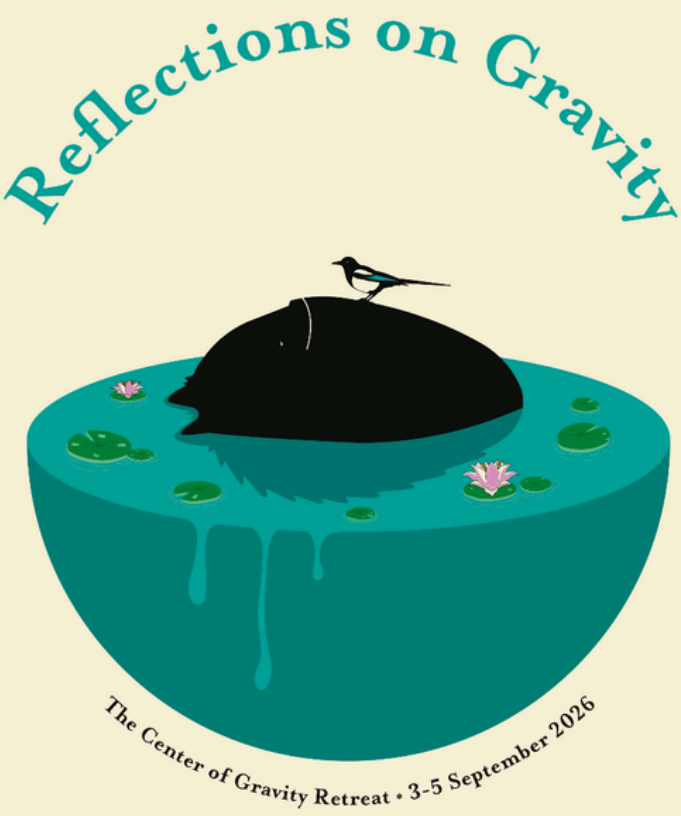


Departure @ NBI

03.09.2026, 7:30am

The bus leaves at 7:30am outside NBI, Blegdamsvej 17. Please be there at least 15 minutes in advance. The drive to Fuglesang Herregaard takes approx. 2.5 hours., ETA 10:00.

Departure @ Fuglesang Herregaard

05.09.2026, 12:30

The bus leaves at 12:30, dropping us off at NBI, Blegdamsvej 17, around 15:00.

What to bring

Next to clothes appropriate for Danish weather, feel free to bring your favorite game, such as chess, a deck of cards, or games we can play outside (football, frisbee, etc.). The sea is close by, so bring your swimming gear for a potential dip in the Baltic Sea. For ticks and mosquitos, a repellent is advisable. Please also bring Passport or ID.

Day 1

7:30	Departure at NBI
10:15	Welcome snacks, coffee, tea
10:30-11:00	Welcome and introduction & Intro game
11:00-11:30	**What is going on in Motion?** 5 min. state-of-the-art. Vision of future and possible bridges (led by Nabha)
11:30-12:00	**What is going on in Spectroscopy?** 5 min. state-of-the-art. Vision of future and possible bridges (led by Lorena & Simon)
12:00-13:00	**Lunch**
13:00-13:30	**What is going on in Quantum BHs?** 5 min. state-of-the-art. Vision of future and possible bridges (led by Ziqi)
13:30-14:00	**What is going on in Environments?** 5 min. state-of-the-art. Vision of future and possible bridges (led by Johan & Conor)
14:00-14:30	**Points of Contact between groups** How can we flow better as a Center scientifically through brainstorming sessions and projects (led by Vitor)
14:30-15:00	**Coffee & Cake break**
15:00 - 18:30	**Free time** Check in opens at 15:00.
18:30	**Dinner**
20:00-21:00	**Evenings at the castel** Conversations on failures, impostor sydrom. (led by Fanny)

Day 2

08:00 - 09:15	**Breakfast**
09:30-10:20	**Outreach & Impact on Society** A conversation on the responsibility and importance to share our work with society. (led by José & Troels)
10:20-10:30	**Coffee Break**
10:30-11:10	**Who does what at CoG?** Plan for the future. (Social Events; Seminars and Colloquia; Breakfast; Brainstorming sessions; PhD Days; PhD School, Retreat; Student and Postdoc representatives; STSMs)
11:10-11:20	**Coffee Break & Group Photo**
11:20-12:00	**Current and future detectors** (led by Vitor)
12:00-13:30	**Lunch**
13:30-15:00	**Tips and Tricks to navigate the academic world in the 21st Century** Open Access, referees, top journals, jobs, seminars (led by Niels) Followed by discussion on why activity matters
15:00-15:30	**Coffee & Cake break**
15:30 - 18:30	**Free time**
18:30	**Dinner**
20:00-21:00	**Evenings at the castel** Work environments: what to do to improve (led by Emil)

Day 3

08:00 - 09:00	**Breakfast**
09:00-09:50	**Projects** Why apply? (led by Alessia & Maarten)
09:50-10:10	**Coffee Break** Check out of Hotel
10:20-11:00	**Walk and Talk** A brisk walk to the sea
11:00-11:30	**Feedback and Final Remarks**
11:30-12:15	**Lunch**
12:30	**Bus departs for NBI**
Approx. 15:00	**Arrival at NBI** Thank you and goodbye!



