

# Thomas Debris-Alazard

BORN IN PARIS, FRANCE, MAY 1, 1991 · RESEARCHER SCIENTIST AT INRIA

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## Research Interests

**Research Area:** *Public-Key Cryptography (theory, designs, cryptanalysis, standardization) with a focus on code and lattice-based cryptography*

- **Cryptographic Designs,**
- **Cryptanalysis,**
- **Security estimates,** study of the generic decoding problem
- **Security proof,** in the classical or quantum model
- **Algorithms, Reduction** classical and quantum

## Employment

### École Polytechnique

TEACHER ASSISTANT (CHARGÉ D'ENSEIGNEMENT)

Département d'Informatique de l'École Polytechnique (DIX)

Saclay, France

Sept. 2022 - Present

### Inria Saclay

RESEARCHER SCIENTIST (CHARGÉ DE RECHERCHE)

Project-Team: Grace

Saclay, France

Sept. 2020 - Present

### Royal Holloway, University of London, UK

POSTDOC IN THE INFORMATION SECURITY GROUP

Hosted by Pr Martin R. Albrecht

London, UK

Sept. 2019 - Sept. 2020

## Education

### Inria Paris

PH.D., CODE-BASED CRYPTOGRAPHY: NEW APPROACHES FOR DESIGN AND PROOF ; CONTRIBUTION TO

CRYPTANALYSIS

Advisor: Pr Jean-Pierre Tillich

Paris, France

Sept. 2016 - Sept. 2019

### École Normale Supérieure de Cachan (ENS)

THESIS, CODE-BASED CRYPTOGRAPHY: STUDY OF A GENERIC DECODING ALGORITHM, STATISTICAL DECODING

Advisor: Pr Jean-Pierre Tillich

Paris, France

Mar. 2016 - Sept. 2016

MASTER MPRI (PARISIAN MASTER OF RESEARCH IN COMPUTER SCIENCE).

Main Topics: Cryptography, Complexity, Security reductions, Gröebner basis, Quantum algorithms

Sept. 2015 - Sept. 2016

AGRÉGATION DE MATHÉMATIQUES OPTION INFORMATIQUE.

Sept. 2014 - Sept. 2015

## Honors and Awards

2021-2024 **ANR JCJ**

COLA: AN INTERFACE BETWEEN CODE AND LATTICE-BASED CRYPTOGRAPHY

200 000 €

2021 **Finalist for the Cor Baayen Young Researcher Award**

ERCIM

2020 **Gilles Kahn Thesis Award**

THOMAS DEBRIS-ALAZARD UNDER THE SUPERVISION OF JEAN-PIERRE TILlich

Société Informatique de  
France

2019 **Best Paper Award, Wave: A New Family of Trapdoor One-Way Preimage Sampleable Functions Based on Codes**

