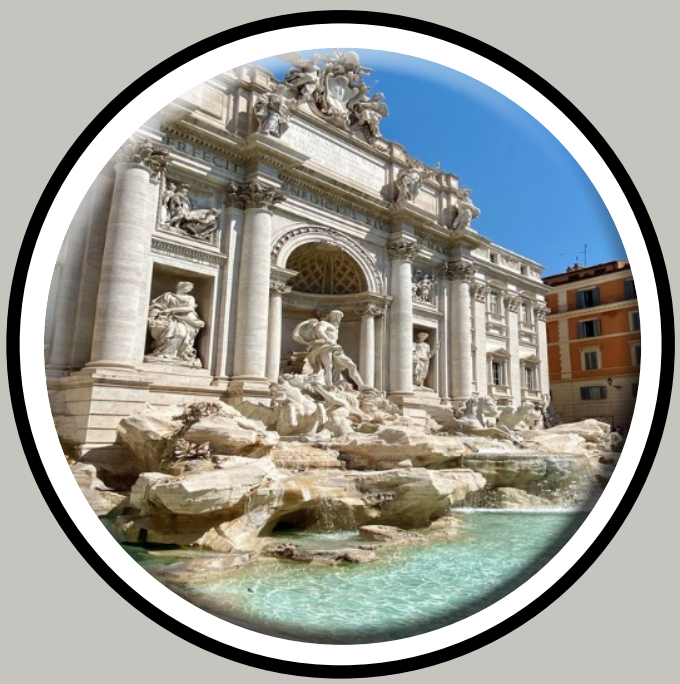
29th international Conference on Automated Deduction



01 – 04 JULY, 2023

ROME, ITALY

CONTENTS

WELCOME NOTE

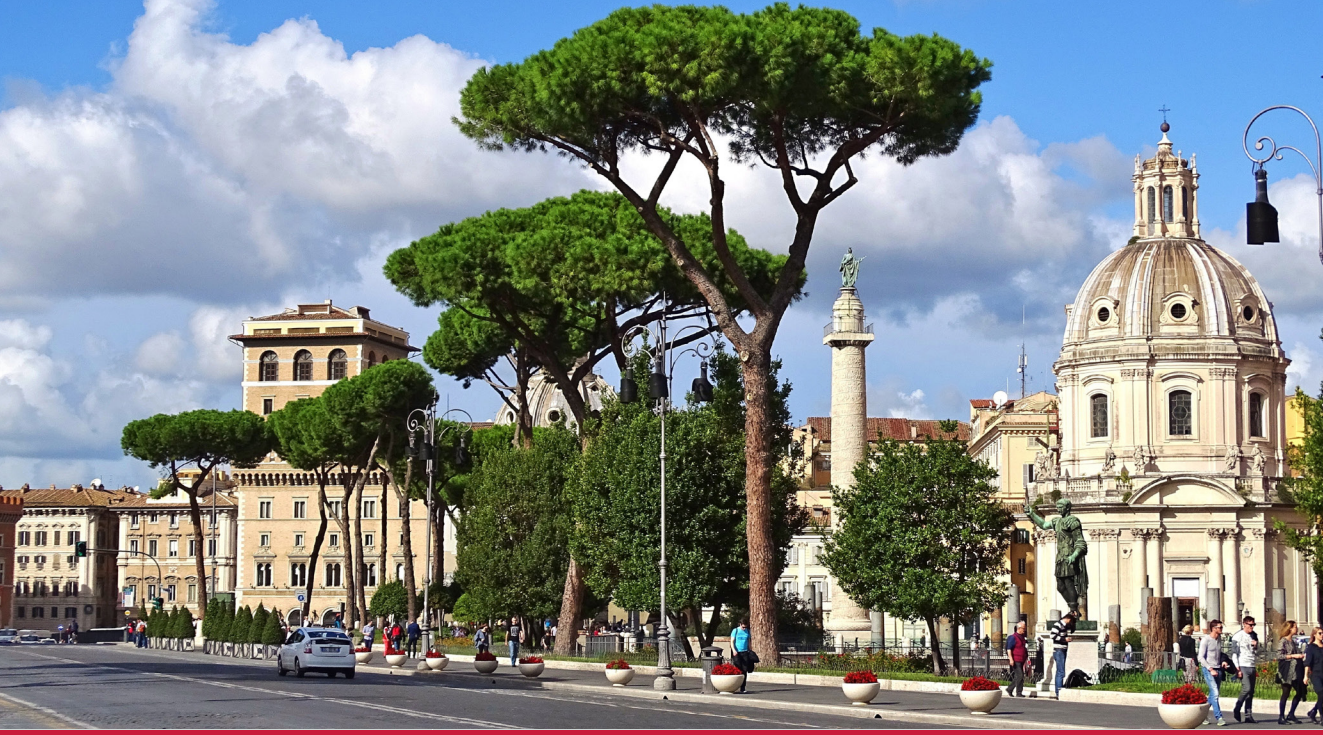
The Conference on Automated Deduction (CADE) is the major international forum for presenting research on all aspects of automated deduction.

The conference programme includes invited talks, paper presentations, workshops, tutorials, and system competitions. Furthermore, the Herbrand Award for Distinguished Contributions to Automated Deduction, the Skolem Award(s) for influential historical CADE papers, and the Bill McCune PhD Award, are presented at the conference.

The 29th International Conference on Automated Deduction (CADE-29) will take place from July 1 to 5, 2023 in Rome, Italy, with satellite events on July 4 and 5. It will be co-located with FSCD 2023.

CADE-29 is organized in cooperation with ACM SIGLOG and implements the ACM policy against harassment.

WELCOME NOTE



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COMMITTEES

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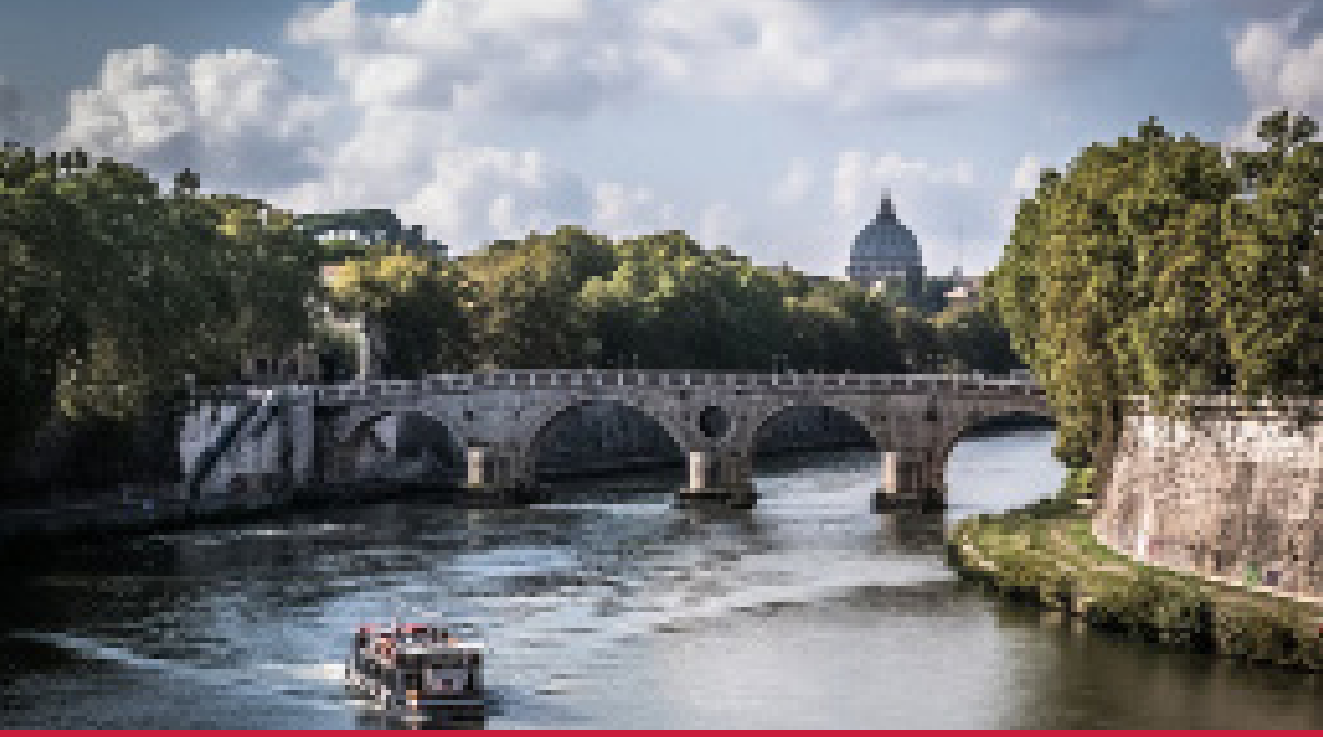

