

TRR 306

# QuCoLiMa



Quantum Cooperativity  
of Light and Matter

**RTG Summer School**

**& Annual Meeting**

**2021**

# Program overview

	Sunday, 10.10.2021	Monday, 11.10.2021	Tuesday, 12.10.2021
	RTG Summer School	Location: Lecture hall H	Location: Lecture hall H
	TRR Annual Meeting		
08:15		Registration	
08:45		Welcome	
09:00			
09:30		Area A	Area C
10:00			
10:30		Coffee Break	Coffee Break
11:00			
11:30		Area B	Area D
12:00			
12:30			
13:00		Lunch	Lunch
13:30			
14:00			
14:30		CDR Meeting	Softskill seminar (Scientific Writing)
15:00			
15:30		Coffee Break	Coffee Break
16:00			
16:30		Poster Session I	Softskill seminar (Scientific Writing)
17:00			
17:30			
18:00			
18:30			
19:00			
19:30			
20:00	Arrival / Get-Together Doct. Res.	Dinner Steinbach Bräu	Merger Get-Together (Novotel)
20:30			
21:00			

Wednesday, 13.10.2021	Thursday, 14.10.2021	Friday, 15.10.2021	
Location: Lecture hall H	Location: Lecture hall H	Location: Lecture hall H	
Registration			08:15
Welcome			08:45
Talks Area A/B/C/D/Ext.	Talks Area A/B/C/D/Ext.	Talks Area A/B/C/D/Ext.	09:00
			09:30
			10:00
			10:30
Coffee Break	Coffee Break	Coffee Break	11:00
			11:30
Talks Area A/B/C/D/Ext.	Talks Area A/B/C/D/Ext.	Talks Area A/B/C/D/Ext.	12:00
			12:30
Lunch	Lunch	Lunch	13:00
			13:30
			14:00
Talks Area A/B/C/D/Ext.	Data management	Individual Discussions	14:30
			15:00
			15:30
Coffee Break	Coffee Break		16:00
			16:30
Talks Area A/B/C/D/Ext.	General Assembly / Lab Tours		17:00
			17:30
			18:00
			18:30
			19:00
Poster Session II	Dinner Krone Hüttendorf		19:30
			20:00
			20:30
			21:00

# Monday and Tuesday

## Monday, 11.10.2021

Time	Project	Title	Presenter(s)
08:15		<b>Registration</b>	
08:45		<b>Welcome</b>	
09:00	<b>Area A</b>	<b>Quantum cooperativity induced by measurement processes</b>	<b>von Zanthier</b>
09:30	<b>A04</b>	The spatial coherence of pulsed electron beams from tungsten needle tips	<b>Meier</b>
10:00	<b>A06</b>	Quantum Cooperativity in Quantum Repeaters	<b>Chelluri</b>
<b>Coffee Break</b>			
11:00	<b>Area B</b>	<b>Quantum Cooperativity of collective degrees of freedom</b>	<b>Viola-Kusminski</b>
11:30	<b>B05</b>	Optical signatures of the coupled spin-mechanics of a levitated magnetic microparticle	<b>Wachter</b>
12:00	<b>B04</b>	Observation of Lasing using cold trapped Yb-atoms	<b>Shaju</b>
<b>Lunch</b>			
14:00		<b>CDR-Meeting</b>	
<b>Coffee Break</b>			
16:00		<b>Poster Session I (list of posters on page 7)</b>	
19:00		<b>Dinner Steinbach Bräu</b>	

## Tuesday, 12.10.2021

Time	Project	Title	Presenter(s)
09:00	<b>Area C</b>	<b>Quantum cooperativity induced by interactions</b>	<b>Sandoghdar</b>
09:30	<b>C05</b>	Polarization-entangled photons from ultrathin non-linear layers	<b>Sultanov</b>
09:50	<b>C04</b>	Super-radiance in inhomogeneous X-ray waveguides	<b>Andrejic</b>
10:10	<b>C02</b>	Light scattering off correlated quantum emitter systems and quantum degenerate systems	<b>Baßler</b>
<b>Coffee Break</b>			
11:15	<b>Area D</b>	<b>Pushing the limits of quantum cooperativity</b>	<b>Morigi</b>
11:45	<b>D01</b>	Cooperative quantum phenomena in light-matter platforms	<b>Reitz</b>
12:15	<b>D06</b>	Extended dynamical mean-field theory for photon-mediated interactions	<b>Lenk</b>
<b>Lunch</b>			
14:00		<b>Softskill Seminar: Scientific Writing</b>	<b>Dzifa Vode</b>
<b>Coffee Break</b>			
16:00		<b>Softskill Seminar: Scientific Writing</b>	<b>Dzifa Vode</b>
18:00		<b>Merger Annual Meeting - Get-Together at Novotel</b>	

