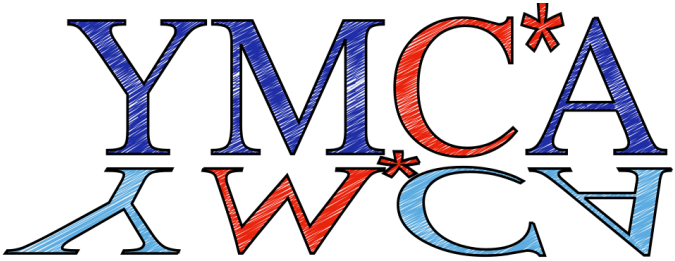


2022

INFORMATION

AND

ABSTRACTS

Contents

Welcome!

We are thrilled to welcome you to the Young Mathematicians in C*-Algebras conference 2022, hosted at the University of Oslo, Norway!

Who are the organizers?

This year's event is organized by current and previous PhD fellows at the University of Oslo and the Technical University of Trondheim:

- Emilie Elkiaer (elkiaer@math.uio.no)
- Floris Elzinga (florise@math.uio.no)
- Ulrik Enstad (ubenstad@math.uio.no)
- Erik Habbestad (erikhab@math.uio.no)
- Lucas Hataishi (lucasyh@math.uio.no)
- Gaute Schwartz (gautesc@student.matnat.uio.no)
- Mathias Palmstrøm

The NSF travel grant for US participants is organized by:

- Priyanga Ganesan
- Mitch Hamidi
- Lara Ismert

If you have any question or need any help, do not hesitate to contact any of the organizers. We can all be reached at

`ymcstara@protonmail.com`

or individually.

Covid restrictions

There are currently no Covid restrictions in place in Norway, including entry restrictions. However, there is a general advice to stay home if you feel sick. Updated information can be found on `https://www.helsenorge.no/en/coronavirus/symptoms/`. Don't hesitate to contact any of the organizers if you have any questions.

We understand if someone chooses to be more careful and take more precautions than what is required or recommended currently in Norway. We therefore ask you to please respect the boundaries of your fellow participants.

Mini courses

The conference features three mini courses, each of which consists of 3 lectures. These will be given by Xin Li (University of Glasgow), Lyudmila Turowska (Chalmers University of Technology and University of Gothenburg) and Sergey Neshveyev (University of Oslo).

Xin Li

Groupoids and topological full groups

Topological groupoids serve as models for C*-algebras and build a bridge between topological dynamics and C*-algebra theory. The construction of topological full groups associated with groupoids gives rise to new examples of groups with very interesting properties, solving outstanding open problems in group theory. My plan is to give an introduction to groupoids and their topological full groups, with a focus on homological invariants.

Sergey Neshveyev

Subproduct systems, associated C*-algebras and their symmetries

Subproduct systems of finite dimensional Hilbert spaces and associated C*-algebras lie at the intersection of two lines of research - noncommutative function theory (Arveson, Popescu) and dilation theory for semigroups of completely positive maps (Shalit, Solel, Bhat, Mukherjee). The goal of this minicourse is to give an introduction into this area, emphasizing the role of (quantum) symmetry in analyzing concrete examples.

Lyudmila Turowska

Quantum correlations, non-local games and operator algebras

There are several mathematical models to describe the conditional probability densities/correlations that can occur when two labs in entangled state conduct quantum measurements. It has been fundamental research done to study whether these models give rise to the same sets of correlations. The celebrated Bell theorem demonstrates that the set of classical correlations is strictly smaller than the set of quantum ones, while the Tsirelsson problems are related to differences between "physically realizable" bipartite probability distributions. Operator systems, operator algebras and their tensor products have been an important tool to study such distributions. One of the Tsirelson problems is related to finite approximability in operator algebras and is equivalent to the Connes' embedding problem in von Neumann algebras, the solution of which was recently announced. Many results on correlations have come from the study of non-local games and their winning strategies. They witness the differences between classes of correlations and provide ways of constructing new interesting classes of operator algebras.

In these lectures I will give an introduction of non-local games. After going over the basic theory of operator systems I will highlight the role C*-algebras and operator systems play in mathematical understanding of quantum correlations and perfect strategies of non-local games. Synchronous games as for example graph homomorphism/isomorphism games are of particular interests as their perfect strategies can be described through traces of affiliated C*-algebras. I will discuss differences between classes of quantum correlations. The last lecture will be devoted to some recent results on quantum no-signaling correlations which appear as strategies of non-local games with quantum inputs and outputs. If time allows I will also talk about quantum graphs and quantum homomorphism/isomorphism games.

Contributed talks

Anshu

Anyonic quantum symmetries of finite spaces

In 1995, Alain Connes posed the problem of the quantum automorphism group of a space. The answer was given by Wang and the notion of quantum symmetries, also known as quantum permutation groups was discovered. In this talk, we briefly discuss the notion of quantum permutation groups and then we construct a braided analogue of them. To construct the braided analogue, we consider the braided structure over the finite integer group and we call it the anyonic quantum permutation group. This is joint work with Bhattacharjee, Rahaman, and Roy.

M. Ali Asadi-Vasfi

The Dynamical Radius of Comparison

Recently, Bosa, Perera, Wu, and Zacharias have introduced the dynamical Cuntz semigroup and the dynamical strict comparison in work in preparation, inspired by comparison for topological dynamics. In this talk, I will outline work in progress concerning some preliminary results related to a radius of comparison with respect to the dynamical Cuntz semigroup for group actions on C^*-algebras which are not Jiang–Su stable. This is joint work with N. Christopher Phillips.