KEYNOTE SPEAKERS

Jasmin Christian Blanchette

Ludwig-Maximilians-Universität München

Lambda-Superposition: From Theory to Trophy

Abstract: Lambda-superposition is a proof calculus for higher-order logic (simple type theory) developed in collaboration with Alexander Bentkamp, Simon Cruanes, Visa Nummelin, Sophie Tourret, Petar Vukmirović, and Uwe Waldmann. To a large extent, the calculus is a graceful generalization of standard superposition, which is a highly successful calculi for first-order logic. On the theory side, we proved the lambda-superposition refutationally complete. On the practical side, we implemented it in the Zipperposition prover and, together with Stephan Schulz, in the E prover. Zipperposition finished first in the higher-order theorem division of the CADE ATP System Competition in 2020, 2021, and 2022, suggesting that superposition is a valuable approach also in a higher-order setting.

Bio: Jasmin Blanchette is holder of the Chair of Theoretical Computer Science at Ludwig-Maximilians-Universität München. His research focuses on the use and development of proof assistants and automatic theorem provers. On the proof assistant front, he (co)developed three tools for the Isabelle/HOL proof assistant: the Nitpick model finder, the Sledgehammer proof tool, and the (co)datatype package. On the automatic theorem proving front, he and his colleagues developed lambda-superposition. He also applied proof assistants to verify the correctness of the logical calculi underlying automatic provers.

Maribel Fernandez (Joint FSCD-CADE)

King's College London

Nominal Techniques for Software Specification and Verification

Abstract: The nominal approach to the specification of languages with binding operators, introduced by Gabbay and Pitts, has its roots in nominal set theory. With a user-friendly first-order syntax, nominal logic provides a formal framework to reason about binding operators similar to conventional, on-paper reasoning. Indeed, nominal logic uses the well-understood concept of permutation groups acting on sets to provide a rigorous first-order treatment for the common informal practice of fresh and bound names.

In this talk, I will present our current work towards incorporating nominal techniques into two widely-used rule-based first-order verification environments:
the K specification framework and the Maude programming environment.

An important component of rule-based programming and verification environments is the unification algorithm used to solve equational problems. In practice, unification problems are solved in the context of equational axioms. In the first part of the talk we will discuss nominal unification modulo equational theories. In particular, we will discuss nominal unification modulo associativity and commutativity, and the use of nominal narrowing to deal with theories presented by convergent rewrite rules.

Another important component of verification environments is the type system. In the second part of the talk we will discuss type systems for nominal languages (including polymorphic systems and intersection systems). Dependent type theories, the dominant approach to formalising programming languages, have also been extended with nominal features. A lambda-less nominal dependent type system is available and we are currently working on a type checker for this system.

The talk will be structured as follows: we will start with the definition of nominal logic (including the notions of fresh atoms and alpha-equivalence) followed by a brief introduction to nominal matching and unification. We will then define nominal rewriting, a generalisation of first-order rewriting that provides in-built support for alpha-equivalence following the nominal approach. Finally, we will discuss notions of nominal unification and rewriting modulo associative and commutative operators and briefly overview typed versions of nominal languages.

● **Mateja Jamnik (Joint FSCD-CADE)**

University of Cambridge, UK (Department of Computer Science and Technology)

How can we trust AI?

Abstract: Not too long ago most headlines talked about our fear of AI. Today, AI is ubiquitous, and the conversation has moved on from whether we should use AI to how we can trust the AI systems that we use in our daily lives. In this talk I look at some key technical ingredients that help us build confidence and trust in using intelligent technology. I argue that intuitiveness, interaction, explainability and inclusion of human domain knowledge are essential in building this trust. I present some of the techniques and methods we are building for making AI systems that think and interact with humans in more intuitive and personalised ways, enabling humans to better understand the solutions produced by machines, and enabling machines to incorporate human domain knowledge in their reasoning and learning processes.

Bio: Mateja Jamnik is Professor of Artificial Intelligence at the University of Cambridge, UK. She is developing AI techniques for human-like computing – she combines AI reasoning with machine learning techniques in order to advance the explainability of AI systems, and applies them to personalised medicine and tutoring systems. Mateja is passionate about bringing science closer to the public and engages frequently with the media and outreach events. She has been advising the UK government on policy direction in relation to the impact of AI on society.

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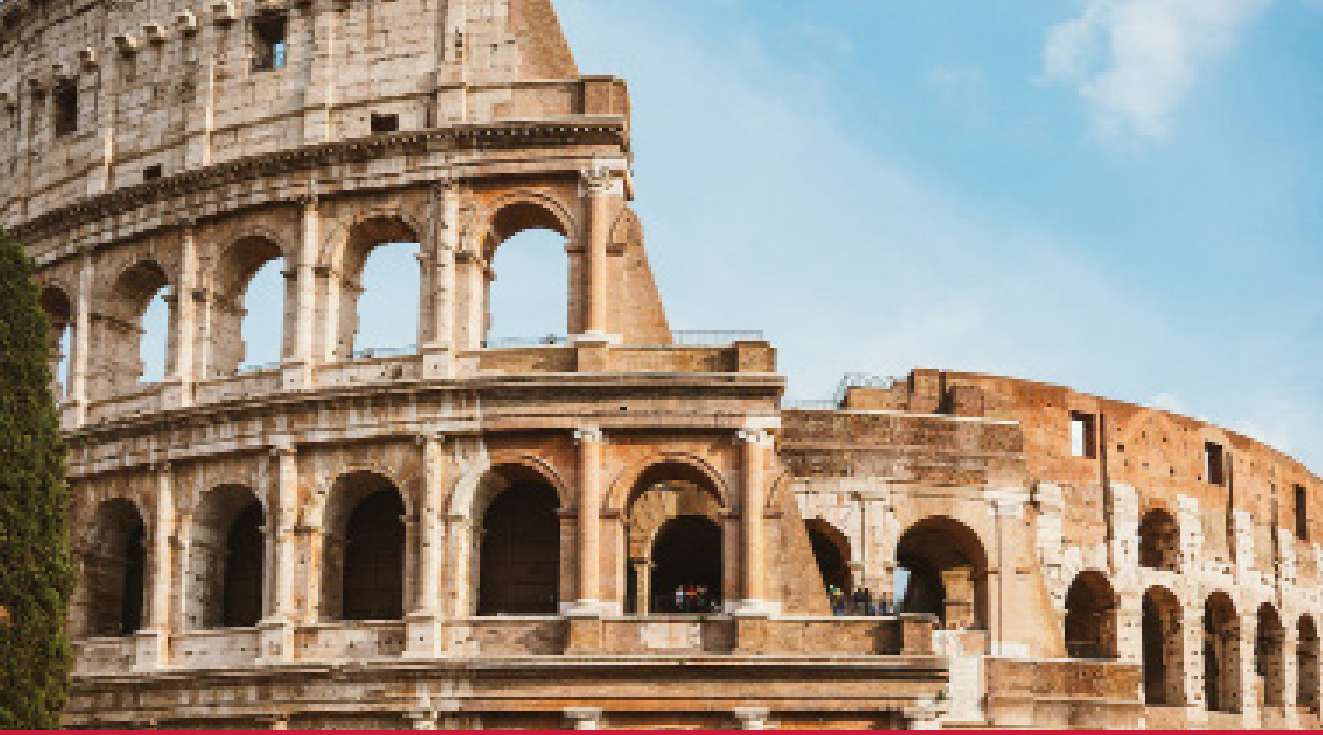