## Wednesday, 13.10.2021

Time	Project	Title	Project leader(s)
08:15		<b>Registration</b>	
08:45		<b>Welcome</b>	
			Session Chair: Schmidt
09:00	<b>A01</b>	Cooperative light emission and spatio-temporal photon correlations from trapped ion arrays	<b>von Zanthier / Schmidt-Kaler</b>
09:30	<b>A02</b>	Generation of photonic cluster states from color center-cavity systems	<b>Becher</b>
10:00	<b>A03</b>	Correlated x-ray photons for incoherent diffraction imaging	<b>Röhlsberger / von Zanthier</b>
10:30	<b>Extern</b>	Learning to measure	<b>Sabrina Maniscalco (Univ. of Turku)</b>
<b>Coffee Break</b>			
			Session Chair: Viola Kusminski
11:30	<b>A05</b>	Cooperative effects of a defined number of organic molecules embedded in a dielectric antenna	<b>Götzinger</b>
12:00	<b>A06</b>	Tailor-made beyond-one-excitation quantum states for quantum information and communication	<b>van Loock</b>
12:30	<b>D05</b>	Quantum Cooperativity and Synchronization	<b>Marquardt</b>
<b>Lunch</b>			
			Session Chair: Schmidt-Kaler
14:30	<b>D01</b>	Cooperative effects in coupled quantum emitter systems	<b>Genes</b>
15:00	<b>D02</b>	Spatio-temporal structures in interacting spin systems	<b>Morigi</b>
15:30	<b>D03</b>	Competing interactions in strongly correlated light-matter assemblies	<b>Schmidt</b>
<b>Coffee Break</b>			
			Session Chair: von Zanthier
16:30	<b>D04</b>	Synchronising quantum spins with long-range dissipation	<b>Marino</b>
17:00	<b>D06</b>	Entangling collective behavior of quantum materials and quantum light	<b>Eckstein</b>
17:30	<b>Extern</b>	Light-induced entanglement between clock atoms	<b>Vladan Vuletic (MIT)</b>
<b>Dinner</b>			
<b>Poster Session II (list of posters on page 7)</b>			

# Thursday and Friday

## Thursday, 14.10.2021

Time	Project	Title	Project leader(s)
			Session Chair: Becher
09:00	A04	Spatio-temporal correlations of electrons emitted from femtosecond laser-driven needle sources	Hommelhoff
09:30	C01	One-dimensional photon-mediated cooperativity of quantum emitters	Sandoghdar
10:00	C02	Light induced correlations in dense atomic media	Windpassinger / Schmidt
10:30	C03	Mechanical and chemical control of single and multiphoton emission	Basché / Jung
Coffee Break / Group photo			
			Session Chair: Windpassinger
11:30	C04	X-ray photonic structures for control of cooperative emission from resonant nuclei	Pálffy-Buß / Röhlberger / von Zanthier
12:00	C05	Quantum cooperative chiral metasurfaces for producing nonclassical light	Krstić / Chekhova
12:30	Z02	Quantum simulation methods for cooperative effects in strongly correlated light-matter systems	Hartmann / Wilhelm-Mauch
Lunch			
14:30	Data management		
Coffee Break			
16:30	PLs: General Assembly Guests / Doct. Res.: Lab Tours		
19:00	Dinner Krone Hüttendorf		

## Friday, 15.10.2021

Time	Project	Title	Project leader(s)
			Session Chair: Marino
09:00	B05	Optomagnomechanical arrays	Viola Kusminskiy
09:30	B02	Levitated ferrimagnetic particles in hollow-core photonic crystal fibres	Joly / Russell
10:00	Extern	Non-linear integrated quantum optics with integrated optics and pulsed light	Christine Silberhorn (Univ. of Paderborn)
Coffee Break			
			Session Chair: Morigi
11:00	B03	Point defects in silicon carbide: Towards a platform for the coupling of light, spin and mechanics	Weber / Neu-Ruffing / Bockstedte
11:30	B04	Optomechanical lasing mechanisms in cold atoms	Eschner
12:00	B01	Collective quantum dynamics of structural- and spin-defects in ion crystals	Schmidt-Kaler / Morigi
Lunch			

