

## Alain CARTALADE

**CEA Research Director**  
**Atomic Energy and Altern. Energies Commission**  
**Senior Expert, Engineer–Researcher, PhD**

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**Updated** : October 28, 2025  
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**Citizenship** : French  
**CEA/Saclay** : Since 22 May 2002

## Mathematical Physicist

«Theory, computational physics and HPC simulations»

## 1/5. Summary

### Career (from 1996 to 2025) – Details in [Section 2/5](#)

<b>2025</b>	CEA Research Director (NIG 757)	CEA/Saclay
<b>2019</b>	Accreditation to Supervise Research in Physics («Habilitation à Diriger des Recherches»)	Univ. Paris-Sud XI
<b>2016–2027</b>	CEA Senior Expert (NIG 580 & NIG 737) «Phase-Field models and MultiScale Modeling»	CEA/Saclay
<b>2011–2016</b>	CEA Expert (NIG 580) in «Fluid Mechanics and Inverse problem»	CEA/Saclay
<b>2002</b>	CEA Engineer–Researcher, Service of Fluid Mechanics	CEA/Saclay
<b>1998–2002</b>	PhD «Simulation of Direct and Inverse problems in Geosciences». CNRS–Univ. Montpellier II	CEA/Cadarache
<b>1996–1998</b>	Graduate studies in theoretical and mathematical (fundamental) Physics	Univ. Montpellier II

### ► *Highlights of my expertise & research activities (from 2002 to 2025) – the [cyan buttons](#) open external files*

#### Skills and areas of modeling (details in [Section 3/5](#))

Mathematical and numerical methods  
Fluid dynamics and thermic  
Materials science and thermodynamics  
Flow and transport in porous media

#### Main research 2010–2025 (see [Fig. 1](#))

Since 2010, my work focuses on [Phase-field models](#) simulated by [Lattice Boltzmann Methods](#) (LBM) for multiphase flows.

#### Supervisor of [LBM\\_Saclay](#) code (details in [Section 3/5](#))

C++ programming & validation of LBM and  $\phi$ -models • Writing [► html doc](#) and specifications [\[R21\]](#) • Facilitation of taskforce and training sessions (see «Teaching»)

#### Teaching (INSTN & ED SMEMaG) (Phase-field 7h and LBM 16h)

Phase-field models	<a href="#">[L1]</a>
LBM – Part A: theory	<a href="#">[L2]</a>
LBM – Part B: practice	<a href="#">[L3]</a>
LBM – Part C: applications	<a href="#">[L4]</a>

#### Publications (see [List of Publications](#))

Publications	<b>21</b>
CEA Technical Reports	<b>18</b>
Thesis (HDR+PhD)	<b>2</b>
Collaborative documents	<b>6</b>

#### Featured publications (4 most representative)

Dissolution of porous media	<a href="#">[P2]</a>
Two-phase flows with phase change	<a href="#">[P3]</a>
LBM for fractional transport Eq.	<a href="#">[P4]</a>
LBM for crystal growth	<a href="#">[P6]</a>

#### Supervisor of students (details in [Appendix A](#))

PhD fellow	<b>7</b>
Post-doctoral fellow	<b>3</b>
Internship students	<b>31</b>
PhD jury as supervisor	<b>3</b>

#### Current research Multiphase/multicomponent

Coupling  $\phi$ -model with Calphad thermodynamics • Three immiscible fluids • Adaptive Mesh Refinement with LBM.

#### Functional management (details in [Section 5/5](#))

Management of the taskforce «mesoscopic modeling» in VESTA project • Management of the workforce [LBM\\_Saclay](#) (permanent staff, students and code maintenance).

<b>Involvement in research projects</b> (see <a href="#">Section 4/5</a> and <a href="#">Appendix B</a> )		<b>CEA/DES projects (2025)</b> Support of my R&D activities		<b>Future research</b> Other multiphysics coupling
Current CEA/DES projects	6	2010–now	SIMU/SIVIT	Extend the scope of LBM_Saclay applications <i>e.g.</i> electromagnetism, fluid/structure interaction and liquid/liquid extraction
Completed CEA/DES projects	3	2016–now	SIMU/SITHY	
National Research Agency project (ANR)	1	2019–now	SIMU/PICI2	
CEA Transverse programme	1	2021–now	CyN/VESTA	

► ***Further information and miscellaneous activities***

<b>Transverse activities</b> 2002–2025	<b>Member of CEA laboratories</b> 2002–now DM2S/ ▶ STMF	<b>Main research at SFME</b> 2002–2011
Since 2002, I am involved in cross-disciplinary CEA projects (MRISQ, SIVIT, VESTA, etc.) with permanent staff from other departments such as DPC, DE2D, DTN, etc.	2014–2025 LMSF/LDEL 2011–2014 LATF 2007–2011 LSET 2002–2007 MTMS	Inverse problems for parameters identification • Simulation of fractional equation for anomalous transport in porous media.
<b>Miscellaneous activities</b> (details in <a href="#">Section 5/5</a> )	<b>Collaborations</b> (see <a href="#">Appendix A &amp; B</a> )	
Participation in summer school, conf etc. Member of «PhD jury» and «CSI» 4 Organization and facilitation of workshop 6 Keynote speaker 1	CNRS/IMFT • CNRS/Polytechnique • INRAE/Univ Avignon • INRIA • IFPEN • CEA DAM, ISEC, IRESNE • IRSN	

## 2/5. Certifications, Degrees and Educational background

<b>CEA certifications</b>			
2025	CEA Director of Research (NIG 757)	▶ Certificate	[C1]
2023	CEA Senior Expert (NIG 737); 2023–2027 «Modèles à champ de phase simulés par LBM et modélisation multi-échelles»	▶ Certificate	[C2]
2016	CEA Senior Expert (NIG 580); 2016–2023	▶ Certificate	[C3]
2011	CEA Expert (NIG 580). Domain fluid mechanics.		[C4]
<b>Degrees</b>			
<b>HDR and PhD</b>			
2019	HDR (ref [T1]) Physique. «Accreditation to Supervize Research» ▶ HDR. University of Paris-Sud XI, France. defence October 4th 2019. Doctoral school SMEMaG, University of Paris-Saclay.		[D1]
2002	Ph.D. (ref [T2]) «Inverse problem in Geosciences», Lab Hydrosiences at University of Montpellier II, France. Director: G. VASSEUR (DR/CNRS), Supervisors: P. GOUZE (CR/CNRS), R. GUÉRIN (CEA/Cad Senior Expert).		[D2]
<b>Graduate studies: fundamental Physics and numerics (University of Montpellier II, France)</b>			
1998	DEA (MSc2), Theoretical Physics (Inverse Prob., Sci. Comp., Statis. Phys., Quantum Field Theory, Elect. in Matter).		[D3]
1997	Maîtrise (MSc1), fundamental Physics (Quantum Phys, Stat Phys, Atoms and Molecules, Solid State Phys, Nuclear).		[D4]
1996	Licence (BSc), fundamental Physics (Classical and Quant. Mechanics, Fluid Mech., Electromagnetism, Optics, ...).		[D5]
<b>Educational background: CNRS summer schools and CEA/INSTN nuclear engineering (≥40h)</b>			
2013	CNRS Summer school «Phase-field models for the evolution of complex structures». Peyresq, France.		80h
2011	CEA–INSTN lectures «Flow and heat transfer for two-phase flows in nuclear reactor». Grenoble, France.		40h
2005	CNRS Summer school «Flow and Transport in porous and fractured media». Cargèse, France.		80h
2003	CEA–INSTN lectures «School of Nuclear Engineering» ( <a href="#">certificate</a> ). Saclay, France.		325h

### 3/5. Skills and areas of modeling

#### My approach in the CEA projects

After talking with the experimental scientists involved in the same project, I derive the Partial Derivative Equations (PDEs) for the target application. Their numerical implementation is performed with the *Lattice Boltzmann Methods* (LBM). Since 2012 the derivation of those PDEs are based on the *phase-field methods* which combine rigorously the interface-capturing with the thermodynamic of the system. The applications are the phenomena observed in the nuclear glasses for waste management ([Fig Observations](#)). They are related to fluid flows, material science and porous media. The whole approach is summarized in Figure 1. Below are presented some keywords of my skills and areas of modeling.