THOMAS DEBRIS-ALAZARD, NICOLAS SENDRIER AND JEAN-PIERRE TILlich

Asiacrypt '19

## Scientific Publications

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- 2022    **On the pseudorandomness of the decoding problem via the Oracle Comparison Problem** *Asiacrypt '23*  
MAXIME BOMBAR, ALAIN COUVREUR AND THOMAS DEBRIS-ALAZARD
- 2023    **Smoothing codes and lattices: systematic study and new bounds** *IEEE Information Theory '23*  
THOMAS DEBRIS-ALAZARD, LÉO DUCAS, NICOLAS RESCH AND JEAN-PIERRE TILLICH
- 2023    **Statistical Decoding 2.0: Reducing Decoding to LPN** *Asiacrypt '22*  
KEVIN CARRIER, THOMAS DEBRIS-ALAZARD, CHARLES MEYER-HILFIGER AND JEAN-PIERRE TILLICH
- 2022    **On Codes and Learning with Errors over Function Fields** *Crypto '22*  
MAXIME BOMBAR, ALAIN COUVREUR AND THOMAS DEBRIS-ALAZARD
- 2022    **An Algorithmic Reduction Theory for Binary Codes: LLL and more** *IEEE Information Theory '22*  
THOMAS DEBRIS-ALAZARD, LÉO DUCAS AND WESSEL P.J. VAN WOERDEN
- 2021    **Classical and Quantum algorithms for generic Syndrome Decoding problems and applications to the Lee metric** *PQCrypto '21*  
ANDRÉ CHAILLOUX, THOMAS DEBRIS-ALAZARD AND SIMONA ETINSKI
- 2020    **Tight and Optimal Reductions for Signatures based on Average Trapdoor Preimage Sampleable Functions and Applications to Code-Based Signatures** *PKC '20*  
ANDRÉ CHAILLOUX AND THOMAS DEBRIS-ALAZARD
- 2019    **Wave: A New Family of Trapdoor One-Way Preimage Sampleable Functions Based on Codes** *Asiacrypt '19*  
THOMAS DEBRIS-ALAZARD, NICOLAS SENDRIER AND JEAN-PIERRE TILLICH
- 2019    **Ternary syndrome decoding with large weights** *SAC '19*  
RÉMI BRICOUT, ANDRÉ CHAILLOUX, THOMAS DEBRIS-ALAZARD AND MATTHIEU LEQUESNE
- 2018    **Two attacks on rank metric code-based schemes: Ranksign and an identity-based-encryption scheme** *Asiacrypt '18*  
THOMAS DEBRIS-ALAZARD AND JEAN-PIERRE TILLICH
- 2017    **Statistical Decoding** *ISIT '17*  
THOMAS DEBRIS-ALAZARD AND JEAN-PIERRE TILLICH

## Preprints

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- 2022    **Worst and Average Case Hardness of Decoding via Smoothing Bounds** *iacr.org*  
THOMAS DEBRIS-ALAZARD AND NICOLAS RESCH
- 2021    **Wavelet: Code-based postquantum signatures with fast verification on microcontrollers** *iacr.org*  
GUSTAVO BANEGAS, THOMAS DEBRIS-ALAZARD, MILENA NEDELJKOVIĆ AND BENJAMIN SMITH
- 2021    **Quantum Reduction of Finding Short Code Vectors to the Decoding Problem** *arxiv.org*  
THOMAS DEBRIS-ALAZARD, MAXIME REMAUX AND JEAN-PIERRE TILLICH
- 2020    **On the Hardness of Code Equivalence Problems in Rank Metric** *arxiv.org*  
ALAIN COUVREUR, THOMAS DEBRIS-ALAZARD AND PHILIPPE GABORIT
- 2019    **About Wave Implementation and its Leakage Immunity** *iacr.org*  
THOMAS DEBRIS-ALAZARD, NICOLAS SENDRIER AND JEAN-PIERRE TILLICH
- 2017    **The problem with the SURF scheme** *arxiv.org*  
THOMAS DEBRIS-ALAZARD, NICOLAS SENDRIER AND JEAN-PIERRE TILLICH

# Teaching

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## Polytechnique (2022-)

- **Introduction to quantum computing and quantum information (INF587)**

## MPRI (2021-)

- **Error-correcting codes and applications to cryptography (with Anne Canteaut and Alain Couvreur)**, introduction to code-based cryptography

## ENS Lyon (2021-2023)

- **Post-quantum cryptography (with Damien Stehlé and Benjamin Wesolowski)**, introduction to code-based cryptography

## Polytechnique (2020-2022)

- **Introduction à l'informatique (INF361)**, under the supervision of François Morain
- **Introduction to cryptology (INF558)**, under the supervision of François Morain

## ENSTA (2020-2021)

- **Mathématiques discrètes pour la protection de l'information**, under the supervision of Françoise Levy-Dit-Vehel

## University Paris-Sorbonne (2016-2019)

- **Advanced Cryptography**, Master 1 under the supervision of Damien Vergnaud
- **Introduction of Cryptography**, 3rd year Bachelor under the supervision of Valérie Ménessier-Morain
- **Environment and Development in Linux**, 2nd year Bachelor under the supervision of Valérie Ménessier-Morain
- **Programming in C**, 1st year Bachelor

# Program Committees

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2021-2022 **Gilles Kahn Award**

SOCIÉTÉ INFORMATIQUE DE FRANCE

2022 **Journées Codage & Cryptographie (JC2)**

# Presentations

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## Selected Talks at Seminars and Conferences