## Poster Session I &amp; II

Abstracts:



#	Project	Title	Presenter
1	A01	<b>Spatial-temporal correlations of the light of an ion crystal</b>	Stefan Richter
2	A01	<b>Remote Imaging in a Three Atom System</b>	Manuel Bojer
3	A03	<b>Incoherent diffractive imaging with hard x-rays</b>	Sebastian Karl
4	A03	<b>Towards Measurement-Based Variational Quantum Simulation of the Multi-Flavor Lattice Schwinger Model with a Flavor-Dependent Chemical Potential</b>	Stephan Schuster
5	B01	<b>Measuring the temperature of a trapped ion with light</b>	Marvin Gajewski
6	B03	<b>Theory of Color Centers in SiC Coupled to Light and Mechanics</b>	Maximilian Schober
7	B03	<b>Coupling of defects in 4H-SiC to external stress induced by mechanical vibrations of cantilevers: part 1 - fabrication &amp; first measurements</b>	André Hochreiter
8	B03		Yanis Abdedou
9	B04	<b>The dynamics of 1S0-3P1 trapped Yb atoms in a high-finesse cavity</b>	Dmitriy Sholokhov
10	B05	<b>Optical to microwave conversion using mechanical and magnetic degrees of freedom inside a crystal</b>	Fabian Engelhardt
11	B05	<b>Coupling an Adsorbed Transition-Metal Complex to Light: Two-Channel YSR-States</b>	Helene Müller
12	C01	<b>Nonlinear optics at the single photon level with a single molecule strongly coupled to a Fabry-Pérot cavity</b>	André Pscherer
13	C02	<b>Transfer of topological properties of light onto dense ultra-cold dipolar media</b>	Ishan Varma
14	C05	<b>Periodic Ensembles of Germanium Nanohelices and Associated Müller Matrix</b>	Günter Ellrott
15	D02	<b>Dynamics of entanglement creation between two spins coupled to a chain.</b>	Sayan Roy
16	D03	<b>Quantum Criticality of the long-range antiferromagnetic Heisenberg ladder</b>	Patrick Adelhardt
17	D03	<b>Ground-state properties of the Boson-Hubbard model on triangular lattice bilayer systems</b>	Jan Koziol
18	D03	<b>From non-Hermitian quantum spin models to frustrated open assemblies</b>	Lea Lenke
19	D06	<b>Cavity induced long-range interactions in the Fermi Hubbard model</b>	Paul Fadler
20	Z02	<b>Optimal control of 4-level qubits Simultaneous readout and reset of superconducting qubits</b>	Alexander Simm
21		<b>Irreversibility investigated using quantum computing</b>	Riccardo Roma

## Poster Session II only

#	Project	Title	Presenter
101	A01	<b>Cooperative Light Emission and Spatio-Temporal Photon Correlations from Trapped Ion Arrays</b>	Sebastian Wolf
102	C05	<b>Polarization-entangled photons from ultrathin nonlinear layers</b>	Vitaliy Sultanov
103	D04	<b>Non-local losses in cavity QED</b>	Oksana Chelpanova
104		<b>Wave-packet super-resolution vortex microscopy</b>	Maurizio Verde

