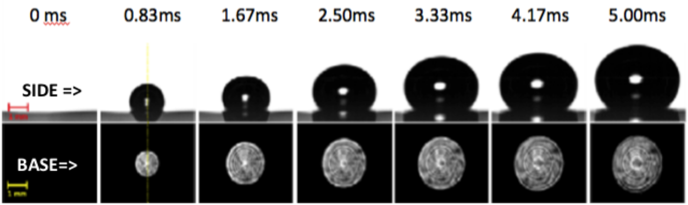

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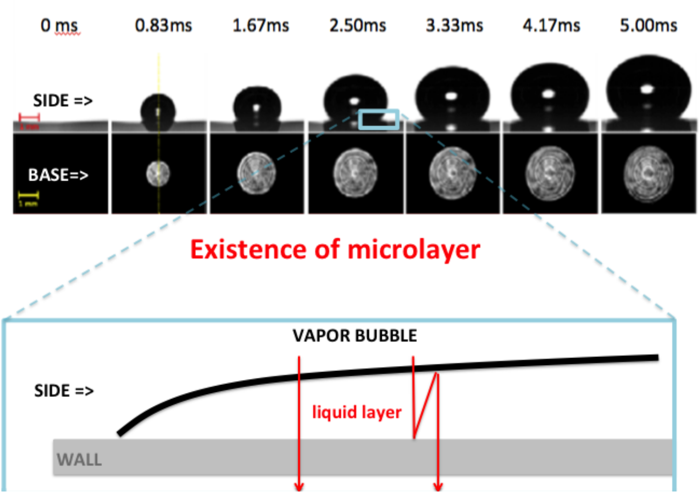

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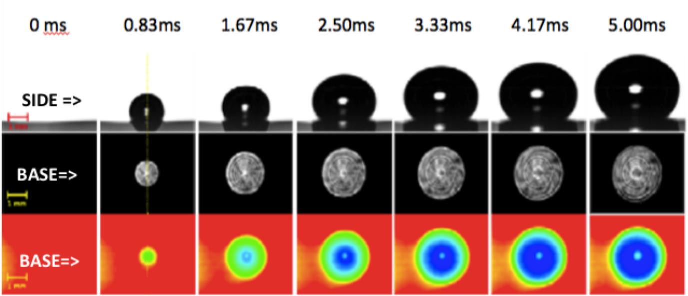

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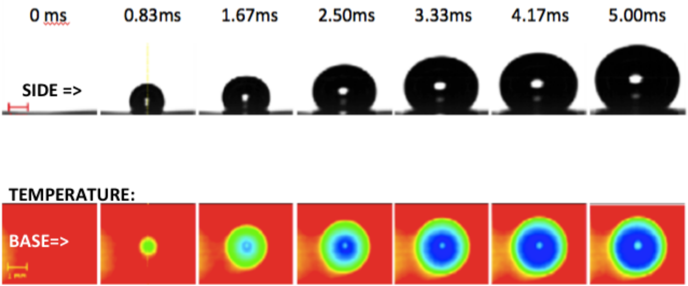

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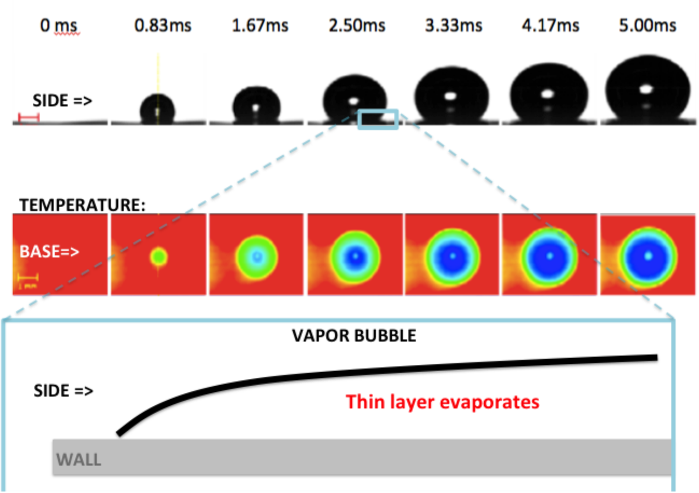