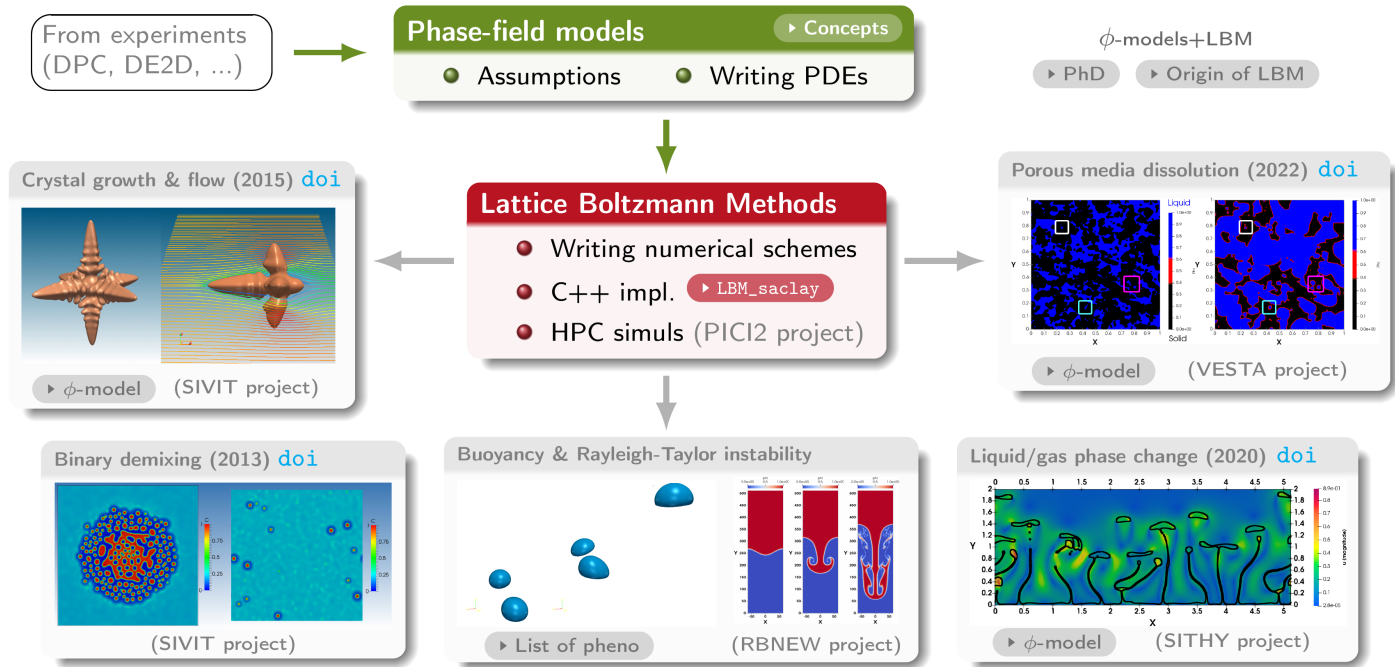


Figure 1: Methodology in the CEA projects. In the green box the «phase-field models» are detailed in the lectures [L2] for two-phase flows and [L4] for advanced applications. In the red box the «Lattice Boltzmann Methods» are detailed in [L2]. The multi-architecture HPC code LBM\_saclay is described in the training session [L3] and the technical report [R1]. For each application (gray boxes), the mathematical models, numerical methods and simulations are detailed in the publications.

#### ► Mathematical and numerical methods (implementation and practice)

#### Phase-field Modeling & Lattice Boltzmann Methods (LBM)

**Phase-field Methods:** derivation of interface-tracking models for various applications such as two-phase flows with phase change, crystal growth, dissolution of porous media and surfactant (details below). Asymptotic expansions between sharp interface and diffuse interface [P2]. Implementation in LBM codes, verifications with the analytical solutions of Stefan's problem & benchmarks.

**Lattice Boltzmann Methods:** derivation and implementation of numerical schemes for various PDEs (Navier-Stokes, Advection-diffusion, fractional Eq., phase-field models, ...). Programmer of a 3D LBM Fortran code SILABE3D [T1] (2009–2018); involved in the development of the C++ multi-architecture HPC code LBM\_saclay (see below); Chapman-Enskog expansions [P6]; BGK, TRT and MRT [P4] collision operators. Adaptive Mesh Refinement with Lax-Wendroff scheme.

#### High Performance Computing & Informatics

**Programming skills:** Fortran 77/90/2000, C++, makefile, CMake, debugger, shell scripts. Coupling with math librairies (lapack, slatec, numerical recipes). Version control with git.

**High Performance Computing (HPC):** practice of MPI commands in SILABE3D. Involved in the development of LBM\_saclay: parallelization with MPI and multi-architecture portability with Kokkos library [R1]. Batch scripts (SGE, slurm);

**Post-processing, OS and analytical calculus:** Paraview, gnuplot, Linux, wxmaxima, python.

**Writing skills:** L<sup>A</sup>T<sub>E</sub>X, B<sup>B</sup>T<sub>E</sub>X, L<sup>y</sup>X. Presentations with Beamer, xfig, tikz, Matcha.



► **LBM\_saclay** Since 2018, I am involved in the development of the C++ multi-architecture HPC code LBM\_Saclay for which I am the main supervisor. LBM\_Saclay has evolved from SILABE3D and can run on several architectures (CPU and GPU) e.g. Jean-Zay V100 (IDRIS) and Topaze A100 (CCRT). Several LBM schemes are implemented for simulating various phase-field models for Multiphase/Multicomponent (MPMC) flows with phase change. Examples of simulations are presented in the red boxes «Fluid dynamics & thermic» and «Materials science & thermodynamics». I participate in writing documentation [R1], specifications [R21] and facilitating the LBM\_Saclay workforce. The code is mainly applied for R&D purposes. It is also used in the 16h training session on «An introduction of Lattice Boltzmann Methods» in the doctoral school SMEMaG (U. Paris–Saclay).

## Other mathematical methods

*Adjoint state method and optimization:* in order to identify PDEs parameters, derivation of adjoint problems in continuous and discrete forms • Fortran implementation in a 2D finite element code and a finite difference code • Coupling with optimization algorithms e.g. with Hessian approximation such as BFGS with bound constraints [T2], [P9], [P5].  
*Other methods:* implementation and practice of finite difference [R17] and finite element methods [T2] with direct solver • Euler explicit & implicit time-schemes • Continuous Time Random Walks and Volume Averaging Methods.

► Areas of modeling and simulations – to watch the videos, click on the ► button

## Computational Fluid Dynamics & Thermics

*Single phase flows:* Navier-Stokes (NS) • Incompressible flows and low Mach number • Eq. of state for compressible flows • Natural convection with Boussinesq approximation [R11] • Non-Newtonian flows [O13].  
*Immiscible two-phase flows:* phase-field models for ► 3D bubbles dynamics & buoyancy • Spinodal decomposition, ► phase separation and ► nucleation and growth with NS/Cahn-Hilliard model [O10], [T1] • NS/Conservative Allen-Cahn model for Rayleigh-Taylor instability ► 2D / ► 3D and ► splashing droplet .  
*Two-phase flows with phase change:* phase-field model for liquid/gas phase change [P3] ► Film Boiling .  
*Two-phase with surfactant:* phase-field model for spinodal decomposition ► with surfactant [R20]  
*Two-phase interacting with solid:* leakage of ► Static and ► Moving tank  
*Three-phase flows:* three-phase spinodal decomposition • Spreading lens • 2D simultaneous splashing droplet with ► Rayleigh-Taylor instability or ► rising droplet • 3D simulation of surface tension effect for three-phase immiscible fluids ► 3D three-phase

## Flow and Transport in porous media

*Flow and Transport in (un)saturated porous media:* hydrogeology of CEA-Cadarache (Fig underground flow – watershed scale) [T2] • Dual-porosity models (Fig BEETI device – column scale) [R10] • Effective diffusion (Pore-scale) [R9] • Darcy-Brinkman-Forchheimer model [R11] and equation of Richards • Hydrodynamic dispersion.  
*Fractional Advection-Diffusion models:* LBM for fractional Eq. (PDEs with derivatives of real order in space) [P4] and time [P5] • Validations and comparisons with equivalent random walks.

## Materials science & Thermodynamics

*Solid-liquid phase transition:* phase-field models simulated by LBM for ► 3D crystal growth [P6]; pure substance [R7] and binary mixture [R6] • Functionals of free energy and grand-potential [P2] • Anisotropic surface tension and ► Interacting crystals [P7] • «Enthalpy-porosity» approach for solidification.  
*Coupling with fluid flow:* simul of phase-field model for 3D crystal growth ► with fluid flow effect [P8].  
*Liquid-liquid mass transfer:* Ostwald ripening ► with fluid flow effect [P1] • derivation of phase-field model for ternary phase diagram and simplification for modeling the thermodynamic database (Calphad).  
*Dissolution and precipitation:* phase-field model of ► dissolution of porous media (pore-scale) of binary [P2] and ternary mixtures.