Shuttle Schedule:

A shuttle will bring those staying at Hotel Falster to the Herregaard and back each morning, and evening. There is also a shuttle for those wishing to go back to the hotel during the break each afternoon from 15:00/15:30 - 18:00

Day 1

Departure	Destination
15:00	Hotel Falster
18:00	Herregaard
21:15	Hotel Falster

Day 2

Departure	Destination
08:00	Herregaard
15:30	Hotel Falster
18:00	Herregaard
21:15	Hotel Falster

Day 3

Departure	Destination
07:45	Herregaard



CoG Retreat Structure

Accommodation

We are 42 participants who will split between the Herregaard Fuglesang and Hotel Liselund, which lies 5 minutes away from the conference venue. Taxi Shuttles will bring the participants who are sleeping at the hotel to and from the Herregaard every morning and evening. Please view the **accommodation list on the last page**.

Groups

Each participant is a part of a group. Whenever there is group work, discussion, conversations, you will sit and work with your respective group.
The groups are as follows:

Black Team: Vitor Cardoso, Maxence Corman, Vita Movrin, Jury Radovsky, Fanny Töpper, Luka Vujeva

Red Team: Emil Bjerrum Bohr, Francesco Del Porro, Taillte May, Ariadna Ribes Metidieri, David Panella, Lorena Magaña Zertuche

Green Team: Marta Cocco, Francesco Ferrarin, Emil Have, Davide Perrone, Johan Samsing, Maarten van de Meent

Blue Team: Dogan Akpinar, Francesca Campani, Raul Carballo, Hannah Kingham, Nils Siemonsen, Ziqi Yan

Yellow Team: Fabian Gunnink, Troels Harmark, Nikesh Lilani, Raj Patil, Alessia Platania, Giada Caneva Santoro

Purple Team: Conor Dyson, Elisa Grilli, Simon Maenaut, Niels Obers, Leart Sabani, Guangzi Xu

White Team: Jose M. Ezquiaga, Shibashis Mukhopadhyay, Nabha Shah, Brian Seymour, Lucía Vélez Tartajo, Serdar Yildiz

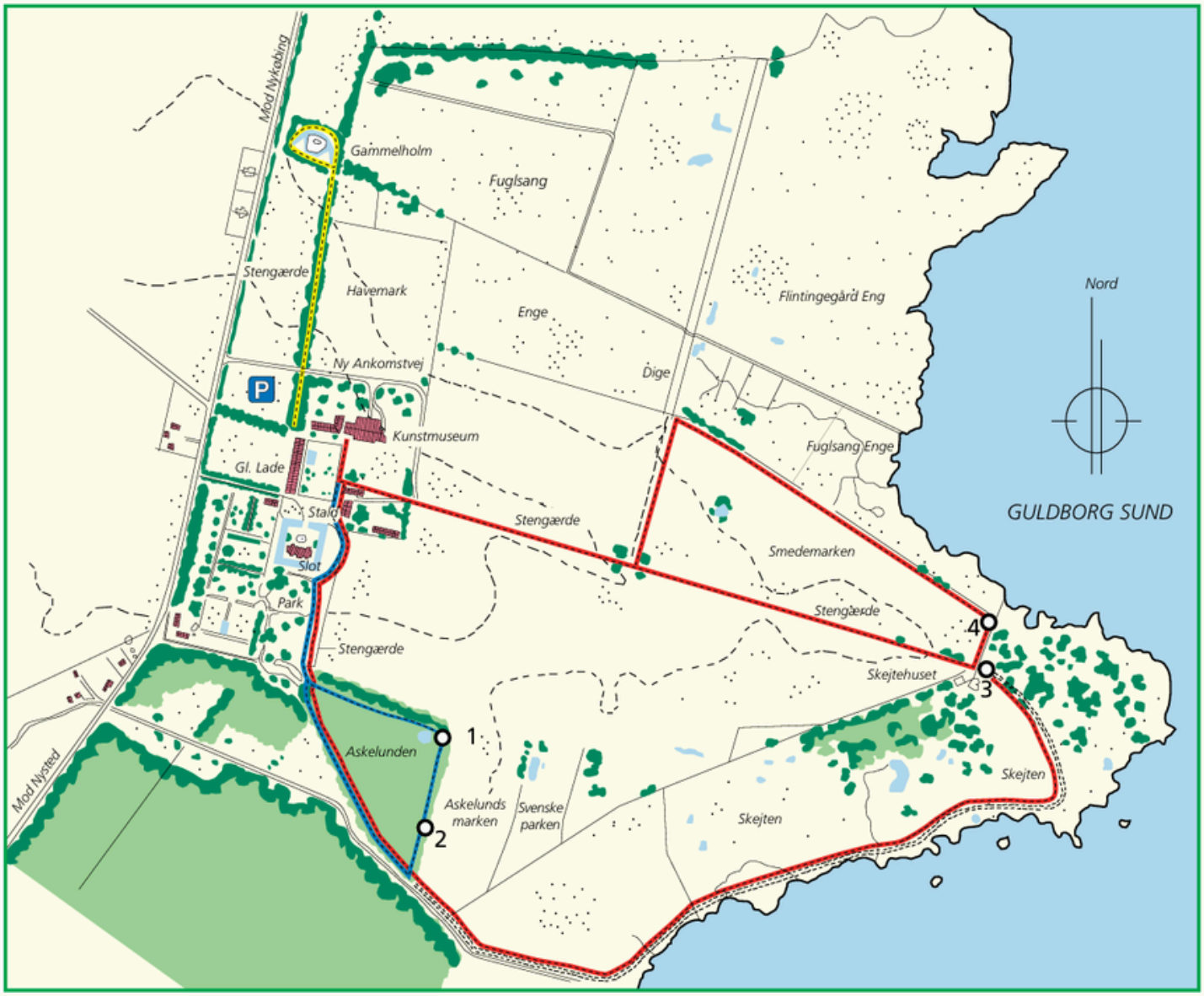
Presentations

One slide per presentation.
Each presentation is lead by a CoG member (tba), followed by group discussions and thought-sharing in plenum.

