



TOR VERGATA
UNIVERSITÀ DEGLI STUDI DI ROMA

Dipartimento di Fisica



European Research Council
Established by the European Commission

Seminar

Monday, 16 January 2023 - h. 14:30

Fisica della Materia room (Department of Physics)

Prof. Francesco ROMANO

*Ecole Nationale Supérieure d'Arts et Métiers, Campus of Lille,
Dept. Fluid Mechanics & Energetics,
Laboratoire de Mécanique des Fluides de Lille (LMFL)*

“The fluid mechanics of airway closure in the bronchioles”

Abstract

The human lung airways are lined by the airway surface liquid (ASL). The ASL is either a layer of mucus or a two-layer liquid film consisting of the serous (outer) and the mucus (inner) layer. Owing to the Plateau-Rayleigh instability, the ASL can lead to airway closure, i.e. the occlusion of the airway due to the formation of a liquid plug. This is typical of distal airways, namely the bronchioles from the 7th generation onwards. In our simulations we focus on the fluid dynamics phenomena occurring during an airway closure, hence we assume the walls of the bronchioles as rigid. We isolate several elements of complexity to well comprehend their standalone effect on the airway closure. Indeed, we consider the airway closure with (i) a single-layer Newtonian clean film, (ii) a two-layer Newtonian clean film (iii) a single-layer surfactant-laden Newtonian film, (iv) a single-layer viscoelastic clean film. Apart from the primary instability leading to airway closure, we focus on the post-coalescence wall stresses and secondary instabilities due to viscoelastic effects.

ERC-2019-ADG Grant N. 882340 “Smart-TURB”
(P.I. Prof. Luca Biferale)

Dipartimento di Fisica - Università degli Studi di Roma “Tor Vergata”
C.F. n. 80213750583 – Partita IVA n. 02133971008 - Via della Ricerca Scientifica, 1 – 00133 ROMA