## 4/5. Involvement in CEA research projects

All details and achievements in [Appendix B](#)

### Projects of «Direction des EnergieS» research programmes (3+6)

		Programme	Project
<b>Current CEA project (6)</b>			
<b>2010–now</b>	Involvement in «SIMulation de la VITrification»	SIMU	SIVIT
<b>2016–now</b>	Involvement in «SIMulation de la Thermo-HYdraulique»	SIMU	SITHY
<b>2019–now</b>	Involvement in «Plateformes, Intégration, Calcul Intensif, Incertitudes»	SIMU	PICI2
<b>2021–now</b>	Involvement in «VERres en STockage et Altération long terme»	CyN	VESTA
<b>2024–now</b>	Involvement in «Recherche de Base»	RTA	RBNEW
<b>2022–2023</b>	Involvement in «SIMulAtion du CYcle»	SIMU	SIACY
<b>Completed CEA project (3)</b>			
<b>2002–2005</b>	Involvement in «Moyenne Activité et Vie Longue»	DDIN	MAVL
<b>2004–2013</b>	Involvement in «Maitrise des RISQues et IMPacts»	DDIN/DISN	MRISQ/MRIMP
<b>2008–2009</b>	Involvement in «COLis en STockage»	DDIN/CESD	COSTO

### Other projects (2)

		Programme	Project
<b>2011–2013</b>	Involvement in the ANR project «TRansport Anormal en Milieu poreux»	ANR/SYSC	TRAM
<b>2021–2023</b>	Invol. in one CEA project of «Programme Transverse de Compétences»	CEA/PTC	MALABAR

## 5/5. Miscellaneous activities

### ► Teaching – facilitation of training session

- 2025 June** Teaching Cours INSTN CFD diphasique du STMF – Partie 1.C. «Approche thermodynamique des interfaces : les modèles à champ de phase». 4h30 at INSTN CEA/Saclay (June 16 & 17 juin). 7h at Sorbonne University (December 2025 and January 2026).
- 2025 Jan** Facilitation of 16h training session on «An introduction to Lattice Boltzmann Methods» in the doctoral school SMEMaG (Centrale–Supélec, University of Paris-Saclay). Teaching the main concepts of «Lattice Boltzmann methods» and «two-phase flows» [L2], and facilitation of practice with LBM\_Saclay code [L3]. CEA Paris–Saclay.
- 2019–2025** 20h/year – Teaching of an introduction of «Phase-field models» and «Lattice Boltzmann methods» [L2] and description of main kernels of LBM\_saclay code [L3],[R1]. Public: engineer-researchers of CEA/Marcoule (2022) and internship students (level M2, 2019 – 2025). CEA Paris–Saclay.
- 2000 Sept** 24h – Mathematical lectures and applications. First year of engineering school ISIM. University of Montpellier II.

### ► Jury & committee member of PhD thesis

#### As jury member

- 2025 Dec** Reviewer of A. BOUNJAD PhD thesis (CEA/Cadarache). Thesis supervised by HERVÉ HENRY (CNRS/PMC). defence dec 13, 2025 at Polytechnique.
- 2023 Nov** Examiner of M.-A. RASOLOFOMANANA PhD defence (CEA/Cadarache). Thesis co-supervised by R. LE TELLIER (CEA/Cad) and H. HENRY (CNRS/Ecole Polytechnique). defence nov 13, 2023 at Cadarache. **2022 June**: committee member of his halfway PhD defence.
- 2017 Nov** Examiner of GUILLAUME BARBA ROSSA PhD entitled «Multiphysics modeling of glass elaboration in cold crucible» co-supervised by A. GAGNOUD (CNRS) and E. SAUVAGE (CEA). defence nov 7, 2017 at ICSM.

#### As CSI member



- 2024–2025** Committee member (CSI) of CLÉMENT PLUMECOCQ (CEA/Cadarache). Thesis co-supervised by R. LE TELLIER (CEA/Cad) and C. INTROÏNI (CEA/Cad).
- 2021–2022** Committee member (CSI) of ARTHUR DOLIVEIRA (CEA/Cadarache). Thesis co-supervised by R. LE TELLIER (CEA/Cad) and C. INTROÏNI (CEA/Cad).

#### As supervisor

- 2025, 2022, 2015, 2008** Jury member as PhD supervisor of Téo BOUTIN (2025), WERNER VERDIER (2022), AMINA YOUNSI (2015) and S. CADALEN (2008).

#### ► Keynote speaker

- 2023 Sept** Keynote speaker at «SumGlass 2023» summer school. Title «Modeling phase separation in the melt: thermodynamics, fluid flow and HPC simulations». Ref [O2]. Duration of the presentation 30min. Musée de la Romanité, Nîmes September 27th, 2023.

#### ► Taskforce management

- 2024–now** «Mesoscopic modeling» taskforce management in the CyN/VESTA project. Monthly reporting to the project leader of the modeling activities in the taskforce. Participating in the meeting with other taskforce managers.
- 2012–2015** Point d'entrée des activités modélisation au DM2S dans le projet SIVIT.

#### ► Organization and facilitation of workshops and conferences

- 2006–2008** Main organizer of «CEA Workshop on Porous Media» at CEA/Saclay. More than 70 people in 2007.
- 2009** Member of organizing committee of 9th «Journée d'Etude des Milieux Poreux» (21-22 october 2009) at Paris-Sud Univ (FAST main organizer).
- 2015** Chairman of one session of PhD thesis presentations. Organization J. SEGRÉ (CEA-DM2S). INSTN, France.
- 2023** Co-chairman of the third session of PhD presentations ([program](#)). Organization S. GOSSÉ (CEA-ISAS). Paris-Saclay, France.

#### ► Reading of Physics and mathematical textbooks

- Since 2002** *Hydrodynamics*: Guyon *et al.* – 1998; *Capillarity and Wetting* (de Gennes *et al.*, 2004); *Instabilities* (Charru, 2007). *Phase-field method*: Provatas&Elder (2010). *Porous media*: Bear&Verruijt (1993); *Volume averaging*: Whitaker (1999). *Lattice Boltzmann*: basic LBM: Krüger *et al.* (2017); *Multiphase flows with LBM*: Huang, Sukop, Lu – 2015. *Statistical physics*: Berkeley (1994); *kinetic theory of gas*: Bird (1994). *Inverse problems*: N.-Z. Sun (1994); *Numerical optimization*: Nocedal&Wright (1999).

#### ► Writing specifications

- 2023 Oct** Participation in writing the specification report for the code maintenance of LBM\_Saclay and EOS.

#### ► Marathon runner & guitar player

- 2008–2015** Finisher of 8 Paris marathons (best time 3h22, Paris Marathon 2014).

## Appendix A: List of supervised young researchers and internship students

### 1/3. PhD young researchers (7 = 5 defended + 2 in progress)

#### ► 2024 – 2027: Clément Bardet (CEA LDEL – INRIA)

*In progress (2nd year)*

**PhD co-director** of CLÉMENT BARDET (profile: applied math, Master «Math en Action», Lyon) affiliated at CEA/STMF/LDEL for his PhD thesis on «Navier-Stokes/Korteweg model with temperature effects». Doctoral school: SMEMAG. Collaboration: R. NOËL (INRIA).

##### Achievements:

- Starting date: November 1st, 2024.

#### ► 2023 – 2026: Hoel Keraudren (CEA – STMF/LDEL)

*In progress (3rd year)*

**PhD Director** of HOEL KERAUDREN (profile: applied math/HPC, Master AMS, Paris-Saclay) affiliated at CEA/STMF/LDEL for his PhD thesis on «Adaptative Mesh Refinement with LBM». Doctoral school: SMEMaG. Collaboration: P. KESTENER, and A. GENTY (CEA).

##### Achievements:

- Starting date: October 18th, 2023.

#### ► 2022 – 2025: Capucine Méjanès (CEA – STMF/LDEL)

*Defence planned (December 8th, 2025)*

**PhD co-director** of CAPUCINE MÉJANÈS (profile: fundamental physics/hydrodynamics, Master Fluid Dynamics and energetics, Paris-Saclay) affiliated at CEA/STMF/LMSF for her PhD thesis on «Phase-field model coupled with hydrodynamics». Doctoral school: SMEMaG. Co-director MATHIS PLAPP (CNRS/Ecole Polytechnique).