Free Time

Free time is self-organised. If you have an idea, feel free to share and I am sure you find people to tag along. The art museum in walking distance, Fuglesang Kunstmuseum (free entrance), the sea close by, and also the garden offer space for relaxation and play. The common rooms at the venue are for us to be used as well.
Find the **map of the surroundings on the next page**!

Map of Fuglesang Herregaard and surroundings



Walking route 1 km

Walking route 1,5 km

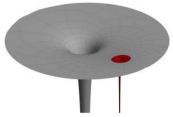
Walking routes 3,5 km or 4 km

Slot = “Castle” or the Fuglesang Herregaard, our venue

Kunstmuseum = Fuglesang Art Museum (free entry)

Gravitational Motion: The Two-body Problem

Self Force Theory



Waveform:

$$h = \sum_{l,m,k} \mathcal{A}_{lm} e^{ik\cdot\phi}$$

Phase:

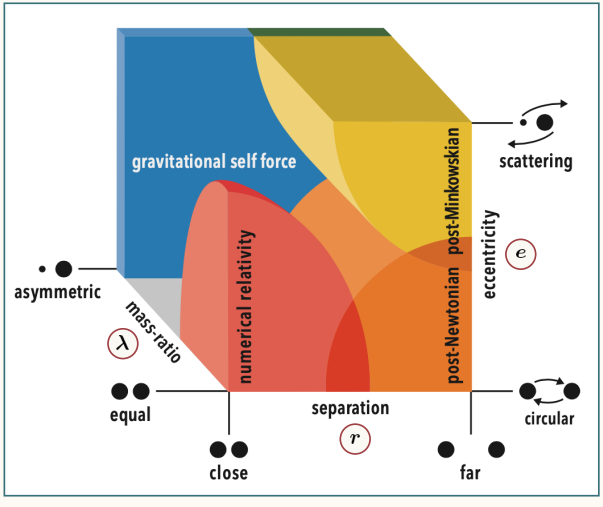
$$\phi = \frac{1}{\lambda}\phi + \phi_1 + \mathcal{O}(\lambda)$$

STATE OF THE ART

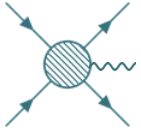
		Schw		Kerr		
		Circ	Gen	Circ	Eq	Gen
1GSF	Diss	✓	✓	✓	✓	✓
	Cons	✓	✓	✓	✓	✓
2GSF	Diss	✓	X	?	X	X
	Cons	X	X	X	X	X

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R = \frac{8\pi G}{c^4}T_{\mu\nu} \quad *$$

Methods: Non-pert. $\frac{m_1}{m_2} \ll 1$ $\frac{GM}{r} \ll 1$ $\frac{v^2}{c^2} \sim \frac{GM}{r}$



https://gwsky.org, Credit: Ana Carvalho



Effective Field Theory

$S \sim$ Einstein-Hilbert gravity

$$\int d^d x \frac{\sqrt{-g}R}{16\pi G}$$

$+$ Massive point particles

$$\sum_{i=1,2} \frac{m_i}{2} \int d\tau \, (1 + g_{\mu\nu}(x_i)\dot{x}_i^\mu \dot{x}_i^\nu)$$