# Information

## ADDRESSES

### Conference Venue

Lecture Hall H  
Staudtstraße 5  
91058 Erlangen

### Hotel

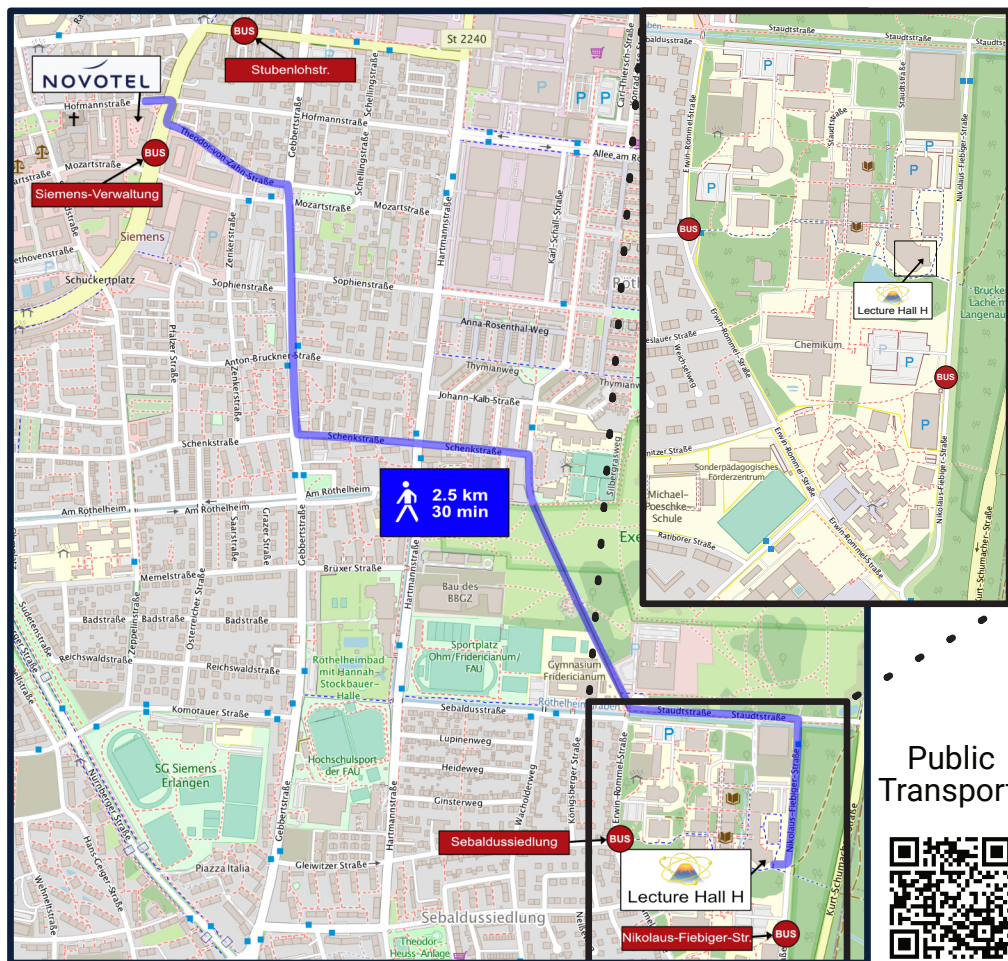
Novotel  
Hofmannstr. 34  
91052 Erlangen

### Dinner Monday

Steinbach Bräu  
Vierzigmannstr. 4  
91054 Erlangen

### Dinner Thursday

Landgasthof Krone  
Talblick 5  
91056 Erlangen-Hüttendorf



Public  
Transport:





## BUS SHUTTLE

There will be a QuCoLiMa bus shuttle connecting the hotel and the conference venue:

### Wednesday:

Morning: **leaving 8:10 !** at Novotel (standby from 8:00)

Evening: There will be **no bus shuttle** on Wednesday evening due to the floating end of the poster session. Either you take the public transport or an evening walk of ~30 minutes (see map on the left).

### Thursday:

Morning: **leaving 8:20 !** at Novotel (standby from 8:15)

Evening - Conference dinner: The bus will leave at **Novotel at 18:00**, passes via **Lecture hall H (18:15)** and then drives to the dinner venue. For the return trip, the bus leaves at **~22:00** and stops at lecture hall H as well as the Novotel.

### Friday:

Morning: **leaving 8:20 !** at Novotel (standby from 8:15)