OVERVIEW PROGRAMME

SAT 1st Jul	SUN 2nd Jul	MON 3rd Jul	TUE 4th Jul	WED 5th Jul	THU 6th Jul
CADE	CADE	CADE	CADE		
		FSCD	FSCD	FSCD	FSCD
TLLA	TLLA	CASC	HOR	SMT	SMT
LSFA	LSFA			AdeMaL	
WIL	DCM			THeDu	
	LFMTP			Vampire	
WPTE	UNIF			IFIP WG 1.6	
	CADE business meeting	CADE excursion & dinner		FSCD general meeting	
CADE welcome	FSCD welcome	FSCD optional excursion & dinner			

The CADE and IJCAR conferences are the major forums for the presentation of new research in all aspects of automated deduction. In order to stimulate ATP research and system development, and to expose ATP systems within and beyond the ATP community, the CADE ATP System Competition (CASC) is held at each CADE and IJCAR conference. CASC-29 will be held on 3rd July 2023, during the 29th International Conference on Automated Deduction (CADE-29).

CASC evaluates the performance of sound, fully automatic, ATP systems. The evaluation is in terms of:

- the number of problems solved,
- the number of problems solved with a solution output, and
- the average time taken for problems solved;

in the context of:

- a bounded number of eligible problems, chosen from the TPTP Problem Library, and
- specified time limits on solution attempts.

The competition organizer is Geoff Sutcliffe, assisted by Martin Desharnais (SLH and LTB divisions). The competition is overseen by a panel of knowledgeable researchers who are not participating in the event. The panel members are Cláudia Nalon, Sophie Tourret, and Christoph Weidenbach.

Location: Room 47

09:00-9:30	**MCP: Learning Propositional Formulas From Binarized Data** M. Hermann and G. Salzer
09:30-10:00	**The Inadequacy of Shapley Values for Explainability** X. Huang and J. Marques-Silva
10:10-10:30	**Coffee Break**
10:30-12:30	**Presentation of software systems using automated deduction for machine learning**
12:30-14:00	**Lunch Break**
14:00-15:30	**Discussion**

Location: Room 13

09:00-10:00	**Session 1: Invited Talk - Chair Mathias Preiner**
09:00-10:00	**Invited Talk: Deductive Verification of Distributed Protocols in Decidable Logics** Oded Padon
10:00-10:30	Coffee Break
10:30-12:30	**Session 2: Quantifiers, SAT, OMT - Chair Sophie Tourret**
10:30-11:00	**Complete Trigger Selection in Satisfiability modulo First Order Theories** Christopher Lynch and Stephen Miner
11:00-11:30	**Selecting Quantifiers for Instantiation in SMT** Jan Jakubuv, Mikolas Janota, Bartosz Piotrowski, Jelle Piepenbrock and Andrew Reynolds
11:30-12:00	**IPASIR-UP: User Propagators for CDCL** Katalin Fazekas, Aina Niemetz, Mathias Preiner, Markus Kirchweger, Stefan Szeider and Armin Biere
12:00-12:30	**An Abstract Calculus for Optimization Modulo Theories** Nestan Tsiskaridze, Clark Barrett and Cesare Tinelli
12:30-14:00	Lunch Break
14:00-15:30	**Session 3: SMT Applications and SMT-COMP - Chair Mikoláš Janota**
14:00-14:30	**Automated Analysis of Halo2 Circuits** Fatemeh Heidari Soureshjani, Mathias Hall-Andersen, Mohammadmahdi Jahanara, Jeffrey Kam, Jan Gorzny and Mohsen Ahmadvand
14:30-15:00	**Application of SMT in a Meta-Compiler: A Logic DSL for Specifying Type Systems** Romain Beguet and Raphaël Amiard
15:00-15:30	**Discussion on Future of SMT-COMP** François Bobot, Martin Bromberger and Jochen Hoenicke
15:30-16:00	Coffee Break
16:00-17:45	**Session 4: SMT-LIB and SMT Business Meeting - Chair Mathias Preiner**
16:00-16:45	**SMT-LIB Report** Pascal Fontaine and Cesare Tinelli
16:45-17:45	**Business Meeting**

Location: Room 13

09:00-10:00	**Session 1: Invited Talk - Chair Stéphane Graham-Lengrand**
09:00-10:00	**Invited Talk: SAT and SMT solving at Cloud Scale** Michael Whalen
10:00-10:30	**Coffee Break**
10:30-12:30	**Session 2: SMT Theories and Solving - Chair Jochen Hoenicke**
10:30-11:00	**Satisfiability Modulo Finite Fields** Alex Ozdemir, Gereon Kremer, Cesare Tinelli and Clark Barrett
11:00-11:30	**Exploiting Strict Constraints in the Cylindrical Algebraic Covering** Philipp Bär, Jasper Nalbach, Erika Abraham and Christopher Brown
11:30-12:00	**Reasoning About Vectors using an SMT Theory of Sequences** Ying Sheng, Andres Noetzli, Andrew Reynolds, Yoni Zohar, David Dill, Wolfgang Grieskamp, Junkil Park, Shaz Qadeer, Clark Barrett and Cesare Tinelli
12:00-12:30	**Partitioning Strategies and Partitioning Portfolios for Parallel SMT Solving** Amalee Wilson, Andres Noetzli, Andrew Reynolds, Byron Cook, Cesare Tinelli and Clark Barrett
12:30-14:00	**Lunch Break**
14:00-15:30	**Session 3: Proofs, Certificates, and Models - Chair Yoni Zohar**
14:00-14:30	**Automatic Verification of SMT Rewrites in Isabelle/HOL** Hanna Lachnitt, Mathias Fleury, Leni Aniva, Andrew Reynolds, Haniel Barbosa, Andres Noetzli, Clark Barrett and Cesare Tinelli
14:30-15:00	**Satisfiability of Non-Linear Transcendental Arithmetic as a Certificate Search Problem** Enrico Lipparini and Stefan Ratschan
15:00-15:30	**Verifying Models with Dolmen** Guillaume Bury and François Bobot
15:30-16:00	**Coffee Break**
16:00-17:00	**Session 4: SMT-COMP - Chair Stéphane Graham-Lengrand**
16:00-17:00	**SMT-COMP Results and Tool Presentations** François Bobot, Martin Bromberger and Jochen Hoenicke