Are Austad

C*-uniqueness results for groupoids

Given a reduced $*$-algebra A admitting an enveloping C^*-algebra, there are in general many non-isomorphic C^*-completions of A. However, if the enveloping C^*-algebra is the unique C^*-completion of A up to isomorphism, we say A is C^*-*unique*. In this talk we consider the question of C^*-uniqueness for $L^1(G,\sigma)$, where G is a second-countable locally compact Hausdorff étale groupoid and σ is a continuous normalized 2-cocycle for G. The property of C^*-uniqueness is strictly stronger than that of weak containment, both for groups and groupoids. We show how the question of C^*-uniqueness of $L^1(G,\sigma)$ can be reduced to the question of C^*-uniqueness of groups appearing in the fibers of the subgroupoids $\mathrm{Iso}(G)^\circ$, the interior of the isotropy subgroupoid of G, and give examples of C^*-unique groupoids. This is joint work with Eduard Ortega.

Krzysztof Bardadyn

Simplicity of L^p-operator algebras crossed products

In 2010's Phillips initiated a program whose aim is to generalize large parts of the modern C* -algebra theory to operator algebras acting on L^p-spaces. Since then a number of papers appeared establishing some strong results in this direction, but there are still some fundamental open problems. One of them, explicitly stated in Phillips (2013) and Gardella–Lupini (2017), is a characterization of simplicity of L^p-crossed products, and in particular a generalization of the C^*-algebraic results from the seminal paper of Archbold and Spielberg (1993). In my talk I will present a solution to the aforementioned problem for an action of a discrete group on a locally compact Hausdorff space. The techniques work also for étale groupoids and give a characterization of the intersection property and simplicity of the corresponding L^p-operator algebras in terms of topological freeness. Based on joint work with Bartosz Kwaśniewski and Andrew McKee.

Samantha Brooker

Pullback diagrams of relative Toeplitz graph algebras

Relative Toeplitz algebras of directed graphs were introduced by Spielberg in 2002 to describe certain subalgebras corresponding to subgraphs. They can also be used to describe quotients of graph algebras corresponding to subgraphs. We use the latter relationship to answer a question posed in a recent paper regarding pushout diagrams of graphs that give rise to pullback diagrams of the respective graph C^*-algebras. We introduce a new category of relative graphs to this end, and we prove our results using graph groupoids and their C^*-algebras. This is joint work with Jack Spielberg.

Soham Chakraborty

Classification of regular subalgebras of injective type III factors

In this talk, we classify regular subalgebras $B \subset M$ of any injective factor M satisfying the relative commutant condition, $Z(B) = B' \cap M$. We specifically focus on the classification problem of triple inclusions $A \subset B \subset M$ where M is an injective factor, $A \subset M$ is a Cartan subalgebra and the intermediate subalgebra $B \subset M$ is regular. This in general boils down to the problem of classifying corresponding outer cocycle actions of the associated groupoid on a measurable field of equivalence relations using the results of Feldmann-Moore. In the case of the hyperfinite II_1 factor R, it was recently shown by Popa-Shlyakhtenko-Vaes that any two such actions are cocycle conjugate, hence classifying all such inclusions $A \subset B \subset R$. We extend these results to any injective factor of type III, and provide a complete classification of such triple inclusions in terms of the Connes-Takesaki module map applied to actions of the corresponding isotropy groups of the groupoid. This talk is based on ongoing joint work with Stefaan Vaes.

Ian Charlesworth

Non-commutative probability, matrices, and ε-independence

A tracial von Neumann algebra can be viewed as a space of non-commutative random variables, and many techniques from probability theory can be adapted to this perspective. The notion of independence must also be changed to account for the fact that there are more polynomial test functions than usual: there is no reason that $xyxy$ and x^2y^2 should have the same expectation. The most prominent independence is free independence, which is the relation describing both the distribution generators of the free group within $L(\mathbb{F}_n)$, and the asymptotic eigenvalue distributions of independent unitarily-invariant random matrices.

In this talk, I will briefly cover the background and motivations of non-commutative probability theory, then turn to the setting of ε-independence, where some variables are taken to be freely independent while others classically independent. This corresponds to the distribution of the generators of a graph product of groups, or of ensembles of random matrices which are still independent but only invariant under certain unitary conjugations. I will show that if this structure is chosen carefully, a desired graph product may be realized asymptotically, giving an alternate proof that $\mathscr{R}^\omega$-embeddable von Neumann algebras are closed under graph products. This project is joint work with Benoît Collins.

Antje Dabeler

Exotic group C^*-algebras of higher rank Lie groups

An exotic group C^*-algebra of a non-amenable group G is a C^*-completion of $C_c(G)$ that lies naturally in between the reduced and the universal group C^*-algebra of G. Using asymptotic properties of matrix coefficients of representations of G, one can construct potentially exotic group C^*-algebras. For simple Lie groups with real rank one, this construction was shown to define exotic group C^*-algebras, by Samei and Wiersma and by de Laat and Siebenand. I will explain how similar methods can be used to show the existence of exotic group C^*-algebras of higher rank simple Lie groups, e.g. $\mathrm{SL}(n,\mathbb{C})$ with $n \geq 3$.

Priyanga Ganesan

Spectral bounds for quantum chromatic numbers of quantum graphs

Quantum graphs are an operator space generalization of classical graphs that have appeared in different branches of mathematics including operator algebras, non-commutative topology and quantum information theory. Recently, a quantum chromatic number for quantum graphs was introduced using the framework of a non-local quantum graph coloring game with quantum inputs and classical outputs. In this talk, I will present a combinatorial definition of the quantum chromatic number and use it to obtain spectral lower bounds for the chromatic number of quantum graphs. It will be shown that many well-known bounds for chromatic number of classical graphs, such as Hoffman's bound, also hold in the setting of quantum graphs. This is achieved using a quantum adjacency operator and techniques from operator algebra.