##### Achievements:

- Starting date: October 24th, 2022.
- Presentation at SIVIT project (June 2023)
- Poster at international conf «Sumglass 2023» (September)

#### ► 2021 – 2024: Téo Boutin (3,5 years at CEA – STMF/LMSF)

*Defence 2025*

**PhD Director** of TÉO BOUTIN (profile: applied math/numerical methods, Master AMS, UVSQ) affiliated at LMSF for his PhD thesis on «Phase-field model for gels». Doctoral school: SMEMaG. Collaboration with STÉPHANE GIN and JEAN-MARC DELAYE (CEA/Marcoule). Starting date: 25 October, 2021.

##### Achievements:

- Publication [P2] (2022)
- 1 CEA report (2022).
- Presentation at the scientific seminar TANGRAM (Sept 2002) and Several presentations in the VESTA project.

#### ► 2019 – 2022: Werner Verdier (3 years at CEA – STMF/LMSF)

*Defence 2022*

**PhD co-director** of WERNER VERDIER (profile: physicist/numerical methods, Master AMS, UVSQ) affiliated at LMSF for his PhD thesis on «Phase-field model for multi-phase flows». Doctoral school: Institut Polytechnique de Paris. PhD co-director MATHIS PLAPP (DR/CNRS, École Polytechnique). Context of SIVIT project (CEA-Orano). Starting date: 1st October, 2019.

##### Achievements:

- PhD defence 12th December 2022
- Publications [P1], [P2], [P3]; 1 CEA Technical report.
- Several presentations in the SIVIT project.
- Presentation at CALPHAD international conference, 2022.

► **2012 – 2015: Amina Younsi (3 years at CEA – STMF/LMSF)**

**Defence 2015**

**PhD supervisor** of **AMINA YOUNSI** (profile: applied math-numerical methods, Master M2S, INSTN) affiliated at LMSF for her PhD thesis on «hydrodynamic effect on crystal growth by lattice Boltzmann method». Doctoral school: Institut Polytechnique de Paris. PhD director MATHIS PLAPP (DR/CNRS, École Polytechnique). Context of SIVIT project (CEA-AREVA).

**Achievements:**

- PhD defence ([web link of manuscript](#)): october 2015.
- Publications [P7], [P6], [P8], proceeding [P19] and CEA Reports [R6], [R5]
- Best poster award [PT3] at the «3rd International Symposium on Phase-Field Method 2014».
- Dr A. YOUNSI is «Researcher-Engineer» at IRSN.

► **2004 – 2008: Sébastien Cadalen (4 years at CEA – SFME/MTMS)**

**Defence 2008**

**PhD supervisor** of **SÉBASTIEN CADALEN** (profile engineer/fluid mechanics, ENSEEIHT) affiliated at MTMS for his PhD thesis on «homogenization of transport models in unsaturated porous media». PhD Director MICHEL QUINTARD (DR/CNRS, IMFT). Context of MRISQ project.

**Achievements:**

- PhD defence ([web link of manuscript](#)): november 2008.
- Proceedings: with peer-review [P22], without [P24].
- CEA reports: [R12], [R13] and [R14].
- Dr S. CADALEN currently works at HP, Spain.

## 2/3. Post-doctoral young researchers (3)

► **2021 – 2023: Evangelos Stavropoulos Vasilakis (CEA – STMF/LAFT)**

**24 months**

**Co-supervisor** of Dr **EVANGELOS STAVROPOULOS VASILAKIS** (profile mechanical engineer) affiliated at LATF on «adaptative Mesh Refinement» of «Lattice Boltzmann Methods» in CEA (Programme Transverse de Competences) project. Collaboration with P. KESTENER (CEA/DAM) and A. GENTY (CEA/STMF).

**Achievements:**

- Several presentations at CEA.
- International conference (Am Phys Soc, Nov 2022) [O3] and presentation at Minattec Grenoble (2021).

► **2011 – 2013: Boris Maryshev (CEA – STMF/LAFT)**

**18 months**

**Main supervisor** of Dr **BORIS MARYSHEV** (profile physics/mechanics-numerical methods) affiliated at LATF on «parametric identification» of «fractional» transport equation in ANR TRAM project and CEA MRISQ project. Collaboration with M.-C. NÉEL (PR Avignon). Univ/Avignon knows about fractional PDE and CEA/DM2S knows about «adjoint state» for solving inverse problem.

**Achievements:**

- Publications [P5], [P9], proceeding [P18]
- Poster presented at ICPM [PT5] (Potsdam/Germany).
- Several presentations in TRAM project.
- Dr B. MARYSHEV is researcher at «Institute of Continuous Media Mechanics» at Perm, Russia.

► **2008 – 2010: Andrea Zoia (CEA – STMF/LSET)**

**18 months**

**Main supervisor** of Dr **ANDREA ZOIA** (profile physicist) affiliated at LSET on «continuous time random walk» method to simulate «anomalous transport» in sand column. Collaboration with CEA/DPC (C. LATRILLE) where experiments were carried out for experimental data which appear in publications. Context of MRISQ project.

**Achievements:**

- Publications [P10], [P11]
- Poster presented at EGU [PT6] at Vienna
- Several presentations at CEA.
- Dr A. ZOIA is researcher at CEA/DM2S/SERMA



### 3/3. Internship students (31)

List of 31 supervised internship students. Main supervisor (except ‡). Few noticeable students in bold.

	Year	Name	Profile	Level/Affiliation	Laboratory	Achievement
1.	2001	‡SÉBASTIEN BOUGAULT	Hydrogeologist	M2/Montpellier (UMII)	CNRS	[T2]
2.	2001	‡GAËL RIGAL	Hydrogeologist	M2/UMII	CNRS	[T2]
3.	2002	‡BENJAMIN CAVANNA	Applied Math	M1/Nice	Univ/Nice	[R18]
4.	2003	SÉBASTIEN ARRIGHI	Applied Math	M1/UMII	CEA/MTMS	
5.	2003	‡NINA KHVOENKOVA	Applied Math	M2/Paris 6 (P6)	INRIA	[R16]
6.	2004	ALEXANDRA MENDES	Chemical Engineering	3rd year/ENSIC	CEA/MTMS	
7.	2004	FOUAD AGUNAOU	Physicist	M2/P6	CEA/MTMS	
9.	2006	RIM HARICH	Physicist	M2/P6	CEA/MTMS	[R13]
10.	2006	DHAVH BOUMBA SITOU	Applied Math	M2/Bordeaux	CEA/MTMS	
11.	2006	NICOLAS BAUCLIN	Energetic Engineer	2nd year/ENSIAME	CEA/MTMS	
12.	2007	DAMIEN JUTS	Fluid flow Engineer	3rd year/(id)	CEA/MTMS	
13.	2007	<b>GUILLAUME LAPASSET</b>	Energetic Engineer	3rd year/(id)	CEA/MTMS	[R12]
14.	2007	<b>ROMAIN RISCHETTE</b>	Applied Math	M2/Lyon	CEA/MTMS	[PT7]
15.	2008	JEAN-MARC BLANQUIES	Energetic Engineer	2nd year/ENSIAME	CEA/LSET	
16.	2008	PASCAL THIEBOT	Energetic Engineer	3rd year/ENSIAME	CEA/LSET	
17.	2011	<b>JEAN-FRANÇOIS PAISANT</b>	Applied Math	M2/Reims	CEA/LSET	
18.	2011	ÉMILIE BARRÉ	Applied Math	3rd year/ENSIMAG	CEA/LSET	
19.	2012	XUEZHOU LU	Applied Math	M2/P6	CEA/LATF	
20.	2014	VICTOR HELLAUDAIS	Applied Math	3rd year Polytech/Lyon	CEA/LATF	[R6]
21.	2019	<b>WERNER VERDIER</b>	Physicist	M2/AMS	CEA/LMSF	[P3]
22.	2020	PAULINE RICHARD	Physicist	Césure M1/M2	CEA/LMSF	
23.	2021	<b>TÉO BOUTIN</b>	Applied Math	M2/AMS	CEA/LMSF	[P2]
24.	2021	WISSAM BOUYMEDJ	Mechanical Eng.	M2/CHPS	CEA/LMSF	
25.	2022	HUGO DE GIETER	Applied Math	M2/MACS	CEA/LMSF	
26.	2022	<b>THÉO DUEZ</b>	Applied Math	Centrale Paris – Césure M1/M2	CEA/LMSF	
27.	2023	<b>HOEL KERAUDREN</b>	Applied Math	M2/AMS Paris-Saclay	CEA/LMSF	
28.	2023	CHAÏMA ELHARTI	Physicist HPC	M2/MSCHP Paris-Saclay	CEA/LMSF	
29.	2023	<b>SACHA DUPUY</b>	Applied Math	ENSTA Paris – Césure M1/M2	CEA/LMSF	
30.	2024	<b>CLÉMENT BARDET</b>	Applied Math	M2/Maths en Action – Lyon I	CEA/LMSF	
31.	2024	<b>SIMON CAPPE</b>	Applied Math	Mines Paristech – Césure	CEA/LMSF	
32.	2025	PIERRE CHAVASSE-FRÉTAZ	Physicist	Centrale Paris – Césure	CEA/LDEL	