Location: Sala Consiglio

08:45-09:00	**Welcome & Announcements**
09:00-10:00	**Isabelle Proof Assistant in Education - Chair P. Quaresma**
09:00-9:30	**Interactive Formal Specification for Mathematical Problems of Engineers** Walther Neuper
09:30-10:00	**Teaching Higher-Order Logic Using Isabelle** Simon Tobias Lund and Jørgen Villadsen
10:00-10:30	**Coffee Break**
10:30-12:30	**Invited Talk & Coq PA in Education - Chair J. Narboux**
10:30-11:30	**Invited talk: The challenges of using Type Theory to teach Mathematics** Yves Bertot
11:30-12:00	**Waterproof: educational software for learning how to write mathematical proofs** Jelle Wemmenhove, Thijs Beurskens, Sean McCarren, Jan Moraal, David Tuin and Jim Portegies
12:00-12:30	**A Coq Library of Sets for Teaching Denotational Semantics** Qinxiang Cao, Xiwei Wu and Yalun Liang
12:30-14:00	**Lunch Break**
14:00-15:30	**PAs in Education & Learning Environments - Chair W. Neuper**
14:00-14:30	**Use of two proof assistants in an introduction to proof course: an experiment** Frédéric Tran Minh
14:30-15:00	**Underlying theories of proof assistants and potential impact on the teaching and learning of proof** Iro Bartzia, Emmanuel Beffara, Antoine Meyer and Julien Narboux
15:00-15:30	**WebPie: A Tiny Slice of Dependent Types** Christophe Scholliers
15:30-16:00	**Coffee Break**
16:00-17:30	**Business Meeting and Closing - Chair Pedro Quaresma**
16:00-16:30	**Business Meeting and Closing** Julien Narboux, Walther Neuper and Pedro Quaresma

Location: Room 13

09:00-10:00	**Session 1: Invited Talk**
09:00	**The Spawns of the Saturation Framework** Sophie Tourret
10:00-10:30	**Coffee Break**
10:30-12:30	**Session 2: Efficient Reasoning**
10:30	**Lazy and Eager Patterns in High-Performance Automated Theorem Proving** Stephan Schulz
11:00	**Engineering Subsumption Resolution in Vampire** Robin Coutelier
11:30	**Heuristic Definition Introduction** Michael Rawson
12:30-14:00	**Lunch Break**
14:00-15:30	**Session 3: Reasoning Application**
14:00	**Integrating Answer Literals with AVATAR for Program Synthesis** Petra Hozzová
14:30	**Syntax-driven induction** Marton Hajdu
15:00	**Sorting without Sorts in Vampire** Pamina Georgiou
15:30-16:00	**Coffee Break**
16:00-18:00	**Session 4: Higher-Order and Training**
16:00	**Towards verifying Vampire proofs in λΠ-calculus Modulo Theories** Anja Petković Komel, Michael Rawson and Martin Suda PRESENTER: Michael Rawson
16:30	**New Trends in Higher-Order** Ahmed Bhayat
17:00	**Spider: Learning in the Sea of Options** Andrei Voronkov

09:00-10:00 Session 1: CADE Invited Talk

Invited Talk
Chair: Brigitte Pientka
Location: Sala del Chiostro

09:00 **Lambda-Superposition: From Theory to Trophy**
Jasmin Blanchette

10:00-10:30 Coffee Break

10:30-12:30 Session 2: Higher Order Theorem Proving

Chair: Peter Lammich
Location: Sala del Chiostro

10:30 **Verification of NP-hardness for Exact Lattice Problems**
Katharina Kreuzer and Tobias Nipkow
PRESENTER: Katharina Kreuzer

11:00 **Verified Given Clause Procedures**
Jasmin Blanchette, Qi Qiu and Sophie Tourret
PRESENTER: Sophie Tourret

11:30 **An Isabelle/HOL Formalization of the SCL(FOL) Calculus**
Martin Bromberger, Martin Desharnais and Christoph Weidenbach
PRESENTER: Martin Desharnais

12:00 **Theorem Proving in Dependently-Typed Higher-Order Logic**
Colin Rothgang, Florian Rabe and Christoph Benzmüller
PRESENTER: Colin Rothgang

12:30-14:00 Lunch Break

14:00-15:30 Session 3: Applications

Chair: Yoni Zohar
Location: Sala del Chiostro

14:00 **Reasoning about Regular Properties: A Comparative Study**
Lukáš Holík, Tomas Fiedor, Adam Rogalewicz, Pavol Vargovčík, Martin Hruska and Juraj Síč
PRESENTER: Juraj Síč

14:30 **A Theory of Cartesian Arrays with Applications in Quantum Circuit Verification**
Yu-Fang Chen, Philipp Rümmer and Wei-Lun Tsai
PRESENTER: Yu-Fang Chen

15:00 **Formal Reasoning about Influence in Natural Sciences Experiments**
Florian Bruse, Martin Lange and Sören Möller
PRESENTER: Martin Lange

15:30-16:00	**Coffee Break**
16:00-18:00	**Session 4: Rewriting and Termination**
	Chair: Carsten Fuhs Location: Sala del Chiostro
16:00	**An Experimental Pipeline for Automated Reasoning in Natural Language** Tanel Tammet, Priit Järv, Martin Verrev and Dirk Draheim PRESENTER: Tanel Tammet
16:15	**Proving Non-Termination by Acceleration Driven Clause Learning – Short Paper** Florian Frohn and Jürgen Giesl PRESENTER: Florian Frohn
16:30	**Proving Almost-Sure Innermost Termination of Probabilistic Term Rewriting Using Dependency Pairs** Jan-Christoph Kassing and Jürgen Giesl PRESENTER: Jan-Christoph Kassing
17:00	**Proving Termination of C Programs with Lists** Jera Hensel and Jürgen Giesl PRESENTER: Jürgen Giesl
17:30	**Left-Linear Completion with AC Axioms** Johannes Niederhauser, Nao Hirokawa and Aart Middeldorp PRESENTER: Johannes Niederhauser
18:30-20:00	**CADE Reception**
	Location: Cloister

09:00-10:00	**Session 5: Herbrand Award Ceremony and Talk**
	Chair: Jürgen Giesl Location: Sala del Chiostro
09:00	**Automated Reasoning with Data** Moshe Vardi
10:00-10:30	**Coffee Break**
10:30-12:30	**Session 6: Proof Theory / Non-Classical Logics**
	Chair: Florian Rabe Location: Sala del Chiostro
10:30	**A Uniform Formalisation of Three-Valued Logics in Bisequent Calculus** Andrzej Indrzejczak and Yaroslav Petrukhin PRESENTER: Andrzej Indrzejczak
11:00	**Buy One Get 14 Free: Evaluating Local Reductions for Modal Logic** Cláudia Nalon, Ullrich Hustadt, Fabio Papacchini and Clare Dixon PRESENTER: Ullrich Hustadt
11:30	**Towards a Verified Tableau Prover for a Quantifier-Free Fragment of Set Theory** Lukas Stevens
12:00	**COOL 2 - A Generic Reasoner for Modal Fixpoint Logics** Oliver Görlitz, Daniel Hausmann, Merlin Humml, Dirk Pattinson, Simon Prucker and Lutz Schröder PRESENTER: Merlin Humml
12:15	**Iscalc: an Interactive Symbolic Computation Framework (System Description)** Bohua Zhan, Yuheng Fan, Weiqiang Xiong and Runqing Xu PRESENTER: Runqing Xu
12:30-14:00	**Lunch Break**