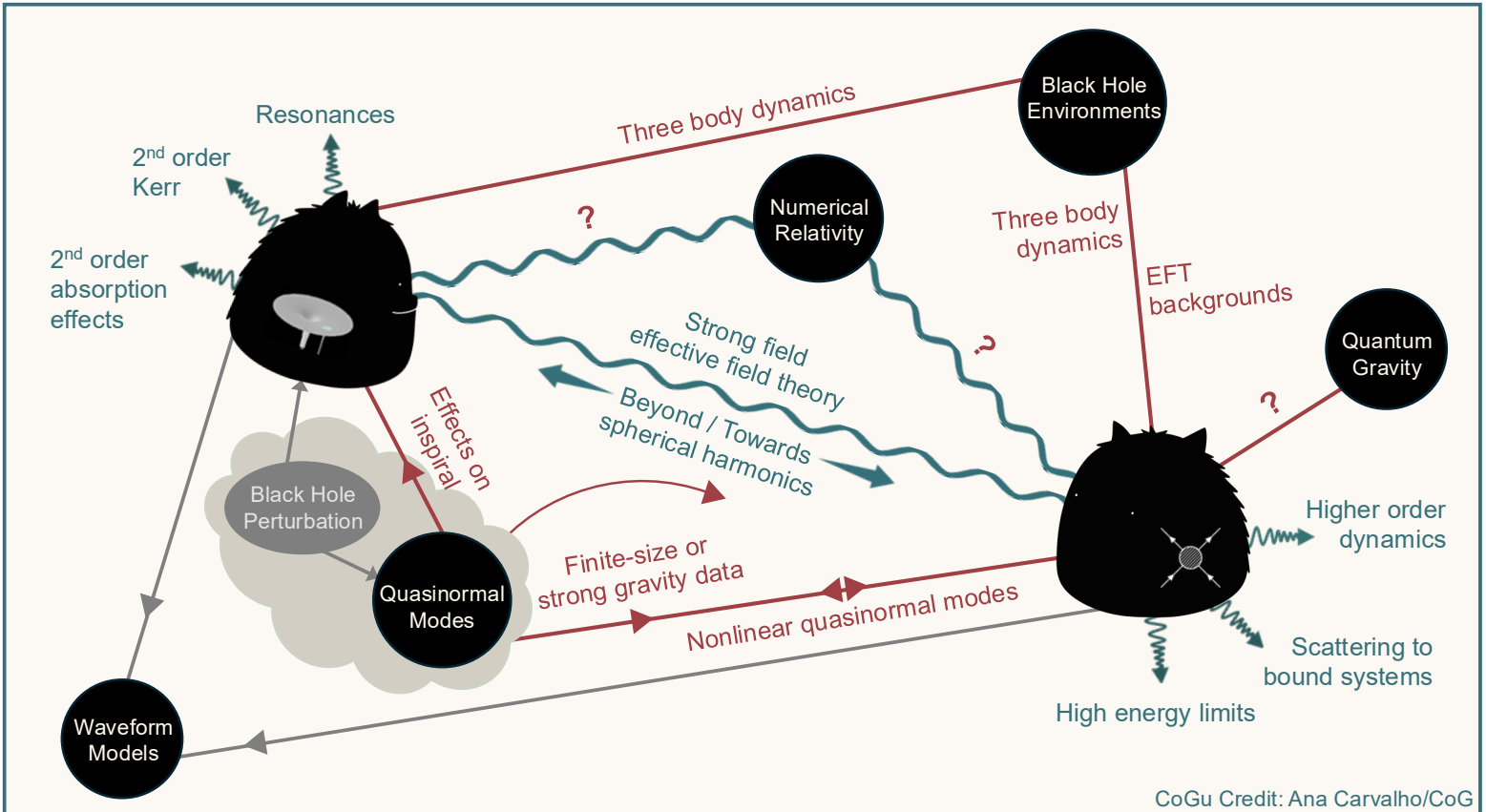
$+$ Effects from finite size and spin

Insert: $g_{\mu\nu} = \eta_{\mu\nu} + \sqrt{G}h_{\mu\nu}$, $x = v\tau + \delta x$



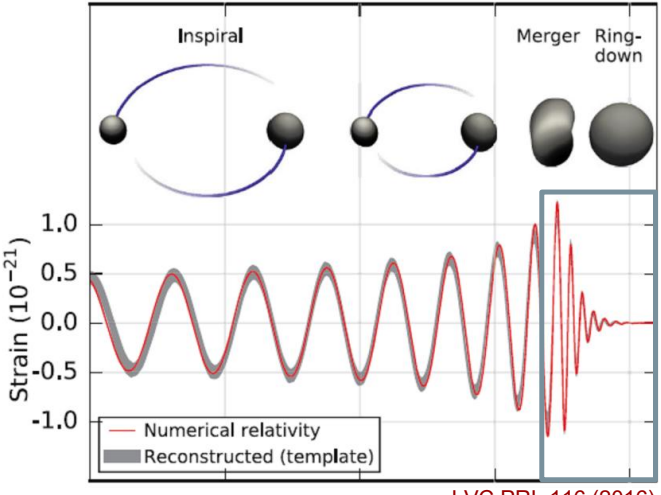
STATE OF THE ART

Order	No Spin	Spin
PM	4 (Complete)	...
PN	5 (Complete)	...


Resonances
2nd order Kerr
2nd order absorption effects
Three body dynamics
Black Hole Environments
?
Numerical Relativity
Three body dynamics
EFT backgrounds
Strong field effective field theory
Beyond / Towards spherical harmonics
Effects on inspiral
Quantum Gravity
?
Black Hole Perturbation
Quasinormal Modes
Finite-size or strong gravity data
Nonlinear quasinormal modes
Higher order dynamics
Scattering to bound systems
High energy limits
Waveform Models
CoGu Credit: Ana Carvalho/CoG

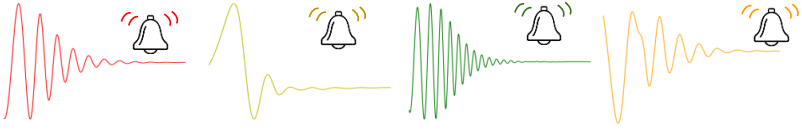
The Fascinating World of Spectroscopy

Rigorously test general relativity in the merger-ringdown phase.



LVC PRL 116 (2016)

A remnant black hole rings like a bell at different frequencies:

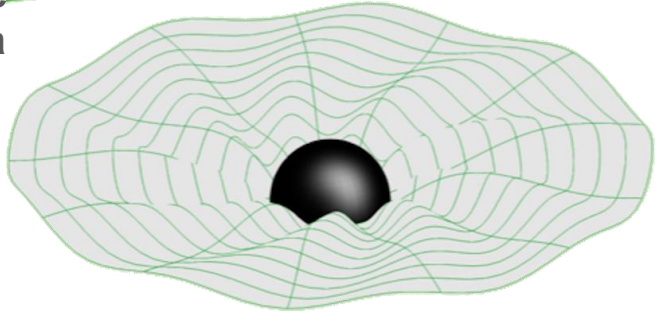


$$h^{RD}(u,\theta,\phi) = \sum_{\ell,m,n} \mathcal{A}^{\pm}_{\ell mn} e^{-i\omega^{\pm}_{\ell mn} t}\, {}_{-2}S_{\ell m}(\theta,\phi; a\omega^{\pm}_{\ell mn})$$