Lucas Hall

Modular Stone–von Neumann Theorems

The author reports on recent progress in the classification of C^*-action and coaction representations over Hilbert C^*-modules. After a brief review of the history and development of the Stone–von Neumann theorem, we explore the theory of Hilbert modules over elementary C^*-algebras, highlighting the Abstract Modular Stone-von Neumann Theorem. We then apply this theorem to classify all covariant representations of of actions and coactions of a locally compact group on elementary C^*-algebras. This is joint work with J. Quigg and L. Huang.

Arturo Jaime

Complexity Rank One and K-Theory of C^*-algebras

The notion of a C^*-algebra decomposing over a class of C^*-algebras is, essentially, the existence of almost central elements that cut the C^*-algebra into two pieces from the class, with a well behaved intersection. Beginning with the

class of finite dimensional C^*-algebras leads to a notion of complexity hierarchy, with the complexity rank of a C^*-algebra being the number of decompositions needed to get down to the finite-dimensional level.

I will focus on complexity rank one and a weaker variant of complexity rank one, describing how weak complexity rank one is closely related to nuclear dimension one and real rank zero. Using K-theoretic arguments that decomposability lends itself to, we show that complexity rank one and weak complexity rank one are indeed different, with torsion in K_1 being the obstruction. This is based on joint work with Rufus Willett.

Jacek Krajczok

Injective factors associated with compact quantum groups

It is well known that if a group von Neumann algebra of a (nontrivial) discrete group is a factor, then it is a factor of type II_1. During the talk, I will answer the following question: which types appear as types of injective factors being group von Neumann algebras of discrete quantum groups (or looking from the dual perspective - von Neumann algebras of bounded functions on compact quantum groups)? An important object in our work is the subgroup of real numbers t for which the scaling automorphism τ_t is inner. This is joint work with Piotr Sołtan.

Amudhan Krishnaswamy-Usha

Local and multilinear non-commutative de Leeuw thoerems

For a function m on the real line, its Fourier multiplier is the operator which acts on a function f by first multiplying the Fourier transform of f by m, and then taking the inverse Fourier transform of the product. These are well-studied objects in Euclidean harmonic analysis. Of particular interest is when the Fourier multiplier defines a bounded operator on L^p. Fourier multipliers can be generalized to arbitrary locally compact groups. If the group is non-abelian, the L^p spaces involved are now the non-commutative L^p spaces associated with the group von Neumann algebra.

One question of interest is this: If m is a function on a group G which defines a bounded L^p multiplier, is the restriction of m to a subgroup H also the symbol of a bounded L^p multiplier on H? De Leeuw proved that the answer is yes, when G is $\mathbb{R}^n$. In the non-commutative case, Caspers, Parcet, Perrin and Ricard showed that the answer is still yes, provided the group has 'small almost-invariant neighbourhoods with respect to H'. In this talk, I will present a localized version of this theorem in the linear case, where we trade off this restriction for a constant which depends on the support of m. I will also present multilinear versions of the de Leeuw theorems, and use this to construct multilinear Fourier multipliers on the Heisenberg group. This is part of joint work with Martijn Caspers, Bas Janssens and Lukas Miaskiwskyi.

Alexey Kuzmin

CCR and CAR algebras are connected via a path of Cuntz-Toeplitz algebras

For $q \in \mathbb{R}$, $|q| < 1$ we consider the universal enveloping C^*-algebra of a $*$-algebra of q-canonical commutation relations (q-CCR), which is generated by $a_1, \ldots, a_n$ subject to the relations

$$a_i^* a_j = \delta_{ij} 1 + q a_j a_i^*.$$

It has a distinguished representation π_F called the Fock representation, which is believed to be faithful. We consider the image of the universal enveloping C^*-algebra of q-CCR in the Fock representation. The question whether it is C^*-independent of q has been considered in the literature and proved for $|q| < 0.44$. In this talk we show that it is true for $|q| < 1$.

Miho Mukohara

C^*-simplicity of relative profinite completions of generalized Baumslag-Solitar groups

Locally compact groups are called C^*-simple if their reduced group C^*-algebras are simple. C^*-simplicity of discrete groups has long been studied, and as of today, many characterizations have been found. On the other hand, C^*-simplicity of non-discrete locally compact groups is not well understood compared to that of discrete groups. Suzuki recently gave constructions of non-discrete examples of locally compact C^*-simple groups and Raum showed C^*-simplicity of relative profinite completions of Baumslag-Solitar groups by using Suzuki's results. In this talk, I will explain a proof of C^*-simplicity of relative profinite completions of generalized Baumslag-Solitar groups by using an analogue of the Powers averaging property.

Robert Neagu

On the nuclear dimension of $*$-homomorphisms

As introduced by Winter and Zacharias, a C^*-algebra is said to have finite nuclear dimension if the identity map can be approximated in a suitable way by factoring through finite-dimensional C^*-algebras. Then, one can generalise this property to *-homomorphisms.

While the 0-dimensional C^*-algebras are precisely the AF-algebras, *-homomorphisms with nuclear dimension 0 are not so well-understood. In this talk, I will aim to describe which *-homomorphisms between classifiable C^*-algebras have nuclear dimension 0. This is joint work with Jorge Castillejos.

Abraham Chi Shun Ng

Stably finite extensions of rank-2 graph C^*-algebras

Let $0 \to I \to A \to B \to 0$ be an extension of one stably finite C^*-algebra by another. There's a result by Spielberg (1988) that characterises when the extension is also stably finite in terms of the positive cone of $K_0(I)$ and the map in K-theory i_* induced by the inclusion $i : I \to A$. In order to apply Spielberg's result to rank-2 graph C^*-algebras, we need a better grasp of i_* than was previously afforded us by Evans' (2008) original computation of K-theory for rank-2 graph C^*-algebras. Hence we will go through an alternative way of computing the K-theory that gives us the handle on i_* needed to prove a sufficient condition for stable finiteness of extensions of rank-2 graph C^*-algebras. This is joint work with Astrid an Huef and Aidan Sims.