## Appendix B: Details of my involvement in research projects

### 1/3. Current CEA projects (6)

#### 2010–now: SIMU/SIVIT (SIMulation de la VITrification – with Orano & EDF)

Dates	«Modeling and simulation of crystal growth and two fluids demixing in glasses» Actions	Achievements
2010	Involvement in writing the project roadmap.	[R23]
2010–2011	Contacts and collaboration with É. RÉGNIER and S. SCHULLER at CEA/Marcoule/DE2D.	[R8], [O13]
2011	J.-F. PAISANT internship on Navier-Stokes/Cahn-Hilliard coupling.	Intern's report
2013	Writing the <a href="#">technical report on simulations of crystal growth with the Lattice Boltzmann Methods</a> . Oral presentation at summer school «SumGlass» and publication.	[R7] [O12], [P8] [P6], [P7]
2012–2015	References [R7] and [R8] lead to A. YOUNSI PhD thesis on crystal growth with LBM.	
2014	Presentation at CEA–DANS working group on «Phase-field» with DM2S, DMN and DPC.	
2016	Involved in the working group on demixing in glasses.	[PT2]
2019–2022	PhD thesis of W. VERDIER on ternary demixing and Ostwald ripening.	[P1], [P3]
2021	Collaboration with R. LE TELLIER (CEA/Cad/DTN) on thermodynamic database with Calphad.	[O5]
2022	PhD thesis of C. MÉJANÈS	
2023	Keynote speaker at SumGlass2023	[O2]

#### 2016–2023: SIMU/SITHY (SIMulation de la Thermo-HYdraulique)

	«Modeling and simu of thermal-hydraulic in nuclear reactor cores with the TrioCFD code»	
2016	Comparative simulations between TrioCFD and LBM on Navier-Stokes/Darcy-Forchheimer	[R4]
2017	Involvement in the FVCA8 benchmark with TrioCFD and involvement in the roadmap	[P17], [R22]
2019	Involvement in writing the documentation of TrioCFD code	[R3]
2020	Involvement in writing the validation report of TrioCFD code	[R2]
2023	H. KERAUDREN's internship on LBM_Saclay: for two-phase flows with Eq of state	Interns' report

#### 2019–now: SIMU/PICI2 (Plateforme, Integration, Calcul Intensif, Incertitudes)

	«Implementation and simu with LBM_saclay» lot 2 (Calcul Intensif, Veille et R&D amont)	
2018	SILABE3D ([R11], [R10], [R7], [T1]) leads to the collab. with P. KESTENER (CEA/DRF/MDLS) and the development of a new HPC multi-architecture code: LBM_saclay	Code LBM_Saclay
2019–2022	Internships on LBM_saclay: WERNER VERDIER, PAULINE RICHARD, TÉO BOUTIN, WISSAM BOUYMEDJ, HUGO DE GIETER	Interns' report
2022	Writing the <a href="#">technical report on the multi-architecture HPC code LBM_saclay (developers guide)</a>	[R1]
2023	Internship on LBM_Saclay: C. ELHARTI	Interns' report
2023–2026	PhD thesis of H. KERAUDREN for adaptative mesh refinement with a multi-architecture LBM	Code LBM_Saclay2.0

#### 2020–now: CyN/VESTA (Verre En Stockage et Altération long terme)

	«Modeling and simulation at mesoscopic scale of gels with LBM_saclay»	
2020	Contact and collaboration with S. GIN and J.-M. DELHAYE (CEA/Marcoule).	–
2021	T. BOUTIN's PhD on «mesoscopic model of degradation of gels.	–
2022	Publication on dissolution of porous media	[P2]
	Oral presentation at the scientific seminar «TANGRAM» on glasses for nuclear waste management.	[O4]
2023	Participation in the TANGRAM workshop.	

## 2022–now: RTA/RBNEW (Recherche de Base)

«Simulations of two-phase flows for corium applications with LBM_saclay»		
2022	Internship of THÉO DUEZ on Rayleigh-Taylor instability. Coll with R. LE TELLIER (CEA/Cad)	[R19]

## 2024–now: SIMU/SIACY (SIMulation Aval du CYcle)

«Simulations of two-phase flows with mass transfer LBM_saclay»		
2024	Internship of on composition effects of two immiscible fluids	

## 2/3. Completed CEA projects (3)

### 2002–2005: MAVL (Moyenne Activité et Vie Longue – with ANDRA)

Dates	«Parametric identification and 3D simulation of diffusion for waste management» Actions	Achievements
2002	Numerical implementation of «adjoint state method» on experimental data of Mont-Terri.	[R18]
2003	Numerical implementation of «automatic parametrization» and presentation at GdR MOMAS.	[R17]
2004	Direct simulations of DI-A experiment and presentation of results at Paul Scherrer Institute.	[R15], [O16]
2005	Oral presentation at ANDRA international conference (Tours, France) and publication.	[O15], [P13]

### 2004–2013: MRISQ and MRIMP (Maîtrise des RISques et IMPacts)

Modeling, simulations and experimental design of «Transport in unsaturated porous media»		
2004–2006	Contacts and collaboration for experiments with Cemagref/Antony and IRSN/Fontenay	[R13], [R14]
2004–2008	PhD thesis of <b>S. CADALEN</b> .	[P22], [P24]
2006	Involvement in writing a review document for MRISQ project	[R25]
2005–2008	Involvement in the experimental design of BEETI device at CEA/DPC. Collaboration with C. LATRILLE (CEA/DPC) for column and D. CHAMBELLAN (CEA/DRT) for detector + 3 interns	[R12], [P21]
2008–2010	[R12], [P21] lead to the post-doctorate of Dr <b>A. ZOIA</b>	[P10], [P11]
2011	Writing the <a href="#">technical report on application of LBM on experimental data of BEETI</a> .	[R10]
2009–2013	[P10], [P11] and [R12], [P21] lead to ANR TRAM project and post-doc of Dr <b>B. MARYSHEV</b>	[P5], [P9]

### 2008–2009: COSTO (COLis en STOccage)

«Development of the Lattice Boltzmann code SILABE3D»		
2008	First developements of the Lattice Boltzmann code SILABE3D.	–
2009	Writing the <a href="#">first technical report on simulations performed with the Lattice Boltzmann Methods</a>	[R11]

## 3/3. Involvement in other projects (1 ANR & 1 PTC)

### ► 2011–2013: Involvement in one ANR project (French National Research Agency)

**Topic:** modeling and simulations of «Anomalous Transport in porous Media» (TRAM - link abstract pages 30–31). Project reference: ANR-09-SYSC-015. At CEA-DM2S, the project has funded the post-doctorate of **B. MARYSHEV** (18 months) and missions.

#### List of contributors:

- Univ/Avignon: M.-C. NÉEL (lead), M. JOELSON
- CEA-DM2S: B. MARYSHEV, A. CARTALADE
- CEA-DPC: C. LATRILLE (SECR/L3MR)
- IFPEN/Rueil: M. FLEURY, D. BAUER

#### Tasks performed at CEA-DM2S:

- Involvement in writing project with the partners.
- CEA project coordinator ([PT4]).
- Supervision of the post-doctorate; supervision of experiments performed at DPC; simulations. Attendance at all meetings.
- Publications [P5], [P9]

► ***2021–2023: Involvement in one CEA project «Programme Transverse de Compétences»***

**Topic:** «Adaptative Mesh Refinement» with the «Lattice Boltzmann Method». The project has funded the post-doctorate of **E. STAVROPOULOS VASILAKIS** (24 months) at CEA-DM2S and missions.