Oct, 2021	<b>Quantum Reduction of Finding Short Code Vectors to the Decoding Problem</b> , DAGSTUHL SEMINAR, QUANTUM CRYPTANALYSIS	<i>Dagstuhl</i>
Dec, 2019	<b>Wave: A New Family of Trapdoor One-Way Preimage Sampleable Functions Based on Codes</b> , ASIACRYPT 19'	<i>Kobe</i>
Sept, 2019	<b>Wave: A New Family of Trapdoor One-Way Preimage Sampleable Functions Based on Codes</b> , LONDON-ISH LATTICE CODING AND CRYPTO MEETINGS	<i>Imperial College, London</i>
May, 2019	<b>Wave: A New Family of Trapdoor One-Way Preimage Sampleable Functions Based on Codes</b> , CRYPTO MEETING	<i>ENS, Lyon</i>
Feb, 2019	<b>Wave: A New Family of Trapdoor One-Way Preimage Sampleable Functions Based on Codes</b> , CRYPTOGRAPHY SEMINAR	<i>PQShield, Oxford</i>
Dec, 2018	<b>Two attacks on rank metric code-based schemes: Ranksign and an identity-based-encryption scheme</b> , ASIACRYPT 18'	<i>Brisbane</i>
June, 2017	<b>Statistical Decoding</b> , ISIT 17'	<i>Aachen</i>

## Workshops

Sept. 2020-**Organization of the team Grace Seminar**,

*Inria Saclay*

PRESENTATIONS: HERE

Sept. 2020-**Workshop on Transference**, ORGANIZED BY LÉO DUCAS

*CWI*

PRESENTATION: SMOOTHING BOUNDS FOR CODES AND LATTICES

Sept.  
2019-2020 **Workshop “yet another crypto reading group”**, ORGANIZED BY MARTIN R. ALBRECHT

*Royal Holloway  
University of London*

PRESENTATION: WORST-CASE HARDNESS FOR LPN AND CRYPTOGRAPHIC HASHING VIA CODE SMOOTHING

Mar. 2016 - **Workshop “code-based cryptography”**, ORGANIZED BY JEAN-PIERRE TILlich

*Inria Paris*

PRESENTATIONS: ON THE PSEUDORANDOMNESS OF THE DECODING PROBLEM VIA THE ORACLE COMPARISON PROBLEM, STATISTICAL DECODING, SURF : A NEW CODE-BASED SIGNATURE SCHEME, TWO ATTACKS AGAINST SCHEMES BASED ON RANK METRIC, NEW RESULTS ABOUT SIGNATURES BASED ON CODES, WAVE, WORST-CASE HARDNESS FOR LPN AND CRYPTOGRAPHIC HASHING VIA CODE SMOOTHING, AN ALGORITHMIC REDUCTION THEORY FOR BINARY CODES: LLL AND MORE, QUANTUM REDUCTION OF FINDING SHORT CODE VECTORS TO THE DECODING PROBLEM, SMOOTHING BOUNDS: FROM LATTICES TO CODES AND BACK TO LATTICES

## Scientific Popularization

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2021	<b>Rendez-vous des Jeunes Mathématiciennes et Informaticiennes, Fête de la science à l'école Polytechnique, Olympiades de Mathématiques de l'Académie de Créteil</b>
2018	<b>International Tournament of Young Mathematicians (Jury Member)</b>
2018	<b>Tournoi Français des Jeunes Mathématiciennes et Mathématiciens (Jury Member)</b>
2018	<b>Rendez-vous des Jeunes Mathématiciennes et Informaticiennes</b>

## Skills

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<b>Programming</b>	C, Java, Python, jkiloMagma, SageMath
<b>Languages</b>	French (native), English (fluent)

## Reviews

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2022	<b>Asiacrypt, DCC, AMC, PQCrypto, JoC, ANR</b>
2021	<b>Eurocrypt, Crypto, CTRSA, DCC, ISIT, PQCrypto, ANR, IMACC, AMC, Latincrypt</b>
2020	<b>AMC, ITW, IEEE</b>
2019	<b>Eurocrypt, ISIT, DCC, PKC</b>
2018	<b>PQCrypto, WCC</b>
2017	<b>C2SI</b>