Matteo Pagliero

Classification of equivariantly $\mathcal{O}_2$-stable actions on nuclear C^*-algebras

The Cuntz algebra $\mathcal{O}_2$ plays a key role in the classification theory of C^*-algebras. A particularly notable example of this is given by Kirchberg's classification of $\mathcal{O}_2$-stable C^*-algebras, which was first announced by Kirchberg in the 1990s, and finally published by Gabe only a few years ago. This states that a separable, nuclear, stable C^*-algebra A that tensorially absorbs $\mathcal{O}_2$ is classified by its primitive ideal space. Any group action on a C^*-algebra induces an action on its primitive ideal space. Hence, given a second-countable locally compact group G, one may ask whether a G-action on A can be classified by the induced action on its primitive ideal space. In this talk, I will present a new result that answers the question affirmatively when A is as in the theorem above the G-action satisfies some natural assumptions (i.e., amenability and a generalised outerness property) and tensorially absorbs the trivial action on $\mathcal{O}_2$. This is to be understood as the dynamical counterpart to Kirchberg's $\mathcal{O}_2$-stable classification. This talk is based on joint work with Gábor Szabó.

Samantha Pilgrim

Sharp Bounds for the Dynamic Asymptotic Dimension

The dynamic asymptotic dimension of a group action was first introduced by Guentner, Willett, and Yu in 2015. This dimension theory relates to the nuclear dimension when one passes to the crossed product, as well as to computations of K-theory. It has for some time been suspected that the dynamic asymptotic dimension of a group action coincides with the asymptotic dimension of the acting group whenever it is finite (i.e. the topology of the space being acted on does not contribute). However, this has so far only been shown for actions by virtually cyclic groups. We will show this coincidence holds for many actions by more general groups.

Ali Raad

Inductive Systems of Cartan Pairs

Commutative Cartan subalgebras of C^*-algebras are distinguished C^*-subalgebras which have witnessed connections with dynamical systems, geometric group theory, and the classification programme for C^*-algebras. Kumjian and Renault characterised them via étale effective groupoids. Later on Exel studied certain regular inclusions admitting a faithful conditional expectation that were not necessarily commutative, giving rise to the notion of a non-commutative Cartan subalgebra. The underlying structure for this is that of an action by Hilbert bimodules. Kwaśniewski and Meyer pushed this theory further and characterised the actions that give rise to non-commutative Cartan subalgebras.

In this talk we will explore when inductive limit systems give rise to a Cartan subalgebra. The commutative case is based on recent joint work with Xin Li and the non-commutative case is based on recent joint work with Ralf Meyer and Jonathan Taylor.

Jonathan Taylor

C^*-inclusions arising from twists over effective groupoids

In 2008, Renault defined commutative Cartan pairs and showed that such pairs arise from twists over effective, étale, locally compact, Hausdorff, second countable groupoids. In particular, for such a twist, one considers the algebra of continuous functions on the unit space of the groupoid and includes it into the reduced twisted groupoid C^*-algebra. Conversely, from a (commutative) Cartan pair, Renault constructs the Weyl groupoid and twist, and shows that this is unique among twists over groupoids with these adjectives giving rise to this C^*-inclusion. However, if the groupoid is not globally Hausdorff, but rather only has Hausdorff unit space, the reduced twisted groupoid C^*-algebra is in a certain sense "too large". Kwaśniewski and Meyer define the essential groupoid C^*-algebra to compensate for this, and we show inclusions with the essential groupoid C^*-algebra give rise to Cartan-like pairs. We show that by weakening the definition of Cartan pairs (by removing certain restrictions on the conditional expectation), we gain a similar bijective correspondence between twists over effective étale groupoids with locally compact Hausdorff unit space and such essential Cartan pairs. The construction of the underlying Weyl groupoid and twist is the same as Renault defines, and we show that this is again unique among groupoids with this set of adjectives giving this C^*-pair.

Eduard Vilalta

The Global Glimm Problem

Every C^*-algebra with the Global Glimm Property (in the sense of Kirchberg and Rørdam) has no nonzero elementary ideal-quotients. The Global Glimm Problem asks if the converse holds.

In this talk, I will discuss C^*-algebras with an absence of nonzero elementary ideal-quotients (termed nowhere scattered). I will also explain how both the Global Glimm Property and nowhere scatteredness can be characterized by divisibility conditions of the Cuntz semigroup, and how these characterizations lead to a new approach to this problem.

The talk is based on joint work with Hannes Thiel.

Gerrit Vos

Multilinear transference of Fourier and Schur multipliers acting on non-commutative L^p-spaces

Let G be a locally compact unimodular group, and let m be some function of n variables on G. To such a function, one can associate a multilinear Fourier multiplier, which acts on some n-fold product of the non-commutative L^p-spaces of the group von Neumann algebra. One may also define an associated Schur multiplier, which acts on an n-fold product of p-Schatten classes. There are some well-known transference results between Fourier and Schur multipliers. In a recent work with Martijn Caspers and Amudhan Krishnaswamy-Usha, we generalise some of these to the multilinear setting. In this talk, I will give some background on Fourier and Schur multipliers, give some insight in the 'easier' transference results and then state the results we found for multilinear transference.