Black Hole Spectroscopy: $(M_f, \chi_f) \leftrightarrow \{\omega_{lmn}\}$

Previous and Current Research at CoG

- QNMs on hyperboloidal foliations: **Marica, Rodrigo**
- QNMs with Generalised Sasaki-Nakamura: **Rico, Leart, Yucheng**
- Modified Teukolsky with EFT corrections: **Simon**
- Nonlinearities from the Penrose limit: **Davide**
- Ringdown at the black hole horizon: **Ariadna**
- Nonlinear effects on the ringdown**: Taillte**
- GW Memory: **Jann, Lorena, Guangzi**
- QNMs amplitude fitting: **Lorena, Lucia**
- Ringdown waveform modelling: **Lorena**
- LISA Ringdown analysis: **Lorena, Simon**
- LVK Ringdown with pyRing: **Giada, Simon**
- Ringdown waveform model systematics: **Giada**

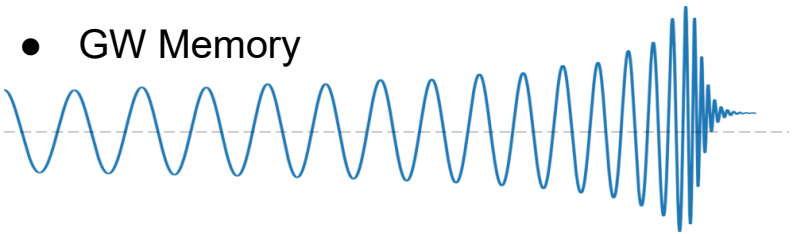


Nearly all of the above and many other things: **Vitor**

Current state-of-the-art and potential connections

Some examples of active topics

- Nonlinearities
- Prompt response
- Green's function analysis
- Environmental effects
- Effects beyond GR
- GW Memory



Connections across CoG

- Astrophysical environments
- Triple systems of black holes
- BHPT / PM for scattering orbits
- Memory and BMS symmetries
- Study black holes beyond GR
- Scenarios to test vacuum GR



What is going on in Quantum Black Holes

should gravity be quantized?

strong theoretical motivations

- coupling to quantum matter
- black hole/cosmology singularity
- black hole entropy & information paradox
- cosmological constant problem...

  ... ...

(indirect) observational evidence of quantum effects in gravity?

a quantum gravity for quantum black holes?

an interrelated CoG perspective & whom you can talk to...

---

start with General Relativity, control higher-derivative quantum corrections

- asymptotic safety: UV fixed points? — Alessia, Francesca, Francesco F
- Lorentz violation: Hořava-Lifshitz BH — Francesco DP

Jury, Ziqi

semi-classical black holes, braneworlds — Andy, Niels, Nikesh

- area law & counting of BH microstates? — Troels, Vita

gravity emergent from quantum mechanics — Emil (Oxford)

- gravity on AdS, dS, flat space...

beyond perturbative string theory...

vision of future & possible bridges

1. braneworlds : gravitational waves leaking in extra dim.; cosmology?

2. quasi-normal mode, superradiance, numerical GR for quantum-corrected BHs?

   higher-derivative, low-/higher-dim., supersymmetric, non-rel. ...

3. how higher quasi-normal modes probe BH interior/singularity?

4. Carrollian expansion around BH singularity / horizon

5. functional renormalization group for post-Newtonian/Minkowski expansions

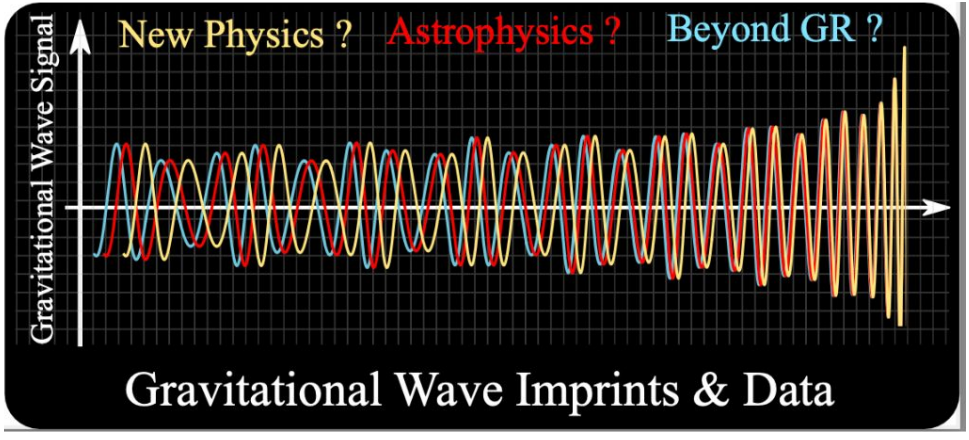
6. covariantization of post-Newtonian: Newton-Cartan formalism