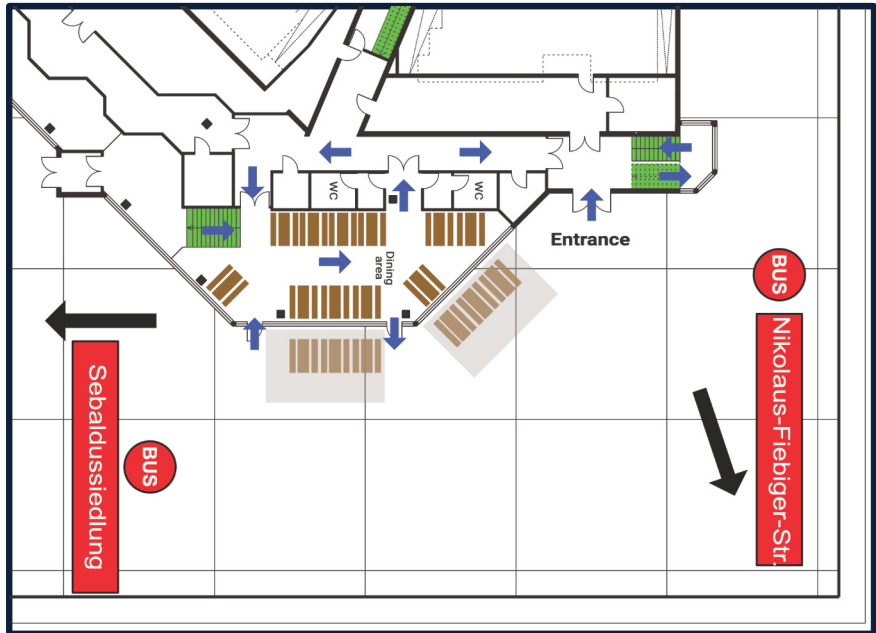
Afternoon: **leaving 13:15** from lecture hall H taking you to the main train station in Erlangen.

## CORONA - important measures and rules of conduct

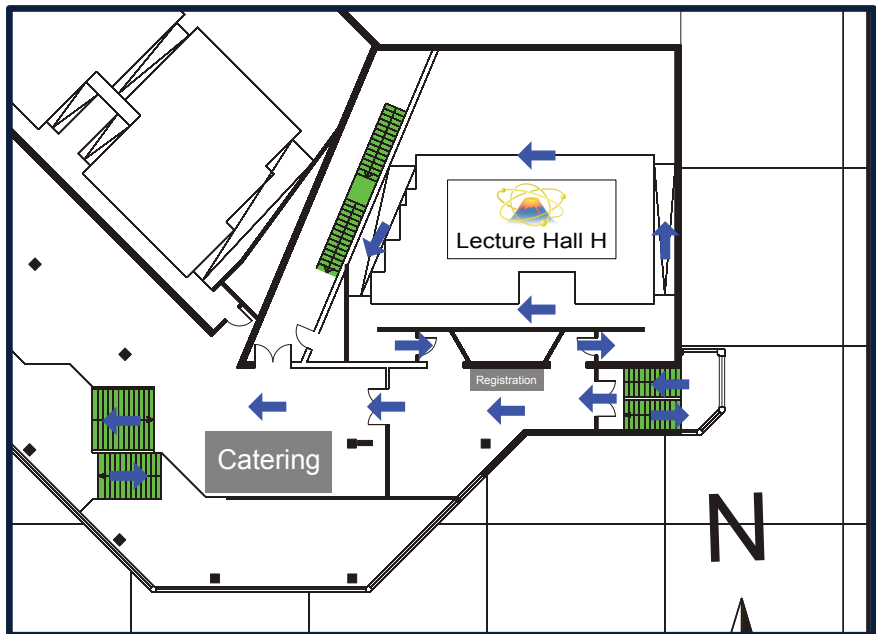
- Every participant has to wear a medical mouth-nose-mask indoors at all times – except at the table in the dining area.
- Only people vaccinated, recovered from Corona, or tested are allowed to participate (3G: geimpft, genesen, getestet).
- The 3G-status will be checked each day at the registration desk; for each day you get a strap of different color verifying your status for the day.
- If you are neither vaccinated nor have recovered from Corona, you must provide an official negative test every day of the conference (the test must not be older than 48 hours in case of a PCR test and 24 hours in case of a POC-antigen test).
- Objects such as glasses, personal office supplies, pens, etc. should not be shared. Also, minimize contact with frequently used surfaces such as door handles, elevator buttons, etc. and use your elbows if possible.
- Indoors, the walking paths are indicated (one-way street).
- Please use the provided hand sanitizer products regularly.
- In the unlikely case of the enforcement of stricter Corona Rules in Bavaria (i.e., „yellow or red traffic light“), we must take the meals outside (roofed); so please bring a warmer jacket in case that the temperatures gets low.
- If you have symptoms such as coughing, increased temperature, shortness of breath, loss of sense of smell/taste, sniffles, sore throat or headache and aching limbs, please stay at home; if you are already on site, you must isolate yourself immediately and contact the TRR office.
- In the event of symptoms of illness or a confirmed infection with the Corona virus, the TRR office must be informed immediately - even after an event.