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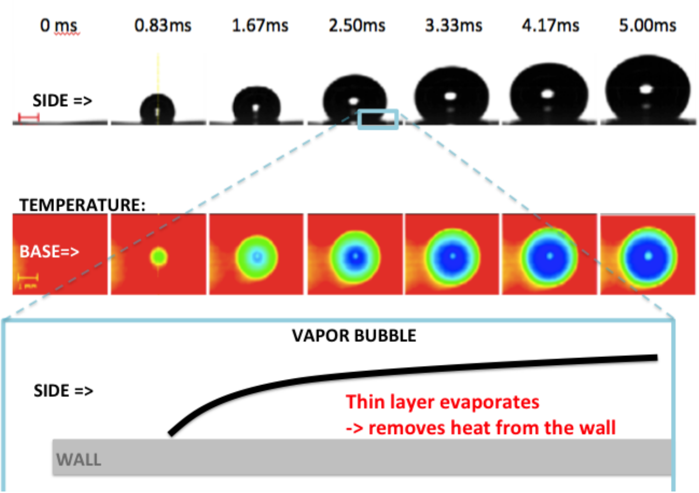

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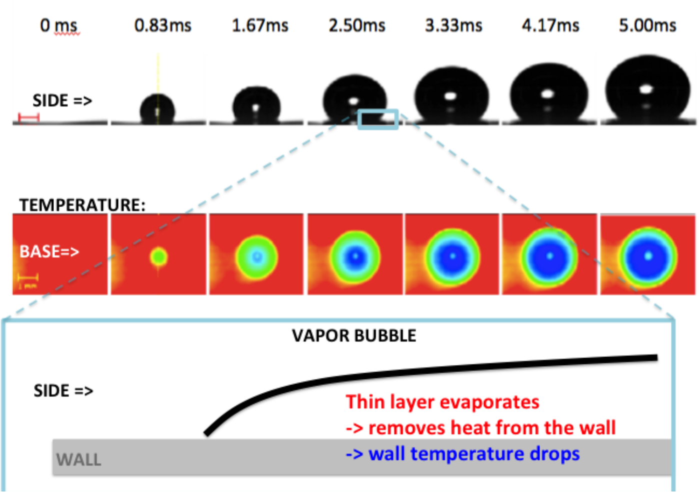

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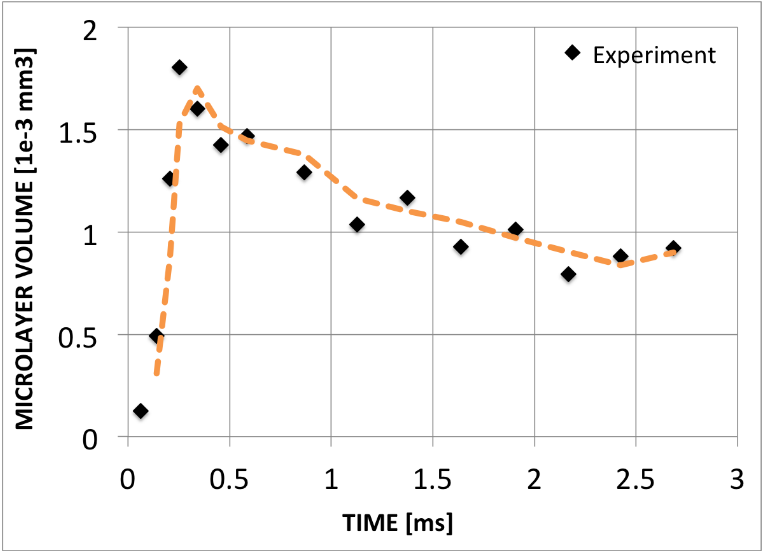
MICROLAYER FORMS, THEN EVAPORATES