**List of contributors:**

- CEA-DM2S: A. CARTALADE (STMF/LMSF)
- CEA-DM2S: A. GENTY (STMF/LATF)
- CEA-DAM: P. KESTENER

**Tasks performed at CEA-DM2S:**

- Involvement in writing project with the partners.
- Supervision of the post-doctorate

## Alain CARTALADE

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**Atomic Energy and Altern. Energies Commission**  
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**CEA/Saclay** : Since 22 May 2002

## List of Publications and other contributions

<b>Publications (21+3)</b>	{	Peer-Reviewed Articles	13	<b>Main supervisor of</b>	{	**POST-DOC FELLOW	3
		Article in progress	3			*PHD FELLOW	7
		Peer-Reviewed Proceedings	7			°INTERNSHIP STUDENTS	31
		Proceeding without peer-review	1				
<b>Technical Reports (20+2)</b>	{	Thesis (1 PhD + 1 HDR)	2	<b>Other (6)</b>	{	CEA roadmaps	2
		CEA Technical reports	18			Synthesis reports (CEA&PSI)	2
		Technical Report in progress	2			ANR project	1

## 1/3. Publications (21 + 3)

### ► International journal; Peer-Reviewed Articles (13)

- [P1] \*VERDIER W., A. CARTALADE, M. PLAPP, Grand-potential phase field simulations of droplet growth and sedimentation in a two-phase ternary fluid, *Modelling and Simulation in Materials Science and Engineering*, 32, 065028, doi: [10.1088/1361-651X/ad627e](https://doi.org/10.1088/1361-651X/ad627e). **2024**.
- [P2] \*°BOUTIN T., \*VERDIER W., A. CARTALADE, Grand-potential-based phase-field model of dissolution/precipitation: lattice Boltzmann simulations of counter term effect on porous medium, *Computational Materials Science*, 207, 111261, doi: [10.1016/j.commatsci.2022.111261](https://doi.org/10.1016/j.commatsci.2022.111261). **2022**.
- [P3] \*°VERDIER W., P. KESTENER, A. CARTALADE, Performance portability of lattice Boltzmann methods for two-phase flows with phase change, *Computer Methods in Applied Mechanics and Engineering*, 370, 113266, doi: [10.1016/j.cma.2020.113266](https://doi.org/10.1016/j.cma.2020.113266). **2020**.
- [P4] CARTALADE A., A. YOUNSI and M.-C. NÉEL, Multiple-Relaxation-Time Lattice Boltzmann scheme for fractional advection-diffusion equation. *Computer Physics Communications*, 234, pp. 40–54, doi: [10.1016/j.cpc.2018.08.005](https://doi.org/10.1016/j.cpc.2018.08.005). **2019**.
- [P5] \*\*MARYSHEV B., A. CARTALADE, C. LATRILLE, M.-C. NÉEL, Identifying Space-Dependent Coefficients and the Order of Fractionality in Fractional Advection-Diffusion Equation. *Transport in Porous Media*, 116 (1), pp. 53–71. doi: [10.1007/s11242-016-0764-1](https://doi.org/10.1007/s11242-016-0764-1). **2017**.
- [P6] CARTALADE A., \*YOUNSI A., M. PLAPP, Lattice Boltzmann simulations of 3D crystal growth: Numerical schemes for a phase-field model with anti-trapping current. *Computers & Mathematics with Applications*, 71 (9), pp. 1784–1798. doi: [10.1016/j.camwa.2016.02.029](https://doi.org/10.1016/j.camwa.2016.02.029). **2016**.
- [P7] \*YOUNSI A. and A. CARTALADE, On anisotropy function in crystal growth simulations using Lattice Boltzmann equation. *Journal of Computational Physics*, 325, pp. 1–21. doi: [10.1016/j.jcp.2016.08.014](https://doi.org/10.1016/j.jcp.2016.08.014). **2016**.



- [P8] **CARTALADE A.**, <sup>\*</sup>YOUNSI A., É. RÉGNIER, S. SCHULLER, Simulations of phase-field models for crystal growth and phase separation. *Procedia Materials Science*, 7, pp. 72–78. doi: [10.1016/j.mspro.2014.10.010](https://doi.org/10.1016/j.mspro.2014.10.010). **2014**.
- [P9] <sup>\*\*</sup>MARYSHEV B., **A. CARTALADE**, C. LATRILLE, M. JOELSON, M.-C. NÉEL, Adjoint state method for fractional diffusion: Parameter identification. *Computers & Mathematics with Applications*, 66 (5), pp. 630–638. doi: [10.1016/j.camwa.2013.02.022](https://doi.org/10.1016/j.camwa.2013.02.022). **2013**.
- [P10] <sup>\*\*</sup>ZOIA A., C. LATRILLE, **A. CARTALADE**, Nonlinear random-walk approach to concentration-dependent contaminant transport in porous media. *Physical Review E*, 79 (4), 041125. doi: [10.1103/PhysRevE.79.041125](https://doi.org/10.1103/PhysRevE.79.041125). **2009**.
- [P11] <sup>\*\*</sup>ZOIA A., C. LATRILLE, A. BECCANTINI, **A. CARTALADE**, Spatial and temporal features of density-dependent contaminant transport: Experimental investigation and numerical modeling. *Journal of Contaminant Hydrology*, 109 (1-4), pp. 14–26. doi: [10.1016/j.jconhyd.2009.07.006](https://doi.org/10.1016/j.jconhyd.2009.07.006). **2009**.
- [P12] NÉEL M.-C., M. JOELSON, <sup>\*\*</sup>ZOIA A., **A. CARTALADE**, Compétition entre transport et rétention de matière en milieu poreux, *Mechanics & Industry*, 10, pp. 217–221. doi: [10.1051/meca/2009050](https://doi.org/10.1051/meca/2009050). **2009**.
- [P13] **CARTALADE A. et al.**, Application of Inverse Modeling Methods to Thermal and Diffusion Experiments at Mont Terri Rock Laboratory. *Physics and Chemistry of the Earth A/B/C*, 32 (1-7), pp. 491–506. doi: [10.1016/j.pce.2006.08.043](https://doi.org/10.1016/j.pce.2006.08.043). **2007**.

### ► Peer-reviewed articles in progress (3)

- [P14] <sup>°</sup>DUEZ T., <sup>\*</sup>BOUTIN T., <sup>\*</sup>MÉJANÈS C., **A. CARTALADE**, Multi-GPUs lattice Boltzmann simulations of 3D three-phase flows with phase change. Article in progress.
- [P15] <sup>\*</sup>MÉJANÈS C., **A. CARTALADE**, M. PLAPP, Solidification with density change fluid flow. Article in progress.
- [P16] <sup>°</sup>DUPUY S., <sup>\*</sup>KERAUDREN H., R. NOËL, **A. CARTALADE**, Simulations of Navier-Stokes/Korteweg model with surfactant: a lattice Boltzmann study. Article in progress.