Jeroen Winkel

Property (T) for Bounded Structure Groups

The classical setting of property (T) applies to topological (usually locally compact) groups. It says that all *continuous* representations of the group have a spectral gap. Clearly, this seems to depend on the topology of the group. We showed that, like in the geometric case, property (T) does not in fact depend on the topology of the group, but it depends only on the large-scale structure. This shows that topological groups are not in fact the most natural setting to study property (T). Instead we can work in the category of so-called *bounded structure groups*, which are groups with a large-scale geometric structure. This talk is based on joint work in progress with Romain Tessera.

Special Sessions

Lightning Talks

A round of lightning talks (3min) given by participants will take place on Monday afternoon. Here is the list of speakers:

Ujan Chakraborty,
From dynamical coverings of topological spaces to dynamical embeddings of nuclear C* algebras

Magnus Fries,
K-homology of manifold boundaries and Baum-Douglas-Taylor index theorem for Dirac operators

Elliott Gesteau,
Operator algebras and quantum gravity

Larissa Kroell,
Quantum graphs - Several ways to quantize a graph.

Arvin Lamando,
Linear Deformation of Noncommutative Tori from Time-Frequency Systems

Malte Leimbach,
Do spectral truncations of the torus converge?

Rafael Pereira Lima,
K-theory and the $R(\sigma)$ groupoid

Levi Lorenzo,
The Smale Space Dance and the C^* Game

Evangelos Nikitopoulos,
Higher Differentiability of Operator Functions.

Dzokou Talla Joel Right,
Invariant integrals on coideals and their Drinfeld doubles

Owen Tanner,
Owen on $\mathcal{O}_n$ and V_2, too.

Ask Anything Session

A new initiative in the 2022 edition of YMC*A. This is your chance to post that question you always wanted to ask - we are almost sure there will be an expert present at the conference. You might be the expert for someone else's question!

Panel discussion

On Friday, we will host a panel who will address common topics such as applying for jobs, giving talks, submitting papers, work-life-balance, navigating a career in and out of academia, etc., as well as questions around equity, diversity and inclusion. The panel consists of mathematicians both from academia and industry:

- Lara Ismert (Embry-Riddle Aeronautical University)
- Xin Li (University of Glasgow)
- Sara Malacarne (Telenor)
- Alexander Müller-Hermes (University of Oslo)
- Lyudmila Turowska (Chalmers University of Technology and University of Gothenburg)
- Makoto Yamashita (University of Oslo)

Social Events

Get together

On Sunday evening we want to give participants the possibility to get to know each other. We will set out into the city to get drinks. First year participants are especially welcome. We will meet at 7pm right outside of the hostel.

Reception

On Monday evening at 6pm, there will be a reception with pizza in the area outside the main auditorium. There we will have the opportunity to meet each other and talk over pizza and soft drinks!

Mentor Network Breakfast

Tuesday morning, all participants underrepresented in mathematics due to gender (e.g., cis-women, transgender, nonbinary and other gender minorities) are invited to an informal discussion over breakfast hosted by the OA Mentor Network. Breakfast will be provided.

Conference Dinner

The conference dinner, which will be a fully vegan buffet, will take place on Wednesday evening at 6:30pm in the area outside the main auditorium in Vilhelm Bjerknes.

Mingling with cake

We will end the conference on Friday afternoon with offering a selection of cakes and an ample opportunity to socialize with new friends and possible collaborators.

Excursions

On Tuesday afternoon, there will be time for an excursion. Below you can find a list of the 6 different excursions that we have planned along with a short description for each.

Hiking

We will hike to the top of the Vettakollen hill and see the city of Oslo from there (if the weather allows it). We will take the metro from Blindern to Songsvann lake, where the hike begins. It will last for about 2.5 hours, is not difficult but requires some effort and proper clothes, like hiking shoes. We advise you to bring a waterproof jacket, so that a mild rain does not prevent us from going to our excursion.

Excursion leader: Lucas

Vigelandsparken

This excursion is meant as a more laid-back alternative. We will visit the famous sculpture park of Gustav Vigeland and the surrounding Frogner Park. Besides their artistic merits, some of the more 'colourful' statues have been known to appear as reaction images and in memes online (ask Google about *Sinnataggen*). Afterwards we will have a picnic in the Frogner Park and play some lawn games. We may also visit the nearby museum about Vigeland, who for instance also designed the Nobel Peace Prize medal. Entrance to the park is free, a museum ticket is 100 NOK.

Excursion leader: Floris

Guided city tour

We will go on a guided walking tour through the heart and history of Oslo. During the walk, we will visit Akershus festning, which has protected Oslo since the

14th century, and we will see where king Christian IV'th demanded the city be rebuild after the fire of 1624. The tour will take us from the city's beginnings to what it is today.

There is an upper limit of 20 participants on this tour. In case more than 20 sign up, spots will be given on a first come first serve principle.

Excursion leader: Emilie

Munch Museum

Edvard Munch was a Norwegian painter and is maybe best known for the famous painting *The Scream*. The new Munch museum opened last year, and while the building itself has been a bit controversial, the exhibitions are generally quite well-received. A real high-light is the current joint exhibition with the band Satyricon, featuring around 15 of Munch's paintings in a very dark room with ambient music composed by the band.

Entrance fee is **160 NOK** (100 NOK if you are 25 or younger).

We ask that you buy the tickets online in advance for entrance at 2pm.

Website: https://www.munchmuseet.no/en/

Excursion leader: Erik

National Museum

The Norwegian National Museum holds Norway's largest collection of art, architecture and design. The museum building is brand-new and the museum opened this June. Here you will find many art pieces from Norwegian greats as well as international artists. The opening exhibition of the museum is still on and is called "Jeg kaller det kunst" ("I Call It Art"). It consists of Norwegian contemporary art which - according to the museum webpage - *explores what is in and what is out in art.*

Entrance fee is **180 NOK** (110 NOK if you are 25 or younger).