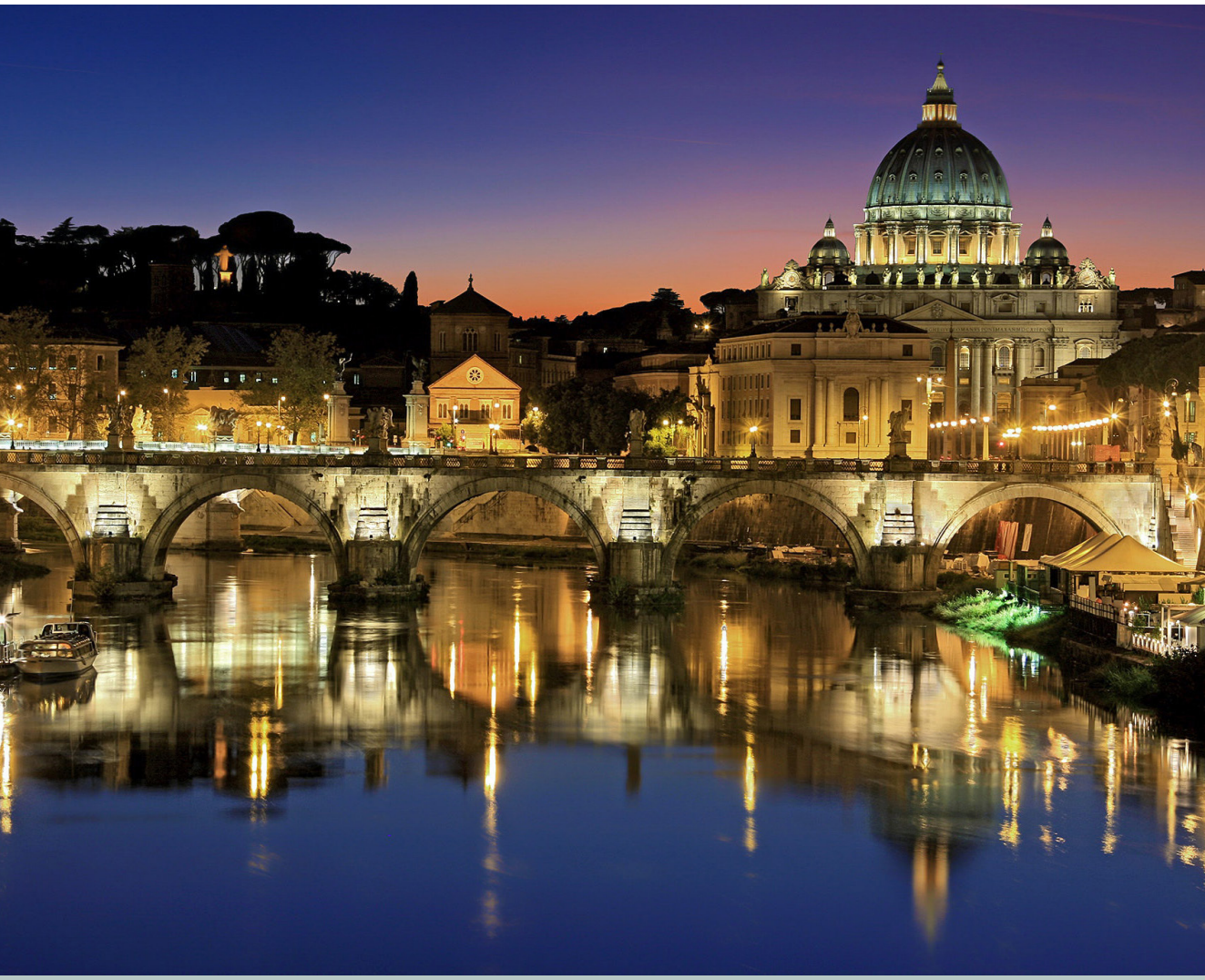
14:00-15:30	**Session 7: Rewriting**
	Chair: Nao Hirokawa Location: Sala del Chiostro
14:00	**Confluence Criteria for Logically Constrained Rewrite Systems** Jonas Schöpf and Aart Middeldorp PRESENTER: Jonas Schöpf
14:30	**Towards Fast Nominal Anti-Unification of Letrec-Expressions** Manfred Schmidt-Schauss and Daniele Nantes-Sobrinho PRESENTER: Daniele Nantes-Sobrinho
15:00	**Incremental Rewriting Modulo SMT** Gerald Whitters, Vivek Nigam and Carolyn Talcott PRESENTER: Gerald Whitters
15:30-16:00	**Coffee Break**
16:00-17:15	**Session 8: SAT**
	Chair: Stephan Schulz Location: Sala del Chiostro
16:00	**SAT-Based Subsumption Resolution** Robin Coutelier, Laura Kovacs, Michael Rawson and Jakob Rath PRESENTER: Robin Coutelier
16:30	**Certified Core-Guided MaxSAT Solving** Jeremias Berg, Bart Bogaerts, Jakob Nordström, Andy Oertel and Dieter Vandesande PRESENTER: Andy Oertel
17:00	**A more Pragmatic CDCL for IsaSAT and targetting LLVM** Mathias Fleury and Peter Lammich PRESENTER: Mathias Fleury
17:15-17:30	**Mini Break**
17:30-18:30	**Session 9: Awards Ceremony and Business Meeting**
	Chair: Jürgen Giesl Location: Sala del Chiostro
18:30-20:00	**FSCD Reception**
	Location: Cloister

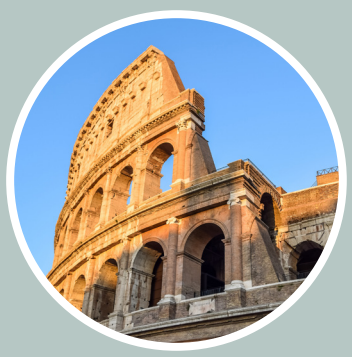
08:30-16:00	Session 10: CASC Competition
	The CADE ATP System Competition Chair: Geoff Sutcliffe
09:00-10:00	**Session 11: CADE-FSCD Joint Invited Talk**
	Chair: Cesare Tinelli Location: Room 33
09:00	**How Can We Make Trustworthy AI?** Mateja Jamnik
10:00-10:30	Coffee Break
10:30-12:30	**Session 12: Satisfiability Modulo Theories**
	Chair: Sophie Tourret Location: Room 33
10:30	**Combining Combination Properties: An Analysis of Stable-infiniteness, Convexity, and Politeness** Guilherme Toledo, Yoni Zohar and Clark Barrett PRESENTER: Guilherme Toledo
11:00	**Choose your Colour: Tree Interpolation for Quantified Formulas in SMT** Elisabeth Henkel, Tanja Schindler and Jochen Hoenicke PRESENTER: Elisabeth Henkel
11:30	**QSMA: A New Algorithm for Quantified Satisfiability Modulo Theory and Assignment** Maria Paola Bonacina, Stéphane Graham-Lengrand and Christophe Vauthier PRESENTER: Stéphane Graham-Lengrand
12:00	**On Incremental Pre-processing for SMT** Nikolaj Bjorner and Katalin Fazekas PRESENTER: Nikolaj Bjorner
12:30-14:00	Lunch Break