# Conference Venue - Overview & One-Way regulation

## Lower Level



## Upper Level



## Uni Erlangen-Nürnberg

Adelhardt, Patrick  
Agne, Sascha  
Andrejic, Petar  
Baßler, Nico  
Bojer, Manuel  
Chekhova, Maria  
Eckstein, Martin  
Ellrott, Guenter  
Fadler, Paul  
Götzinger, Stephan  
Hartmann, Michael  
Heimerl, Jonas  
Hochreiter, André  
Hommelhoff, Peter  
Hörmann, Max  
Joly, Nicolas  
Karl, Sebastian  
Koziol, Jan  
Krstic, Vojislav  
Künzel, Fabian  
Langheld, Anja  
Lehmeyer, Johannes  
Lenk, Katharina  
Lenke, Lea  
Maran, Ilango  
Meier, Stefan  
Mühlhauser, Matthias  
Palffy-Buß, Adriana  
Pleinert, Marc-Oliver  
Richter, Stefan  
Rutscheidt, Erika  
Schiller, Leon  
Schmidt, Kai Phillip  
Schuster, Stephan  
Stöckigt, Anja  
Sultanov, Vitaliy  
Sumeet  
von Zanthier, Joachim  
Wachter, Vanessa  
Weber, Heiko  
Zapletal, Petr

## Uni Mainz

Basché, Thomas  
Chelluri, Siddardha  
Chelpanova, Oksana  
Li, Wenbing

Marino, Jamir  
Proske, Marvin  
Schmidt-Kaler, Ferdinand  
Schumacher, Lena  
Stopp, Felix  
Valencia Tortora, Ricardo  
Javier  
van Loock, Peter  
Varma, Ishan  
Verde, Maurizio  
Windpassinger, Patrick  
Wolf, Sebastian

## Uni Saarbrücken

Becher, Christoph  
Eschner, Jürgen  
Gajewski, Marvin  
Herrmann, Dennis  
Jung, Gregor  
Morigi, Giovanna  
Roma, Riccardo  
Roy, Sayan  
Schmit, Tom  
Shaju, Saran  
Sholokhov, Dmitriy  
Simm, Alexander  
Unni, Malavika  
Weber, Yannick  
Wilhelm-Mauch, Frank  
Wojtkowiak, Marko

## MPL Erlangen

Aiello, Andrea  
Engelhardt, Fabian  
Genes, Claudiu  
Graf, Jasmin  
Kumar, Pardeep  
Luo, Siwei  
Marquardt, Florian  
Mueller, Helene  
Pscherer, André  
Reitz, Michael  
Russell, Philip  
Roth, Paul  
Sandoghdar, Vahid  
Sharma, Sanchar  
Viola-Kusminsky, Silvia  
Wong, Gordon

## Uni Jena

Röhlsberger, Ralf

## Uni Linz

Bockstedte, Michel  
Schober, Maximilian

## TU Kaiserslautern

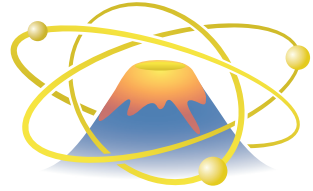
Abdedou, Yanis  
Neu-Ruffing, Elke

## Extern

Maniscalco, Sabrina  
(Univ. of Turku, Finland)  
Silberhorn, Christine  
(Univ. of Paderborn)  
Vuletic, Vladan  
(MIT, Boston, USA)

TRR 306

# QuCoLiMa



QuCoLiMa (***Q**uantum **C**ooperativity of **L**ight and **M**atter*) is a Collaborative Research Centre Transregio (TRR 306) of the universities



Friedrich-Alexander-Universität  
Erlangen-Nürnberg



JOHANNES GUTENBERG  
UNIVERSITÄT MAINZ



UNIVERSITÄT  
DES  
SAARLANDES

It intends to explore the distinctive traits of quantum cooperativity within a large variety of quantum platforms at the intersection of quantum optics and condensed matter. We aim at understanding what is the interplay of quantum interference and entanglement in the collective response of many-body quantum systems interacting with light. We will explore in particular the role of the quantum properties of radiation in establishing and mediating quantum cooperative phenomena in a variety of complex matter systems, entering the regime of many-body physics of quantum cooperative light-matter.

[www.qucolima.de](http://www.qucolima.de)

Funded by



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