7. Compton amplitudes from black hole mergers & quantum membrane

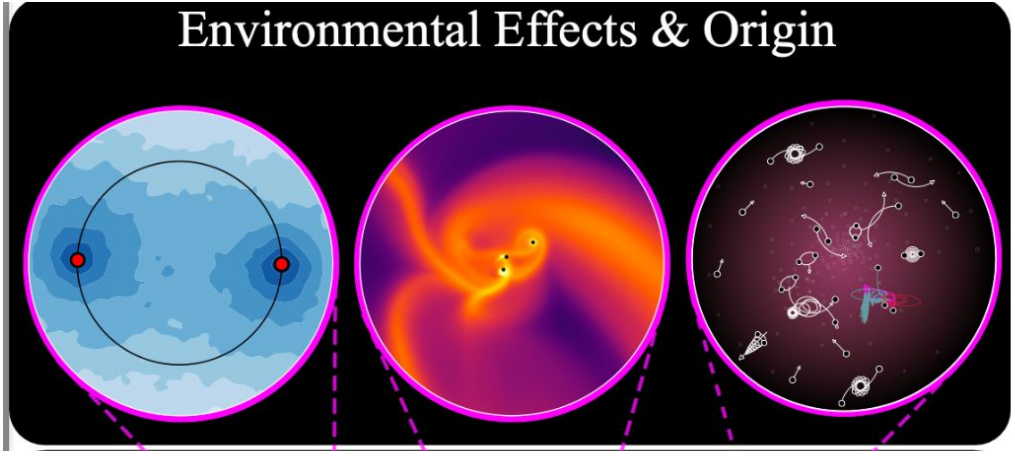
8. gravitational waves: BMS symmetry, flat space holography & higher-dim.

   .....

Whats going on in Environments?



Whats going on in Environments?

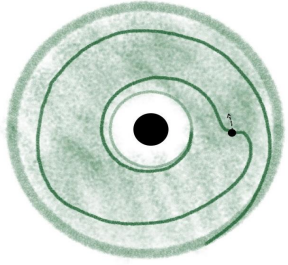




Whats going on in Environments?

Extreme Mass Ratio Inspirals

Conor, Lorenz, Maarten, Simon, Vitor



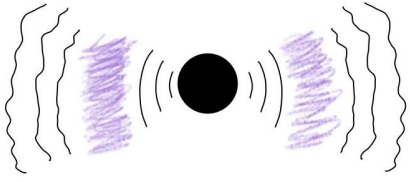
Embedded BH Binaries

Conor, Brian, Johan, Lorenz, Pankaj



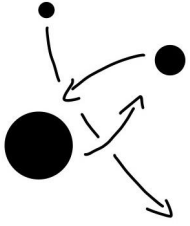
Ringdown

Giada, Taillte, Vitor

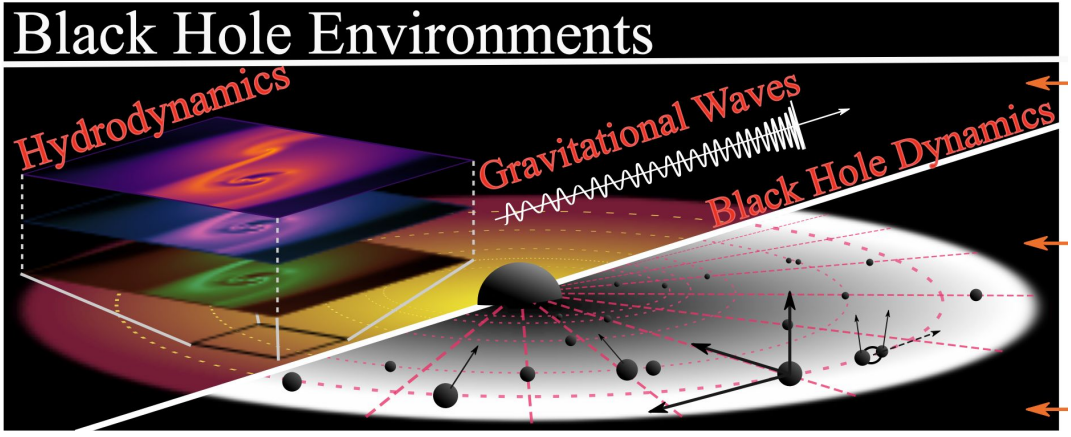


Triple Systems

Brian, Davide, Elisa, Johan, Luka, Marta, Marta, Pankaj, Troels

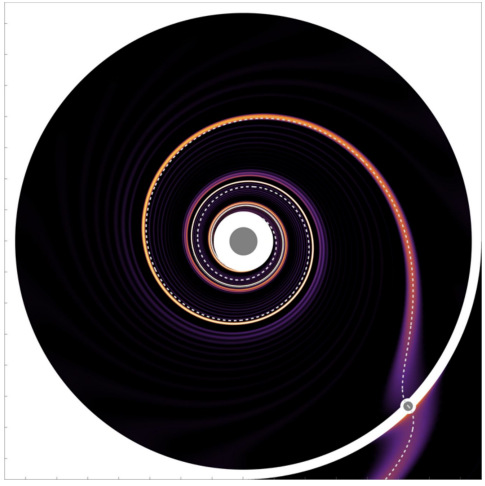


Progress at CoG: Embedded BBHs

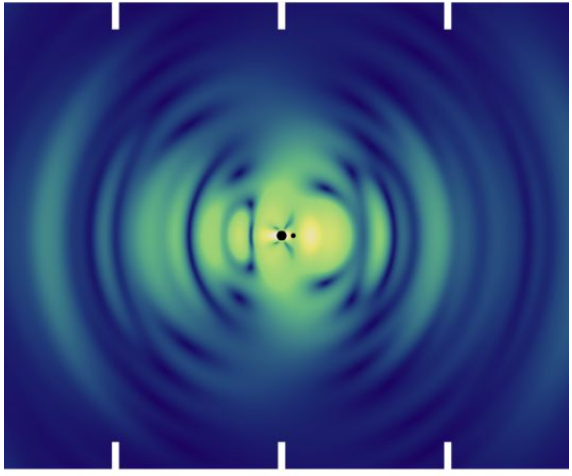


[Caneva Santoro, Samsing, Zwick]