14:00-15:30	**Session 13: Non-Classical Logics**
	Chair: Maria Paola Bonacina Location: Room 33
14:00	**Decidability of difference logic over the reals with uninterpreted unary predicates** Baptiste Vergain, Bernard Boigelot and Pascal Fontaine PRESENTER: Baptiste Vergain
14:30	**On P-interpolation in local theory extensions and applications to the study of interpolation in the description logics ${\cal EL}, {\cal EL}^+$** Dennis Peuter, Viorica Sofronie-Stokkermans and Sebastian Thunert PRESENTER: Viorica Sofronie-Stokkermans
15:00	**Uniform Substitution for Dynamic Logic with Communicating Hybrid Programs** Marvin Brieger, Stefan Mitsch and André Platzer PRESENTER: Marvin Brieger
15:30-16:00	**Coffee Break**
16:00-20:00	**Excursion**
20:00-23:00	**Conference dinner**

09:00-10:00	**Session 14: FSCD-CADE Joint Invited Talk**
	Chair: Femke Raamsdonk Location: Room 33
09:00	**Nominal Techniques for Software Specification and Verification** Maribel Fernandez
10:00-10:30	Coffee Break
10:30-12:00	**Session 15: Superposition**
	Chair: Uwe Waldmann Location: Room 33
10:30	**Superposition with Delayed Unification** Ahmed Bhayat, Michael Rawson and Johannes Schoisswohl PRESENTER: Ahmed Bhayat
11:00	**Program Synthesis in Saturation** Petra Hozzová, Laura Kovács, Chase Norman and Andrei Voronkov PRESENTER: Petra Hozzová
11:30	**SCL(FOL) Can Simulate Non-Redundant Superposition Clause Learning** Martin Bromberger, Chaahat Jain and Christoph Weidenbach PRESENTER: Martin Bromberger
12:00-12:10	**Session 16: Closing Remarks**
	Location: Room 33
12:30-14:00	Lunch Break

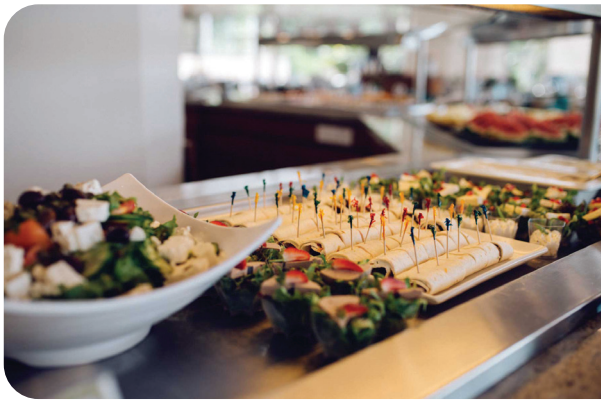
SOCIAL EVENTS





Welcome Reception

Date: **1 JULY 2023**
Time: **18:30 - 20:00**
Where: **Venue**



The Welcome Reception is the first social gathering between all conference delegates and it will take place at the Venue. It will be a relaxing evening during which delegates will have the opportunity to talk to colleagues and peers, while enjoying local drinks and ample canapés.

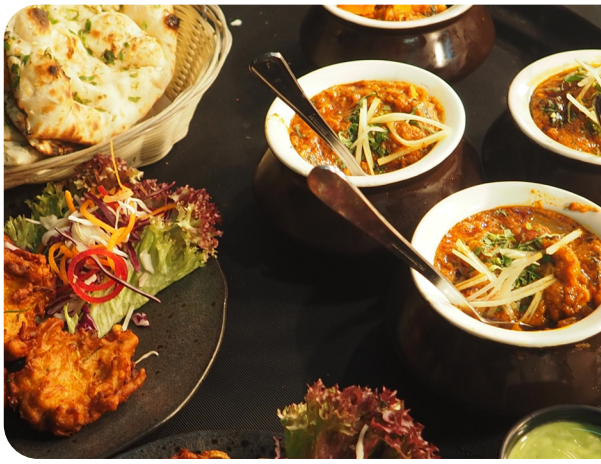
The welcome reception is included in all Physical (except Workshop only) Registration fees registration fees.

Additional tickets for accompanying persons & Workshop only registrations can be purchased through the registration system or onsite.

Cost for extra Welcome Reception ticket: **€40.00**

Excursion and Conference Dinner

Date: **3 JULY 2023**
Time: **20:00-23:00**
Departure Time: **17:00**
Departure From: **Venue**