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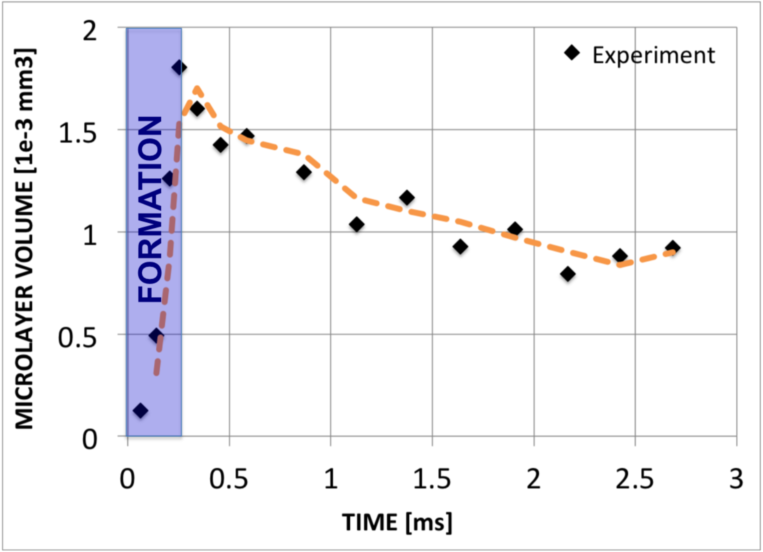

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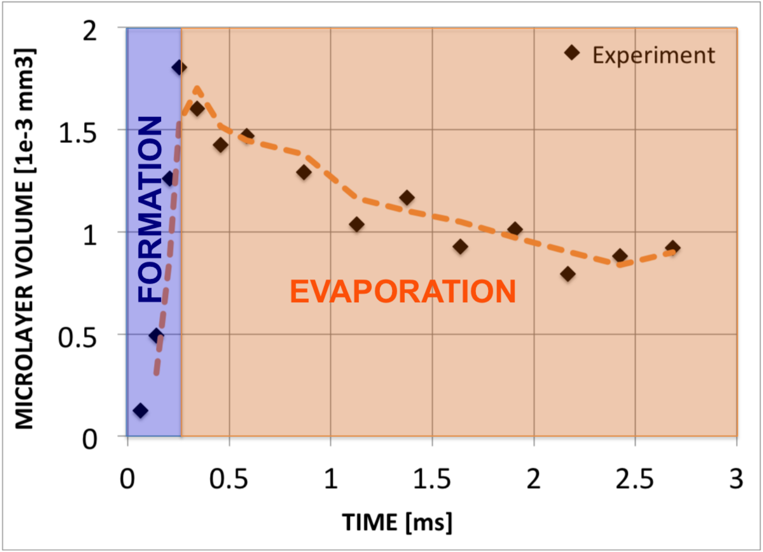

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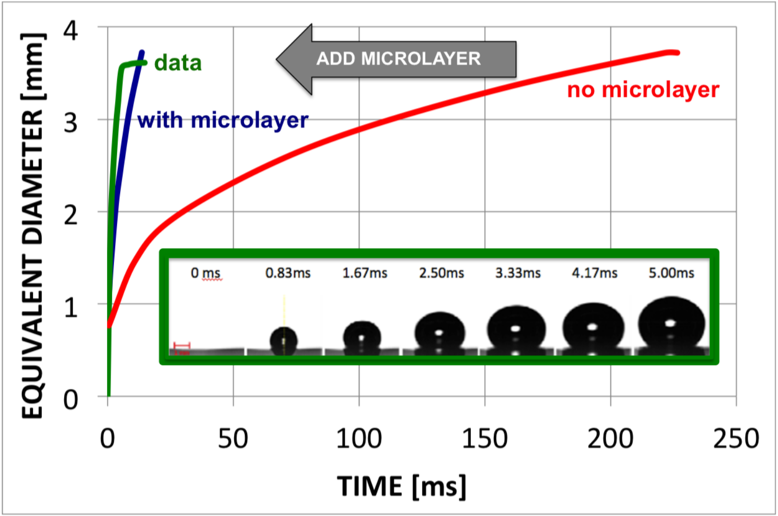
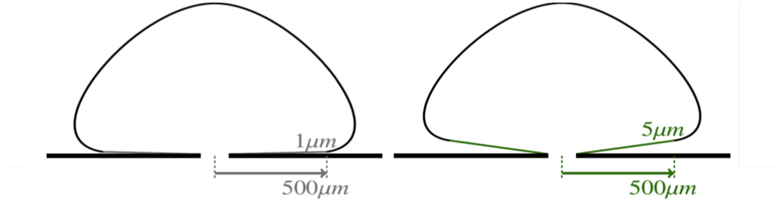
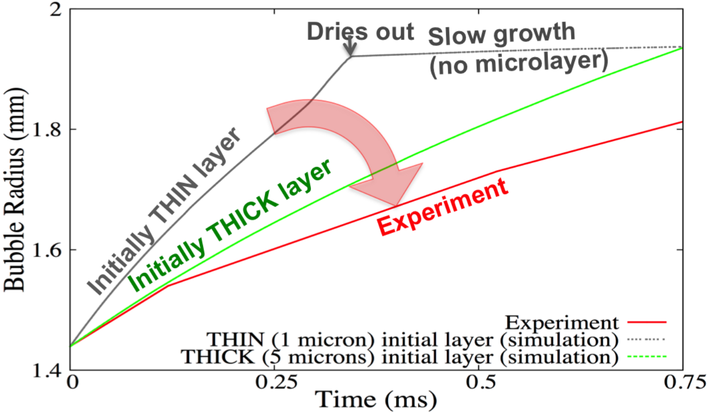
MODEL CAPTURES CONSISTENT DYNAMICS