We ask that you buy the tickets online in advance for entrance at 2pm.

Website: https://www.nasjonalmuseet.no/en/

Excursion leader: Gaute

Bouldering

Bouldering is a type of climbing done on walls that are not too high, typically 3–4 meters, with mats on the floor to break your fall. This means that safety harnesses and ropes are not needed. Different routes with varying levels of difficulty are set on the walls. Bouldering is a kind of problem solving, which might explain why so many mathematicians enjoy it! We will take the metro from Blindern to Brynseng to get to the indoor bouldering gym *Klatreverket Bryn* (Brynsveien 3, 0667 Oslo) where an instructor will guide us through the basics of bouldering. Note that this excursion might have limited capacity.

Entrance fee is **150–210 NOK** depending on how many participants we get.

Excursion leader: Ulrik

Getting around

This part of the booklet includes all the information you need to get around in Oslo and to get to and from relevant locations.

Getting around in Oslo

Public transportation in Oslo is operated by Ruter and includes T-bane (metro), bus, tram, commuter train, and non-sightseeing boat lines. Tickets are valid for all modes of public transportation.

The price is determined by the duration of validity of the ticket and by the number of Zones traveled through. Other than traveling from and to the airport, Zone 1 should be enough. See here for a list of possible tickets and prizes.

There are two main options for buying tickets:

- RuterBillett (app for iOS and Android).
  Payment is possible via Visa/MasterCard from most European countries or through PayPal or Apple Pay.
  There is also a newer app simply called Ruter where one can both plan a journey and buy tickets. However, for buying tickets, we recommend RuterBillett as it is much simpler to use.
- Reisekort (Travelcard).
  A new plastic card costs 50 NOK and can be bought in most kiosks (Narvesen, 7-Eleven, Deli de Luca and Mix) or at Ruter's customer service centre or any of their service points.
  On the travelcard, one can have any of the tickets also available in the RuterBillett app. Alternatively, the travelcard can be topped with pay-as-you-go credit.

A journey with public transportation can be planned with the app Ruter or with any standard mobile mapping service.

Alongside public transportation, one can use one of the many available city bikes (in Norwegian: bysykkel). A single ride is 39 NOK for up to 60 minutes. It is easiest to pay in advance either via the website or the Bysykkel app.

Getting from and to Oslo Airport Gardermoen

We recommend taking the train between Oslo Airport Gardermoen and the city of Oslo. If you have accommodation at Anker Hostel, then getting off at Oslo Central Station makes the most sense. There are two train options:

- **Vy.** This is the main train company in Norway and it operates several lines that stop in both Oslo and Oslo Airport Gardermoen. Tickets can be bought from the Vy machines at the airport and Oslo central station, and cost **114 NOK**.

- **Flytoget.** The airport express train is only marginally faster than Vy, but it has the advantage that it leaves every 10 minutes both from and to the airport. A regular ticket is **210 NOK** and can be bought from the Flytoget machines at the airport or in advance online.

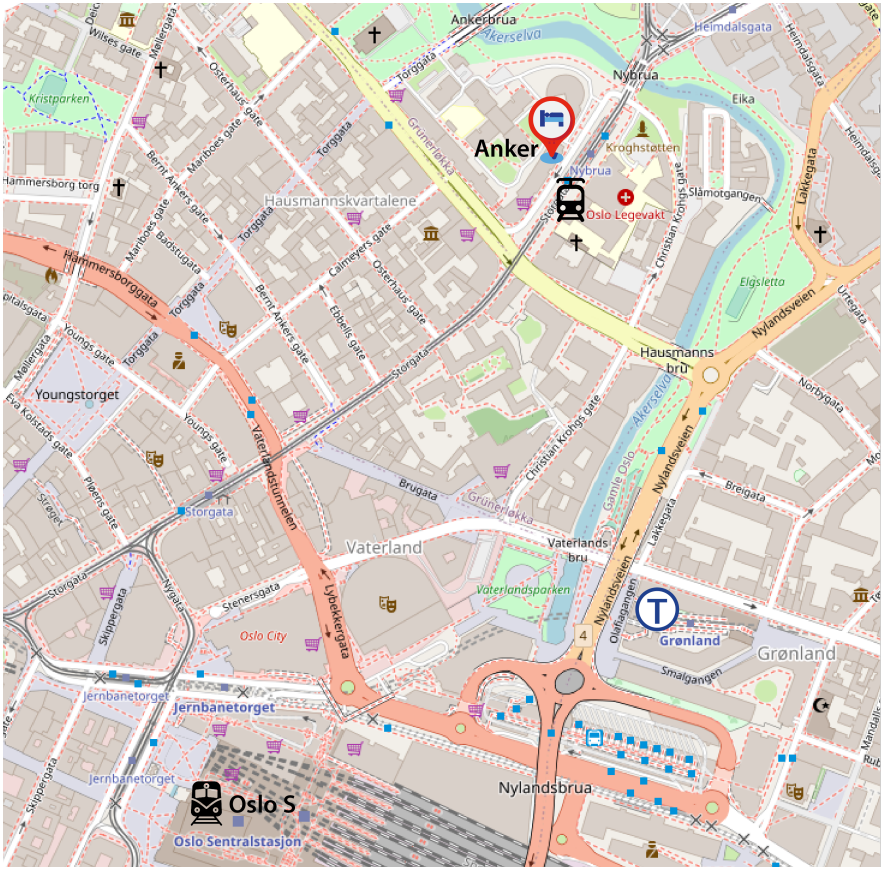
Finding Anker Hostel

Anker Hostel[1] is located at

Storgata 53H, 0182 Oslo

The walk from Oslo S (Oslo Central Station) to Anker Hostel only takes about 10 minutes.