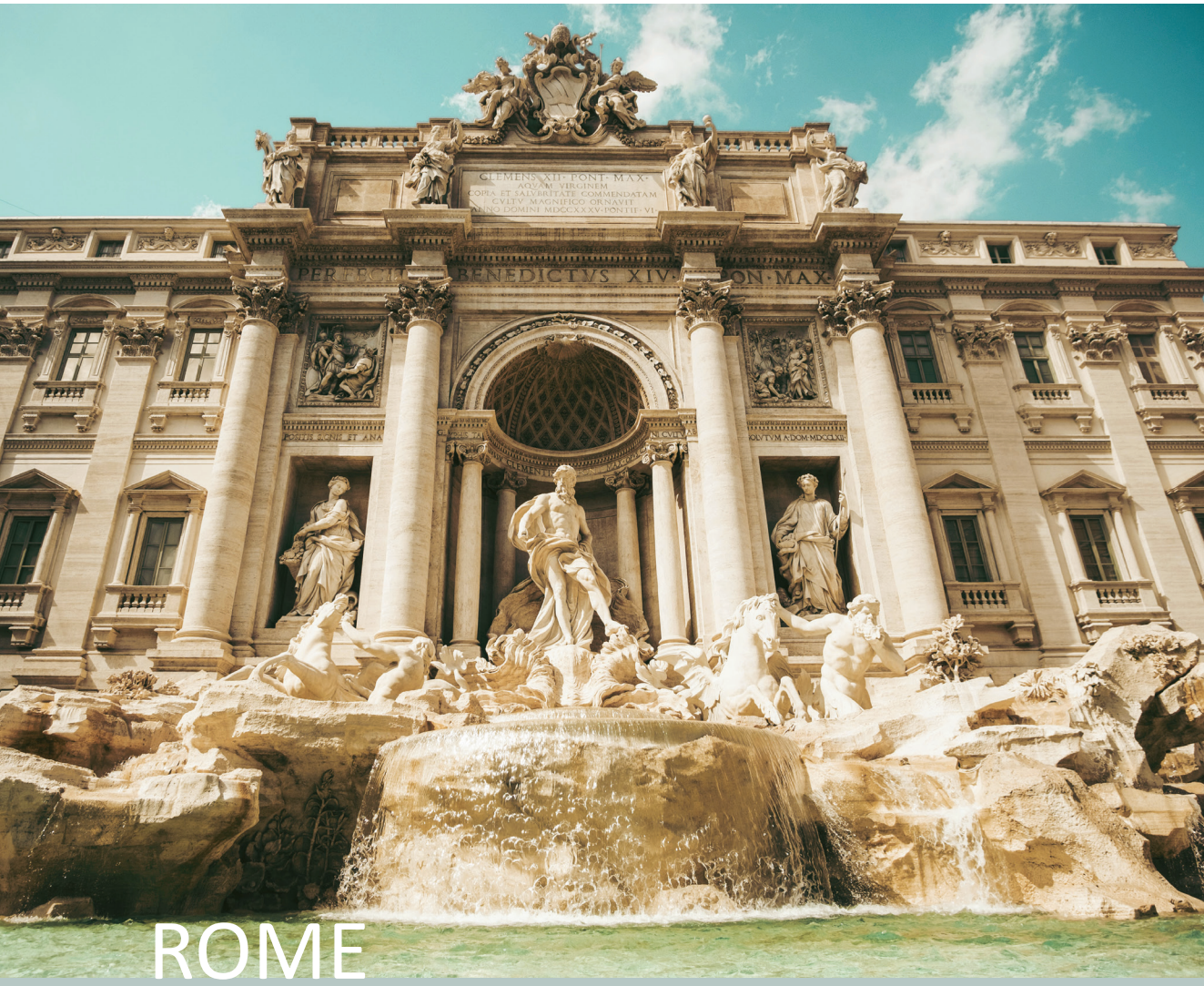


We will depart from the venue in air conditioned busses with licensed tour guides for an excursion to the historical sites of Rome. The excursion will be a combination of driving and walking tour. We will end the day with the Conference Dinner, which will be at a local restaurant. At the end of the evening, the buses will be available for return (stop at the venue area).

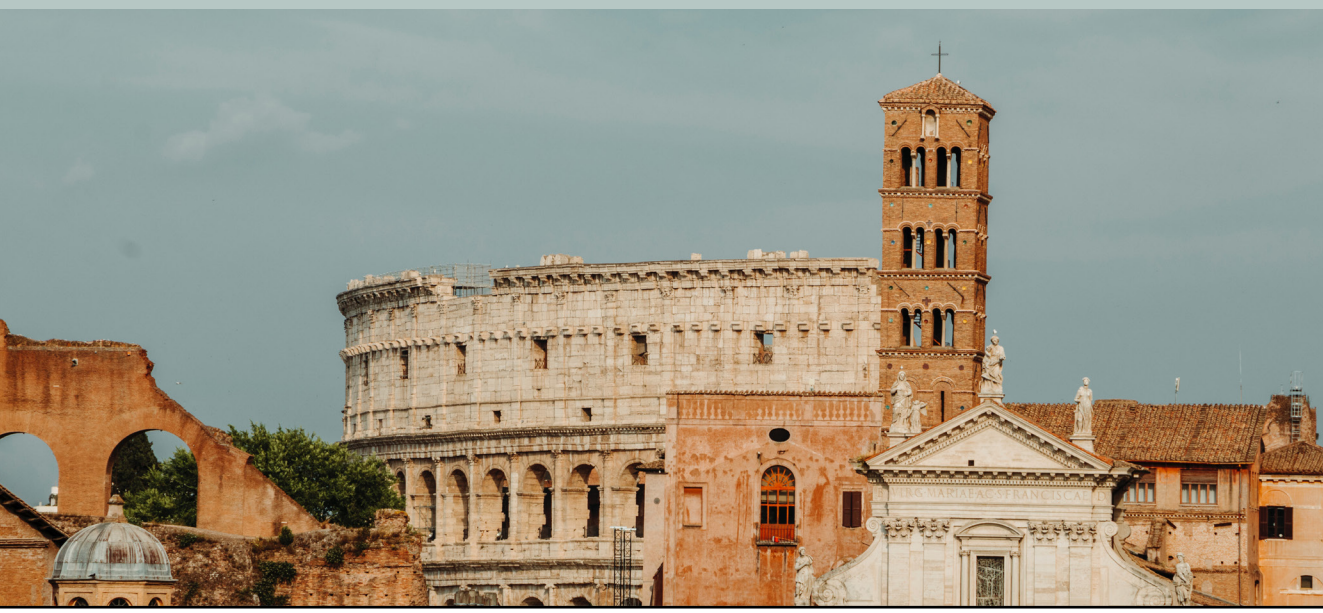
The Confernece Dinner is not included in the Online, Workshop Only & Student registration fees;

Tickets can be purchased through the registration system or onsite.

Cost for Conference dinner ticket: **€80.00**



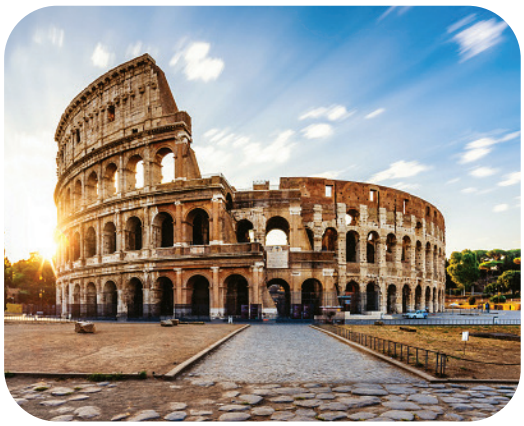
ROME



Interesting Facts

Modern Rome has 280 fountains and more than 900 churches.
Nearly 700,000 euros worth of coins are tossed into Rome's Trevi Fountain each year. The proceeds are donated to Caritas to help those in need.

The Romans had built a road network of 53,000 miles by the early fourth century. Each Roman mile was about 4,800 feet and marked by a milestone, giving birth to the saying "All roads lead to Rome."
The mascot of Rome is a she-wolf that cared for brothers Romulus and Remus, the mythological founders of Rome.
Rome became the capital city of unified Italy in 1870, taking the title from Florence.



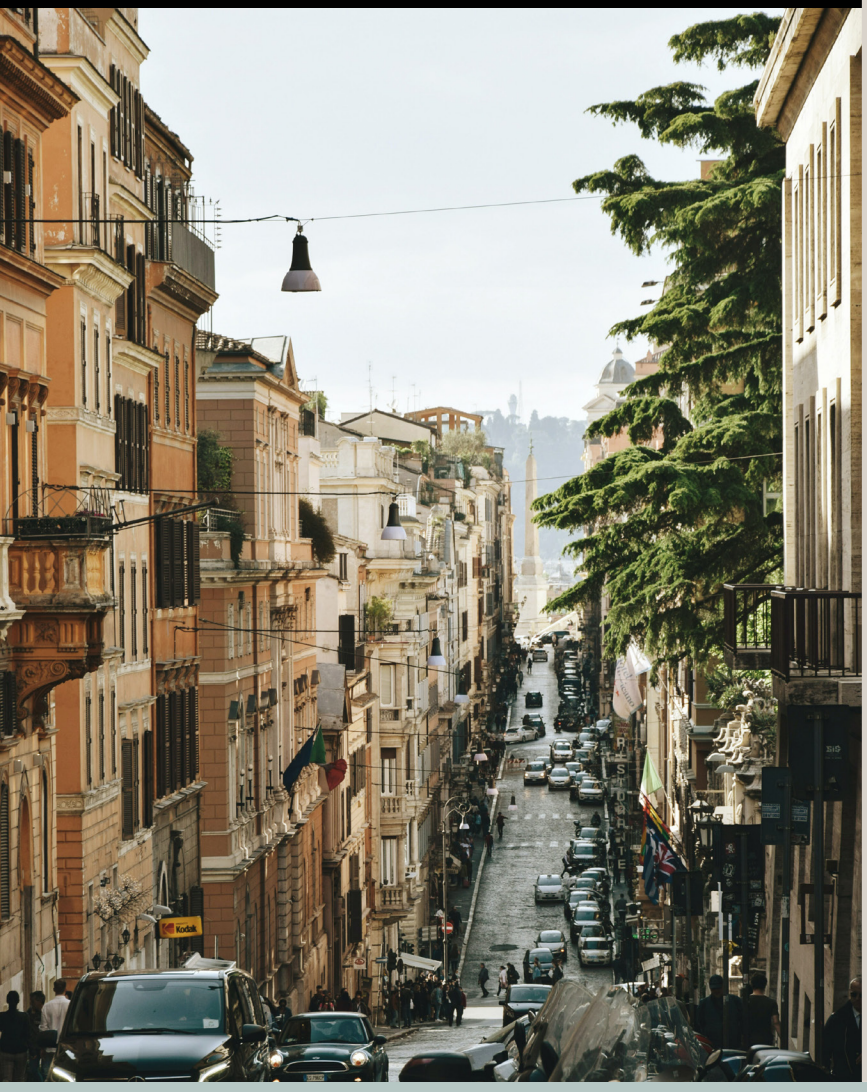
The first ever shopping mall was built in Rome between 107 and 110 AD by Emperor Trajan. It sold a wide variety of goods and grocery items.
Rome's first university, La Sapienza, established in 1303 AD, is the largest in Europe and the second largest in the world.