### ► Peer-Reviewed Proceedings (7)

- [P17] ANGELI P.-E., M.-A. PUSCAS, G. FAUCHET, **A. CARTALADE**, FVCA8 benchmark for the Stokes and Navier-Stokes equations with the TrioCFD code – Benchmark session. Proceeding of the Finite Volumes for Complex Applications VIII, Methods and theoretical aspects, conference (21 pages), FVCA8, June 12-16, Université Lille 1. In “Springer Proceedings in Mathematics & Statistics” Book series, vol 199, pp. 181-202. doi: [10.1007/978-3-319-57397-7\\_12](https://doi.org/10.1007/978-3-319-57397-7_12). **2017**.
- [P18] <sup>\*\*</sup>MARYSHEV B., **A. CARTALADE**, C. LATRILLE, M.-C. NÉEL, Accuracy and efficiency of adjoint state based parameter identification for fractional advection diffusion equation with space-dependent coefficient. Proceeding of International Conference on Control, Decision and Information Technologies, 6–8 April 2016 (CoDIT’16), pp. 134–139, (6 pages). Malta. Electronic ISBN: 978-1-5090-2188-8. doi: [10.1109/CoDIT.2016.7593549](https://doi.org/10.1109/CoDIT.2016.7593549). **2016**.
- [P19] <sup>\*</sup>YOUNSI A., **A. CARTALADE**, M. QUINTARD, Lattice Boltzmann Simulations for Anisotropic Crystal Growth of a Binary Mixture. Proceeding of The 15th International Heat Transfer Conference (IHTC-15), 9 pages, 10-15 Aug. Kyoto, paper 9797, ISBN: 978-1-56700-421-2. doi: [10.1615/IHTC15.cpm.009797](https://doi.org/10.1615/IHTC15.cpm.009797). **2014**.
- [P20] OULOIN M., M.-C. NÉEL, M. JOELSON, **A. CARTALADE**, Inversion d’un modèle de dispersion avec effets de mémoire. Proceedings of 20ème Congrès Français de Mécanique (6 pages). Besançon, 29 août au 2 septembre. [Link HAL](#). **2011**.
- [P21] LATRILLE C., **A. CARTALADE**, New experimental device to study transport in unsaturated porous media. Proceedings of The 13th International Conference on Water-Rock Interaction (WRI-13), pp. 299–302 (4 pages). Water-Rock Interaction – Birkle & Torres Alvarado (eds). Taylor & Francis Group, London. ISBN: 978-041560426-0. [PDF file on ResearchGate](#). **2010**.
- [P22] <sup>\*</sup>CADALEN S., M. QUINTARD, and **A. CARTALADE**, Macro-pore model for Cesium transport in sandy-clayed porous media. Proceeding of XVI International Conference on Computational Methods in Water Resources (CMWR-XVI), Copenhagen, Denmark, June. 8 pages, In: P.J. Binning, P.K. Engesgaard, H.K. Dahle, G.F. Pinder and W.G. Gray (Editors). doi: [10.4122/1.1000000630](https://doi.org/10.4122/1.1000000630). **2006**.
- [P23] DEWONCK S., M. DESCOSTES, V. BLIN, E. TEVISSSEN, J. RADWAN, C. POINSSOT, **A. CARTALADE**, P. BRISSET, and D. COELHO, In situ diffusion experiments in Callovo-Oxfordian mudstone. Goldschmidt Conference in Geochemica et Cosmochimica Acta, 70 (18), Supplement 1, p. A140. doi: [10.1016/j.gca.2006.06.296](https://doi.org/10.1016/j.gca.2006.06.296). **2006**.

## ► *Proceeding without peer-review (1)*

- [P24] <sup>\*</sup>CADALEN S., M. QUINTARD, and A. CARTALADE, Micro-pore Model for Cesium Transport in Clayed Porous Media. Proceeding of International Association for Hydro-Environment Engineering and Research (IAHR), 12 pages, IAHR-GW2006 “Groundwater in Complex Environments”, Toulouse. PDF file from S. Cadalen’s thesis. **2006**.

## 2/3. Thesis, CEA technical Reports & collaborative documents (26)

### ► *Thesis (2)*

- [T1] CARTALADE A., Modèles à champ de phase et équations fractionnaires simulés par méthode de Boltzmann sur réseaux. Mémoire d’Habilitation à Diriger des Recherches (HDR) en Physique, Université Paris-Sud. [PDF on ResearchGate](#), 95 pages. **2019**.
- [T2] CARTALADE A., Modélisation des Écoulements dans les Aquifères Fracturés, Développement d’un Modèle Multi-Continua (Problèmes Direct et Inverse) et Application au Site du CEA/Cadarache. Thèse, Univ. Montpellier II. [PDF on ResearchGate](#), 209 pages. **2002**.

### ► *Technical Reports – in french except ☉ (18)*

- [R1] <sup>\*</sup>VERDIER W., <sup>\*</sup>BOUTIN T., P. KESTENER, A. CARTALADE, LBM\_saclay : code HPC multi-architectures sur base LBM. Guide du développeur. [PDF Report DES/ISAS/DM2S/STMF/LMSF/NT/2022-70869/A](#). 116 pages. **2022**.
- ☉ [R2] DARONA J., P.-E. ANGELI, A. CARTALADE, First version of TrioCFD validation report. Ref: DES/ISAS/DM2S/STMF/LMSF/NT/2020-67417/A. 190 pages. **2020**.
- [R3] ANGELI P.-E., A. CARTALADE, E. JAMELOT, Documentation TrioCFD. Ref: DEN/DANS/DM2S/STMF/LMSF/NT/2019-65912/A, 27 pages, **2019**.
- [R4] CARTALADE A., Comparative simulations of averaged model for simulating flow in porous media. Ref: DEN-DM2S-STMF-LMSF-RT/16-012/A. 19 pages. **2016**.
- [R5] <sup>○</sup>HELLAUDAIS V., <sup>\*</sup>YOUNSI A. et A. CARTALADE, Simulations of 2D/3D anisotropic shapes of crystal growth by a phase-field model: spherical and cubic harmonics of interfacial energy. Ref: DEN-DM2S-STMF-LMSF-NT/15-003/A. 28 pages. **2015**.
- [R6] <sup>\*</sup>YOUNSI A. et A. CARTALADE, Comparisons of Lattice Boltzmann schemes for simulating a transport equation with variable parameters and applications on crystal growth problems. Ref: DEN-DM2S-STMF-LATF-NT/14-033/A. 22 pages. **2014**.
- [R7] CARTALADE A., Lattice Boltzmann simulations for crystal growth problems with a phase-field model II: Model with thin interface limit of 3D pure substance. Ref: [PDF Report DEN-DM2S-STMF-LATF-NT/13-008/A](#). 30 pages. **2013**.
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- [R9] CARTALADE A. and A. GENTY, Effective diffusion of 3D porous media: Lattice Boltzmann simulations. Ref: DEN-DM2S-STMF-LATF-RT/12-016/A. 22 pages. **2012**.
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- [R11] CARTALADE A., Lattice Boltzmann Method for modelling flow and transport in porous media: natural convection and Darcy-Brinkman-Forchheimer equation. Ref: [PDF Report DEN-DM2S-SFME-LSET-RT/09-004/A](#). 52 pages (2 tech notes). **2009**.
- [R12] CARTALADE A., C. LATRILLE, <sup>○</sup>LAPASSET G., D. CHAMBELLAN and <sup>\*</sup>CADALEN S., Beeti experimental device: Dispersivity law identification, Interpretation of X-ray dichromatic data, and calibration system design. Ref: DEN-DM2S-SFME-MTMS-RT/07-018/A. 79 pages (4 technical notes). **2007**.
- [R13] <sup>○</sup>HARICH R., A. CARTALADE, <sup>\*</sup>CADALEN S. et C. ARDOIS, Continuous Time random walks for mass transfer modeling in unsaturated porous media: Theory, comparative simulations and application on experimental data. Ref: DEN-DM2S-SFME-MTMS-RT/07-002/A. 23 pages. **2007**.
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### ► Technical Reports in progress (2)

- [R19] <sup>○</sup> DUEZ T., R. LE TELLIER, A. CARTALADE, BGK and MRT collisions in LBM\_saclay. Comparisons on Rayleigh-Taylor instabilities for corium applications. **2023**.
- [R20] <sup>○</sup> DE GIETER H., A. CARTALADE, Simulations of a phase-field model for surfactant. **2023**.

### ► Involvement in collaborative documents (6)

- [R21] DU CLUZEAU A., **A. CARTALADE**, Cahier des charges relatif à la prestation de maintenance des codes EOS et LBM\_Saclay au STMF. Ref DES/ISAS/DM2S/STMF/LMSF/ST/2023-XXXXX/A. 21 pages. **2023**.
- [R22] BURBEAU A., **A. CARTALADE**, P. OMNES, M.-A. PUSCAS, Roadmap of TrioCFD code development. Version 1. CEA project proposal. Ref. DEN/DANS/DM2S/STMF/LMSF/NT/16-014/A. 57 pages. **2016**.
- [R23] RIBET I., and 14 contributors, SIVIT project: programme of vitrification simulation 2010–2020. CEA project proposal. Ref. DEN/MAR/DTCD/RT/2010/03. 76 pages (Restricted Diffusion). **2010**.
- [R24] NÉEL M.-C., M. JOELSON, **A. CARTALADE**, C. LATRILLE, M. FLEURY, D. BAUER, ANR – TRAM project (Anomalous Transport in Porous Media). ANR project proposal. Program SYSCOMM 50 pages. **2009**.
- [R25] **CARTALADE A.**, P. THOUVENOT, F. VAN DORPE, C. BEAUCAIRE, Transfer in unsaturated zone: synthesis document of DEN activities in MRIMP project. CEA synthesis report. Ref: DEN-DM2S-SFME-MTMS-RT/06-013/A. 97 pages. **2006**.
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## 3/3. Lectures, main Oral presentations and PosTers

<b>Main oral presentations</b>	Lectures	e.g. <a href="#">[L2]</a> , <a href="#">[L3]</a>	International conferences	e.g. <a href="#">[O9]</a> , <a href="#">[O15]</a>
	HDR and PhD	e.g. <a href="#">[O7]</a> , <a href="#">[O17]</a>	Workshops & seminars	e.g. <a href="#">[O4]</a> , <a href="#">[O6]</a>
	Summer school	e.g. <a href="#">[O12]</a>	Meetings of CEA Labs, services and departments	e.g. <a href="#">[O10]</a>
	Keynote speaker	e.g. <a href="#">[O2]</a>	Meetings with indus. partners (Andra, Orano, EDF)	e.g. <a href="#">[O11]</a> , <a href="#">[O13]</a>

### ► Slides of courses & training sessions

«Phase-field models» – 4h30/7h. CEA/INSTN and Master 2 at Sorbonne University

- [L1] **A. CARTALADE**, Cours INSTN CFD diphasique du STMF – Partie 1.C [Approche thermodynamique des interfaces : les modèles à champ de phase](#). 325 slides. Last update **2025**.