[1] NB! Anker Hostel is run by Anker Apartment, and they have another location which appears on Google Maps if you search for "Anker Apartment". The correct address is listed under "Anker Hostel" on Google Maps.



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The above map shows the position of Anker Hostel together with Central Station (Oslo Sentralstasjon), the nearest T-bane/metro stop (Grønland) and the nearest tram stop (Nybrua).

Public transport between Anker Hostel and campus

For traveling between Anker Hostel and the University of Oslo campus Blindern where the conference will take place, we recommend the two following options:

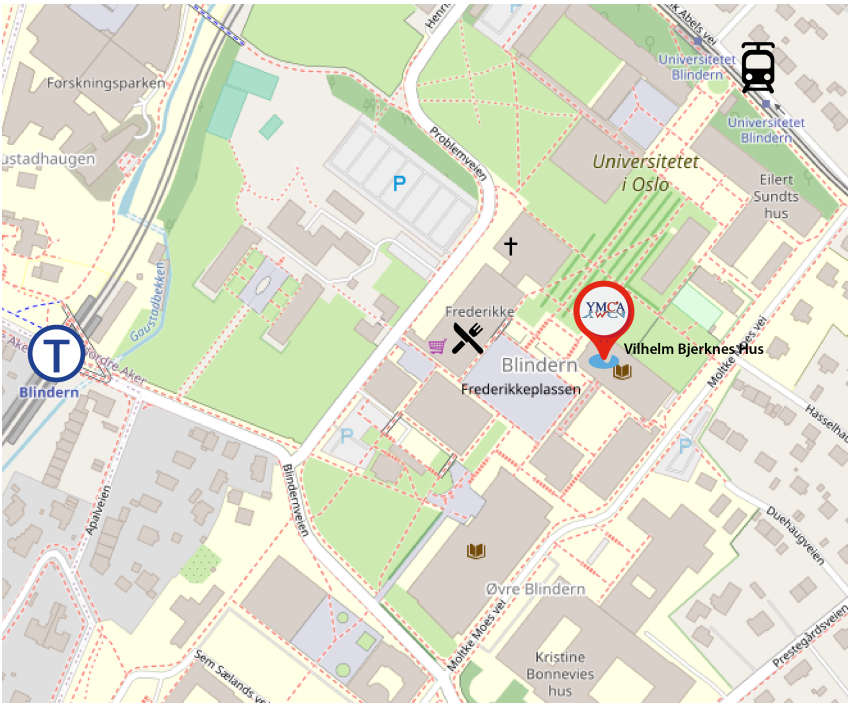
- **Tram**. Tram lines 17 and 18 leave from the tram stop Nybrua located just outside Anker Hostel. Get off at Universitetet Blindern. The walk from here to the conference location is indicated on the campus map on the next page. The duration of the ride is about 20 minutes.
- **T-bane (metro)**. Alternatively you can walk for about 5–10 minutes to the metro stop Grønland and take either line 4 or 5 to the metro stop Blindern. From here the walk to the conference location is indicated on the campus map on the next page. The ride itself takes only about 10 minutes.

For info about public transport and tickets in particular, see the section about Getting around in Oslo.

On Campus

Locations

All lectures and talks will take place in Auditorium 5 in Vilhelm Bjerknes Hus at Blindern campus of University of Oslo.



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Address:

Moltke Moes vei 35, 0851 Oslo

Auditorium 5 is located on the ground floor. Upon entering through the main entrance of Vilhelm Bjerknes Hus, just go straight ahead to find the auditoriums. Auditorium 5 is then furthest to the right. Reception and conference dinner both take place in the area just to the left when entering the building. Coffee breaks will be held in the other end of the building, just outside Auditorium 5.

Food on campus

We do not provide lunch, and people are free to go wherever they want to eat. However, we expect that most people will have lunch in the Frederikke building on campus. It is marked on the map above, but you will probably find your way there just by following the crowd. During the conference there are three options in this building:

- **Frederikke spiseri**. A big cafeteria with both cold premade food and a buffet with some warm food options.
- **Union371**. This is a café serving pizza and sandwiches.
- **Tacoteket**. Tacos, burritos and bowls.

YMC*A will have a few tables located in Union371. You are free to eat your food here even if you bought it in one of the other restaurants.

In Oslo

Welcome to the city of Oslo! Here, you will find tips on where to eat and what to do and see in Oslo. We hope you enjoy your time here!

Eat and drink in Oslo

There are many places around Oslo where you can get something to eat. We recommend the following restaurants:

- **Oslo Street Food** (Torggata 16). This is a popular food court located centrally at the Torggata street very close to Anker Hostel. They offer many different varieties of food and drinks, including options for vegetarians/vegans.
- **Wünderburger** (Torggata 35). The organizers' favorite burger joint. Very close to Anker Hostel. Has vegetarian/vegan options.
- **Punjab Tandoori** (Grønland 24). An affordable (though often crowded) Indian restaurant located only a 10 minutes walk from Anker Hostel.
- **Mathallen** (Vulkan 5). A high-end food court which in addition to restaurants and pubs/bars has several specialty food shops. We recommend Vulkan Fisk in particular. Mathallen is located at Vulkan, an area that also has many other restaurants and bars. Around 10–15 minutes walking from Anker Hostel.
- **Fiskeriet** (Youngstorget 2b). A seafood restaurant 10 minutes walking from Anker Hostel.
- **Mamma Pizza** (Dronningens gate 22) Great pizza, good selection of wine, live jazz on Thursdays! Around 15 minutes walking from Anker Hostel.
- **Funky Fresh Foods** (Hausmanns gate 16). A fully vegan restaurant located 5 minutes walking from Anker Apartment.