Progress at CoG: EMRIs

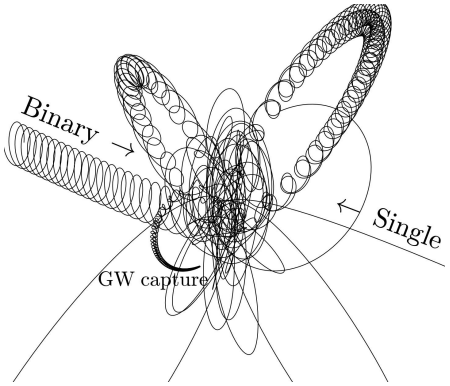


[Dyson & D'Orazio]

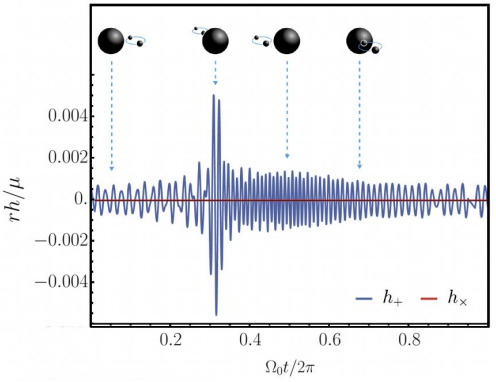


[Dyson, Spieksma, van de meent, , et al]

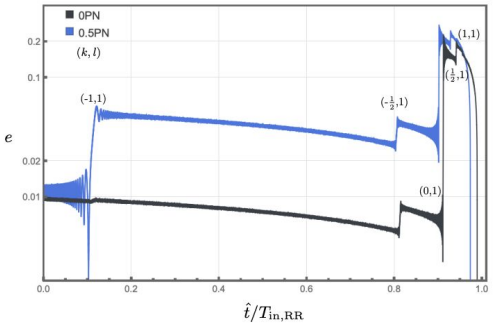
Progress at CoG: Triples



[Samsing]

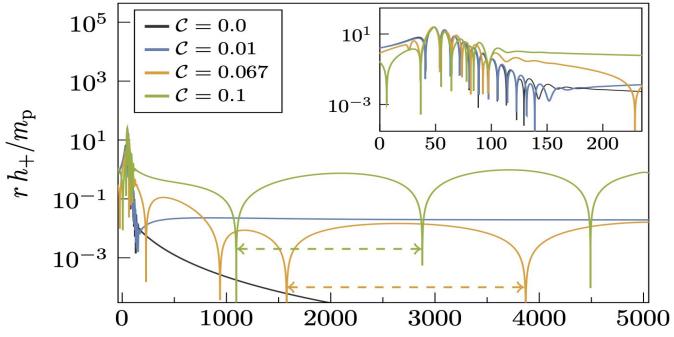


[Cardoso,Santos, van de Meent, Vujeva]

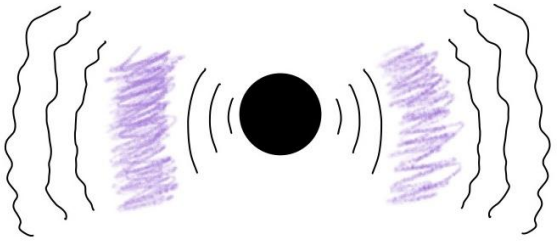


[Cocco, Harmark, Orselli, Panella]

Progress at CoG: Ringdown



[Speiksma, Cardoso, et al]

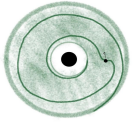


[Caneva Santoro, May, Cardoso]

Synergies



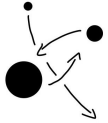
Ringdown



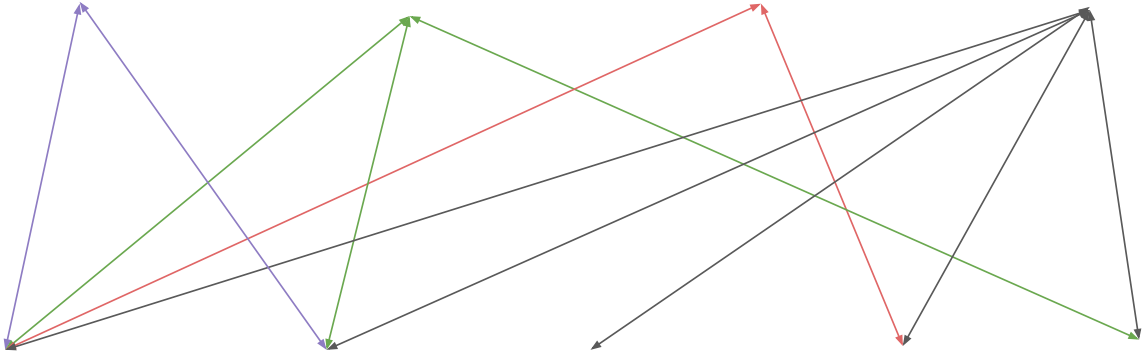
EMRIs



Massive BBHs



Triples



Non-linear Matter Sims

(collaboration with NBIA)

Self-Force

N-body Sims

PM/PN

Lensing

[Solar eclipse 1963, Illinois, photo by Francis Miller]


KLEENEX 200s
KLEENEX TISSUES
BORDWARE
CORN FLAKES
KLEENEX TISSUES
KLEENEX 200s
KLEENEX TISSUES
KLEENEX 200s
KLEENEX TISSUES
KLEENEX TISSUES
KLEENEX TISSUES

Why we do it?