**Training session «An introduction to Lattice Boltzmann Methods»** – 16h. Doctoral school SMEMaG (Centrale–Supélec, U Paris-Saclay).

- [L2] **A. CARTALADE**, [Lattice Boltzmann Methods – Part A: introduction](#). Theory and examples on two-phase flows and phase change. 187 slides. Last update **2024**.
- [L3] **A. CARTALADE**, [Lattice Boltzmann Methods – Part B: practice with LBM\\_Saclay](#). Single phase and two-phase flows. 123 slides. Last update **2024**.
- [L4] **A. CARTALADE**, [Lattice Boltzmann Methods – Part C: phase-field applications](#). 85 slides. Last update **2024**.

## ► Resume

[Cv] A. CARTALADE, «[Pathway and main achievements](#)», presentation of 8 slides + 12 appendice slides. **2023**.

## ► Main oral presentations

- [O1] A. CARTALADE, \*BOUTIN T., \*MÉJANÈS C., L. AMARSID, J.-M. VANSO, «Multi-GPU simulations of three-phase flows with LBM\_Saclay», 3rd CEA-JAEA workshop. Online, 22 March, **2024**.
- [O2] A. CARTALADE, \*VERDIER W., C. \*MÉJANÈS C., S. SCHULLER, R. LE TELLIER, S. GOSSÉ, «Modeling phase separation in the melt: thermodynamics, fluid flow and HPC simulations». Keynote speaker at SumGlass summer school (30min). Musée de Romanité, Nîmes, September 27th, **2023**.
- [O3] \*\*STAVROPOULOS VASILAKIS E., P. KESTENER, A. CARTALADE, A. GENTY, Adaptive mesh refinement Lattice Boltzmann method multi-architecture implementation for multi-phase flows. American Phy Soc., Division of Fluid Dyn, 75th annual meeting, 21 Nov **2022**.
- [O4] \*BOUTIN T., J.-M. DELAYE, S. GIN, A. CARTALADE, «Modèles à champ de phase dans TANGRAM». Scientific seminar on gels for nuclear waste confinement. CEA-Marcoule, ICSM, September 16th, **2022**.
- [O5] \*VERDIER W., R. LE TELLIER, M. PLAPP, A. CARTALADE, Coupling a grand potential ternary phase field model to the thermodynamic landscape of the Na<sub>2</sub>O–SiO<sub>2</sub>–MoO<sub>3</sub> nuclear glass. Calphad conference, 26 May **2022**.
- [O6] \*VERDIER W., \*BOUTIN T., P. KESTENER, A. CARTALADE, «Phase-field models simulated by LBM\_saclay». 3ème Séminaire du réseau des numériciens CEA–Cadars, 1er octobre **2021** (en visio).
- [O7] CARTALADE A., Modèles à champ de phase et équations fractionnaires simulés par méthodes de Boltzmann sur réseaux, Soutenance de HDR, Université Paris-Sud, CEA/Saclay, **2019**.
- [O8] CARTALADE A., P. KESTENER, A. GENTY, S. KOKH, «Méthodes de Boltzmann sur réseaux dans un contexte HPC». Workshop HPC Den/DAM, Aussois, France. 5 juillet **2018**. Publication [\[P3\]](#).
- [O9] CARTALADE A., A. YOUNSI, M.-C. NÉEL, «Fractional and Anisotropic Advection-Diffusion Equation simulated by Lattice Boltzmann scheme». DSFD (LBM conference), Erlangen, Germany, July 10–14. **2017**. Publication [\[P4\]](#).
- [O10] CARTALADE A., S. SCHULLER, M.-E. PASQUINI, «Modèle H pour la simulation de la démixtion dans les verres et les écoulements diphasiques». Presentation of unpublished work on «Navier-Stokes/Cahn-Hilliard simulations for demixing in glasses». Working group DNS at STMF. Org. J. SEGRÉ (STMF). Nov 5, CEA/Saclay. **2014**.
- [O11] CARTALADE A., A. YOUNSI, E. RÉGNIER, and S. SCHULLER, «Simulations of Phase-Field Models for Crystal Growth in Glasses». Review presentation on crystal growth. SiMaDES VI, ICSM, Nov 21st, CEA/Marcoule. **2014**.
- [O12] CARTALADE A., A. YOUNSI, E. RÉGNIER and S. SCHULLER, «Simulations of crystal growth and phase separation. An introduction to phase-field models». SUMGLASS summer school. 24 sept, Nîmes, site pont du Gard. Link program (Tuesday 24th, session 3, 10:40am). **2013**. Publication [\[P8\]](#).
- [O13] CARTALADE A., «Avancement de l'Activité Modélisation de l'Auto-Creuset (Projet AUDRIC)». Presentation of unpublished work on non-newtonian flow simulated by LBM. CEA/Marcoule. Org. I. RIBET (projet SIVIT), 4 nov, CEA-Marcoule. **2010**.
- [O14] CARTALADE A. et al, «Avancement de l'Activité Modélisation du transport en milieu insaturé». Presentation of , [\[R12\]](#), [\[R13\]](#) and [\[R14\]](#), Journée Thématique Milieux Poreux, 3 avril, INSTN, CEA-Saclay. **2008**.
- [O15] CARTALADE A., 2nd International Meeting of «Clays in Natural & Engineered Barriers for Radioactive Waste Confinement», March 16, Tours, France. **2005**. Publication [\[P13\]](#).
- [O16] CARTALADE A., Presentation of CEA Report [\[R15\]](#). Global Research Safety Meeting, Braunschweig, Germany. **2004**.
- [O17] CARTALADE A., Soutenance de thèse de doctorat, Université Montpellier II, **2002**.

## ► *PosTers*

- [PT1] KESTENER P., **A. CARTALADE**, A. GENTY, S. KOKH, Multi-architecture Implementation and Optimizations of Lattice Boltzmann Algorithms. Poster of the Annual Fluid Mechanics workshop, [PDF on ResearchGate](#), January, Institut Henry Poincaré, Paris. **2019**.
- [PT2] PIARRISTEGUY A., S. SCHULLER, **A. CARTALADE**, M. PLAPP, S. GOSSÉ, R. PODOR, Étude de la cinétique de démixtion dans les verres borosilicates de sodium. Journées du GdR Verre. Bordeaux, 17 et 18 nov. **2016**.
- [PT3] \*YOUNSI A., **A. CARTALADE**, M. PLAPP, Lattice Boltzmann simulations of hydrodynamics effects on crystal growth of binary mixture. Best poster award (see CV) at the «Third International Symposium on Phase-Field MethodPFM2014», [PDF on ResearchGate](#), State College, Pennsylvania, USA. **2014**.
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- [PT5] \*\*MARYSHEV B., **A. CARTALADE**, C. LATRILLE, M.-C. NÉEL, Adjoint state method for fractal mobile-immobile model. PDF. Poster presented at the «Fourth International Conference on Porous Media and its applications in Science, Engineering and Industry», Potsdam, Germany. **2012**.
- [PT6] \*\*ZOIA A., C. LATRILLE, **A. CARTALADE**, A nonlinear random walk for coupled flow-transport problems in porous media. European Geosciences Union General Assembly, Vienna, Austria, 19–24 April. **2009**.
- [PT7] <sup>o</sup>RISCHETTE R., **A. CARTALADE**, G. LODS, Modélisation inverse de l'état initial d'un système aquifère : approche par Back and Forth Nudging. Poster présenté au Groupement de Recherche (GdR) MOMAS (MOdélisation MATHématique et Simulation numérique pour le stockage des déchets). [PDF on ResearchGate](#), 14 nov. **2007**.