- **Koie Ramen** (Osterhaus' gate 13). Nice Ramen at a reasonable price only a 5 minutes walk away from Anker Hostel.
- **Sjømagasinet** (Tjuvholmen allé 14). If you are looking for fine dining, we recommend you check out this high end seafood restaurant located with a beautiful view to the fjord. It will not be cheap but it will be amazing.

For a drink in the evening, we recommend the following bars:

- **Kulturhuset** (Youngs gate 6). This is a big pub over several floors, with a decent selection of beer on tap. It is located in Youngs gate, close to Torggata.
- **Hopyard** (Vulkan 5). A pub in Mathallen (see above) with a very good selection of craft beers.
- **Himkok** (Storgata 27). One of Oslo's finest cocktail bars, right next to Kulturhuset. They distill their own gin, vodka and aquavit.
- **Fyrhuset Kuba** (Maridalsveien 23). An informal pub with many seats outside. The beer is quite cheap compared to most other places in Oslo. Close to Vulkan.
- **Torggata Botaniske** (Torggata 17b). Known for their cocktails (and mocktails for people who do not drink alcohol).

Finally, if you are looking for a cup of coffee or if you wish to try a traditional Norwegian waffle with brown cheese, check out one of these cafés:

- **Hønse-Lovisas Hus** (Sandakerveien 2). A cosy cafe located by Akerselva next to a smaller waterfall. This is a good place to try out those traditional waffles with brown cheese.
- **Kaffebrenneriet**. This is a chain of cafés in Oslo with good coffee.
- **Åpent Bakeri**. This is a bakery chain where they sell good sandwiches and coffee. They have a location near campus at Damplassen 24.

To do and see in Oslo

If you are spending a little extra time in Oslo, there is a lot you can see and do. We have collected a few tips for you here. You may find more inspiration in the official travel guide for Oslo at `https://www.visitoslo.com/en/`.

- **City Tours**. Here are a few companies offering guided tours of Oslo:
  `https://www.osloguide.no/`
  `https://vikingbikingoslo.com/`
- **The Historical Museum**. The university's history museum has two small but nice exhibitions with a bunch of relics from the time of the Vikings.
- **Norsk Folkemuseum**. An open-air museum with lots of buildings from Norway's history. If you want to see a real stave church or feel like you're walking around Skyrim, this is the place!
  The museum is on the Bygdøy peninsula, which is also nice for walks and has some small beaches for swimming in the Oslo fjord.
- **Ekebergparken**. A sculpture park which features works by a diverse array of artists. There are also nice views of Oslo from up there, some of which you can find in Munch's paintings if you look closely. Entrance is free.
- **Holmenkollen**. The Holmenkollen ski jump is a useful landmark when navigating Oslo, and quite intimidating to see up close. There's a neat little museum about the history of skiing inside, and you can then also take the elevator to the top of the ramp for some fantastic views. This is a potential starting point for a good hike as well.
- **A swim in the sea**. There are many good spots to take a dip in the sea: Behind the opera there is a newly built beach, and at Sørenga and Tjuvholmen there are good opportunities for swimming.
- **Island hopping**. In the summer months there are a bunch of ferries going around the Oslo fjord and its islands. They are part of the normal public transport inside zone 1, so they don't cost anything extra. More info here:
  `https://www.visitoslo.com/en/product/?TLp=163651`

Monday	Tuesday	Wednesday	Thursday	Friday
08:30 - 08:50 **Registration + Coffee**	08:00 - 08:45 **Mentor Network Breakfast**			
08:50 - 09:00 **Welcome and information**	08:45 - 09:00 **Coffee**	08:45 - 09:00 **Coffee**	**Late Start**	08:45 - 09:00 **Coffee**
09:00 - 10:00 **Lyudmila Turowska**	09:00 - 10:00 **Sergey Neshveyev**	09:00 - 10:00 **Lyudmila Turowska**	09:45 - 10:00 **Coffee**	09:00 - 10:00 **Xin Li**
Break	***Break***	***Break***	10:00 - 11:00 **Xin Li**	***Break***
10:20 - 12:00 **Priyanga Ganesan** **Eduard Vilalta** **Ian Charlesworth**	10:20 - 11:20 **Lyudmila Turowska**	10:20 - 12:00 **Ali Raad?** **Robert Neagu** **M. Ali Asadi-Vasfi**	11:00 - 12:00 **Jonathan Taylor** **Are Austad**	10:20 - 12:00 **Arturo Jaime** **Samantha Pilgrim** **Matteo Pagliero**
	11:20 - 12:20 **Soham Chakraborty** **Alexey Kuzmin**			
12:00 - 13:20 **Lunch**	**Excursions**	12:00 - 13:20 **Lunch**	12:00 - 13:20 **Lunch**	12:00 - 13:20 **Lunch**
13:20 - 14:20 **Sergey Neshveyev**		13:20 - 14:20 **Sergey Neshveyev**	13:20 - 14:20 **Xin Li**	13:20 - 14:20 **Samantha Brooker** **Abraham Ng**
Coffee		***Coffee***	***Coffee***	***Coffee***
14:40 - 16:20 **Miho Mukohara** **Antje Dabeler** **Krzysztof Bardadyn**		14:40 - 15:40 **Anshu** **Jacek Krajczok**	14:40 - 16:20 **Jeroen Winkel** **Gerrit Vos** **Amudhan Krishnaswamy-Usha**	14:40 - 16:10 **Career Panel**
Break		***Break***		
16:30 - 17:30 **Lightning Rounds**		16:00 - 18:00 (open ended) **Ask Anything Session**		**Mingling with Cake**
Break		***Break***		
18:00 - 20:00 **Reception with Pizza**		18:30 - 20:30 **Conference Dinner**		

Minicourse

Contributed Talk

Special Session

Social Event

Break