GROWTH RATE DEPENDS ON INITIAL CONDITION





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DETERMINE INITIAL SHAPE, USING GERRIS

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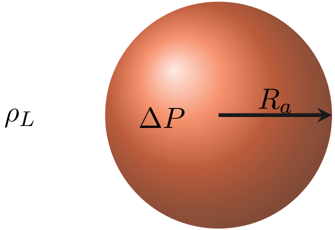
REFERENCE GROWTH RATE: NO WALL (∞ LIQUID)

Rayleigh solution:

$$R_a(t) = \sqrt{\frac{2\Delta P}{3\rho_L}} \times t \tag{2}$$



[*] The equivalent radius can be found by matching the simulated bubble volume with a perfect hemisphere (half a sphere)

RESEARCH OBJECTIVE:
INITIAL MICROLAYER SHAPE, USING GERRIS

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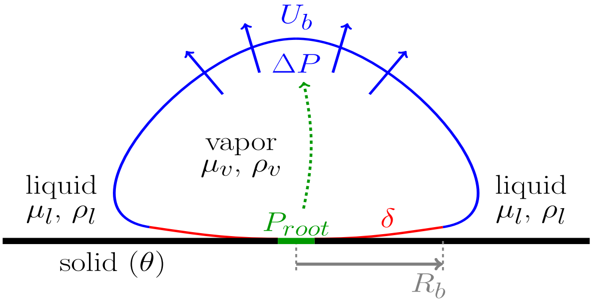

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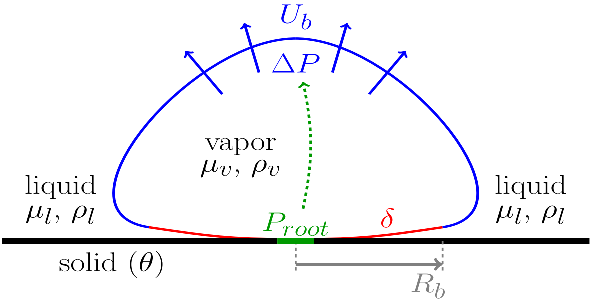

$$\delta = \mathrm{f}\ (\ \mu_v,\ \mu_l,\ \rho_v,\ \rho_l,\ \Delta P,\ \sigma,\ \theta,\ R_b,\ r\ )$$

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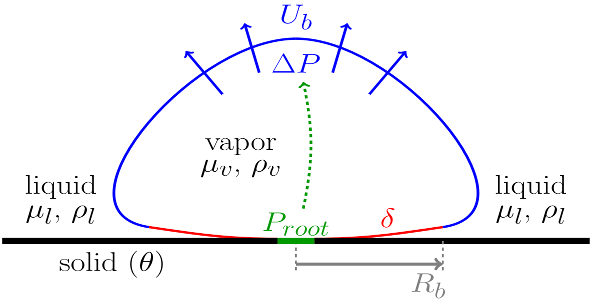