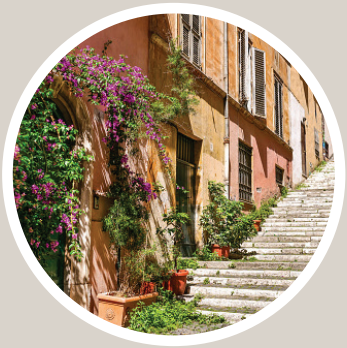
Rome has a museum dedicated entirely to pasta.
St Peter's basilica inside Vatican City is the largest church ever constructed.

Rome, Italian Roma, the historic city and capital of Roma province, of Lazio region , and of the country of Italy. Rome is located in the central portion of the Italian peninsula, on the Tiber River about 15 miles inland from the Tyrrhenian Sea.

The province of Rome is a matching frame for the many treasures of the capital, and the surrounding area has, more or less directly, experienced the influence of the history of the Eternal City.

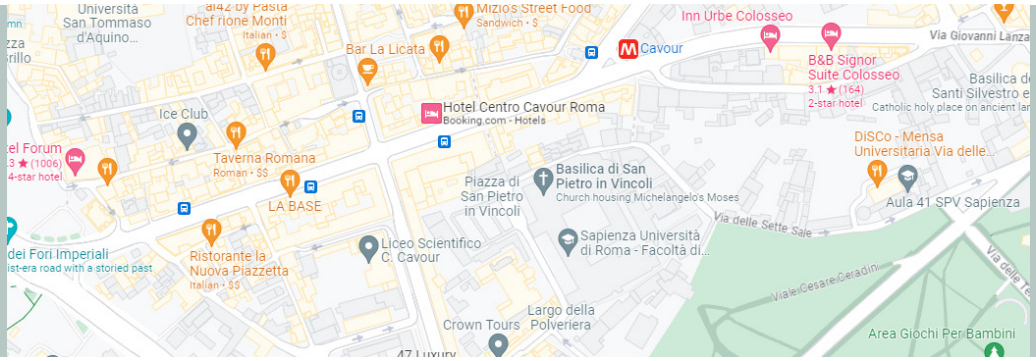
A region with a great deal to offer: sea, nature, good food and villages rich in history and art. The sea, the hills, lakes, rivers and vineyards: the surroundings of Rome offer a kaleidoscope of diversity and attractions for nature lovers.





Sapienza University of Rome, founded in 1303 by Pope Boniface VIII, is one of the oldest universities in the world and a high performer among the largest universities in international rankings. Since its founding over 700 years ago, Sapienza has played an important role in Italian history and has been directly involved in key changes and developments in society, economics and politics. It has contributed to the development of Italian and European science and culture in all areas of knowledge.

The Faculty of Civil and Industrial Engineering has a long tradition of teaching and researching. It has also an international reputation for excellence and strong relations with industrial partners. The Faculty is located in the historic centre of Rome, directly overlooking the Coliseum and next to the ancient Basilica of San Pietro in Vincoli, home to Michelangelo's statue of Moses.



The Faculty of Civil and Industrial Engineering is located in the area of St. Peter in Chains.

Faculty Address

Via Eudossiana, 18, Sapienza University of Rome

00184, Roma, Italy

How to reach

The Department is located in the building B (from the first to the fourth floor) inside the XVth century complex of the Engineering Faculty in via Eudossiana, 18.

On foot

From Colosseum, take the escalators inside Metro B station in Via dei Fori Imperiali and once you are on the top, please have first the great and impressive panoramic view of Colosseum, Costantino Arch, Palatino hill and Fori Imperiali, then turn back and take via della Polveriera and from Largo della Polveriera, make a left and you are on via Eudossiana.

From via Cavour, take either the stairs in front of Palatino Hotel which bring you in front of S. Pietro in Vincoli Basilica, or from Metro B station via Cavour take the stairs of via Monte Polacco once on the top either make a right towards S. Pietro in Vincoli or walk on your left side to via delle Sette Sale and enter the back entrance of the Faculty.

By car

This is not the best way but if you cannot avoid it here are some routes depending where you come from.

From Piazza Vittorio, cross Largo Brancaccio, straight on enter via Lanza, take the first street on the left, via Equizia, at the end make a right and you are on via del Colle Oppio, park where you can. If you park inside the blue lines, please make sure you pay the parking fare in advance (use the machines on the sidewalk or purchase the tickets in advance at newsstands or tobacco shops).

From Piazza Venezia, take via dei Fori Imperiali and then make a left on via Cavour and drive to via Lanza. Find via Equizia on the right side then continue as above.

By public transportation

By bus: lines 81, 85, 87, 11 and 27 stop at Colosseum.

By tram: line 30 stops at Colosseum.

By metro: you can exit at either Colosseum or via Cavour stations of blue line B and follow the indications above.

From the International Airport "Leonardo da Vinci"

By taxi: fare 40 Euros, it takes about 50 minutes up to 90 minutes in heavy traffic conditions.

By train: the easiest way is to take Leonardo Express direct train to Termini Station. From there you can walk to via Cavour (it takes about 15 minutes) or take a taxi or Metro B (one stop to via Cavour). As an alternative you can take a local train to Ostiense Station and take Metro B. For information on timetables and fares visit www.trenitalia.com.

From Ciampino Airport

By private transportation, book a shuttle bus (there are several companies) or take a taxi (same fare from da Vinci Airport. By public transportation, take a bus to Anagnina red line Metro A station, then go to Termini station. Visit the Ciampino Airport website for further details at www.adr.it.

How to reach the centre from the airport

Please visit the websites below to get helpful information on how to reach the centre of Rome from the "Leonardo da Vinci" Fiumicino Airport: https://www.rome-airport.info/in.html

Please visit the website below to get helpful information on how to reach the centre of Rome from the Ciampino Airport: Aeroporti di Roma

NOTES

NOTES

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