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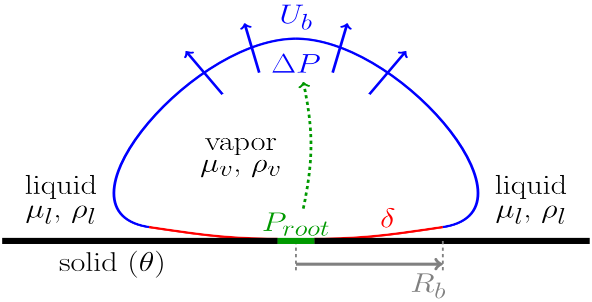

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(r,z) domain: $120\mu m \times 120\mu m$, cavity size $r_c = 10\mu m$

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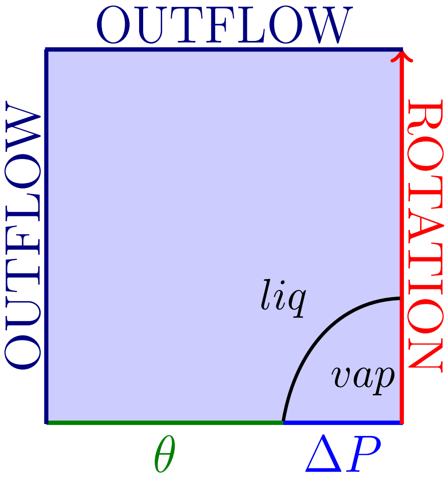

SIMULATED BUBBLE BECOMES HEMISPHERICAL

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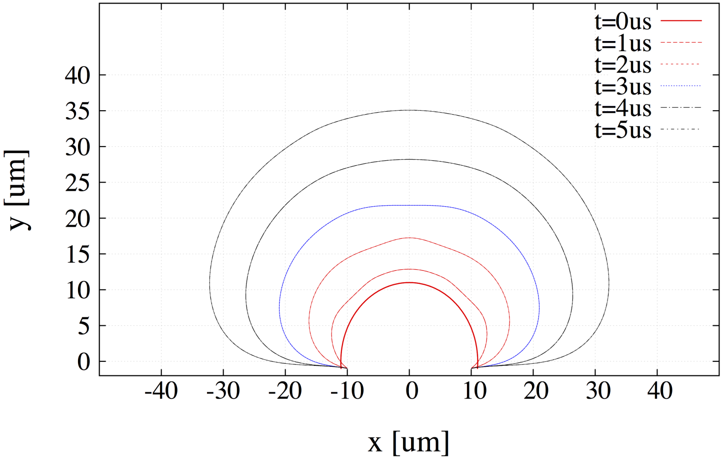

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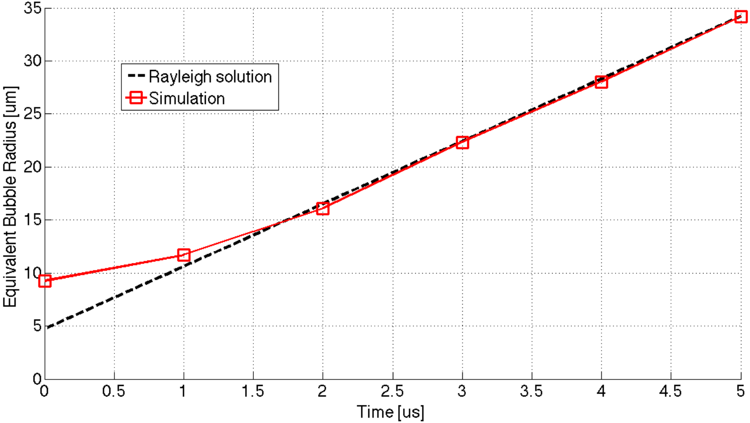

SIMULATED MICROLAYER PROFILES

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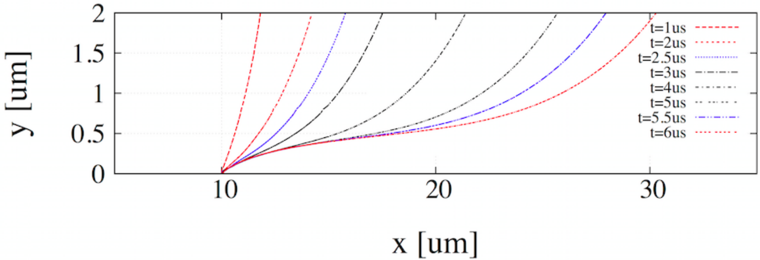

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