Troels & Jose

On the “grand scale”:

Science part of our human culture

Age-old questions: Why are we here? How did we get here? How do things work? What are things made of?

Important to nurture this latent interest in the public



Why we do it?

Troels & Jose

On the “intermediate scale”:

Future funding, future students

Public money for research

On the “short scale”:

Advertise CoG and ourselves

Develop as scientists



Why we do it?

Troels & Jose

Now:

Discuss in your table + write main ideas in post-its [10 mins]

Bring your post-its forward + discussion [10 mins]



Each table discusses either

Why good for society? (black, green, yellow, white)

or

Why good for us? (red, blue, purple)

How we do it?

Troels & **Jose**





How we do it?

Troels & **Jose**

Now:

Discuss in your table + write main ideas in post-its [10 mins]

Bring your post-its forward + discussion [10 mins]

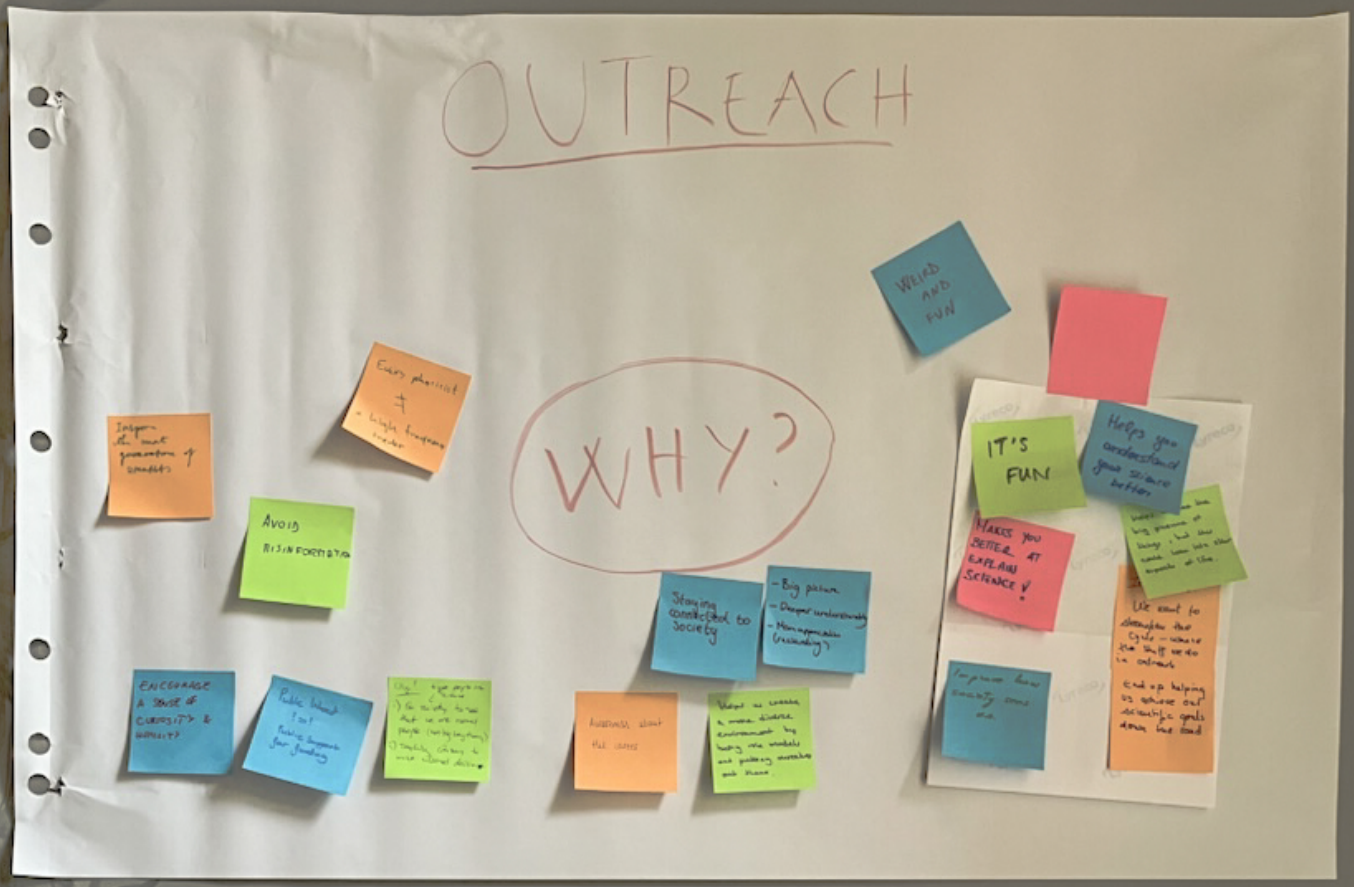


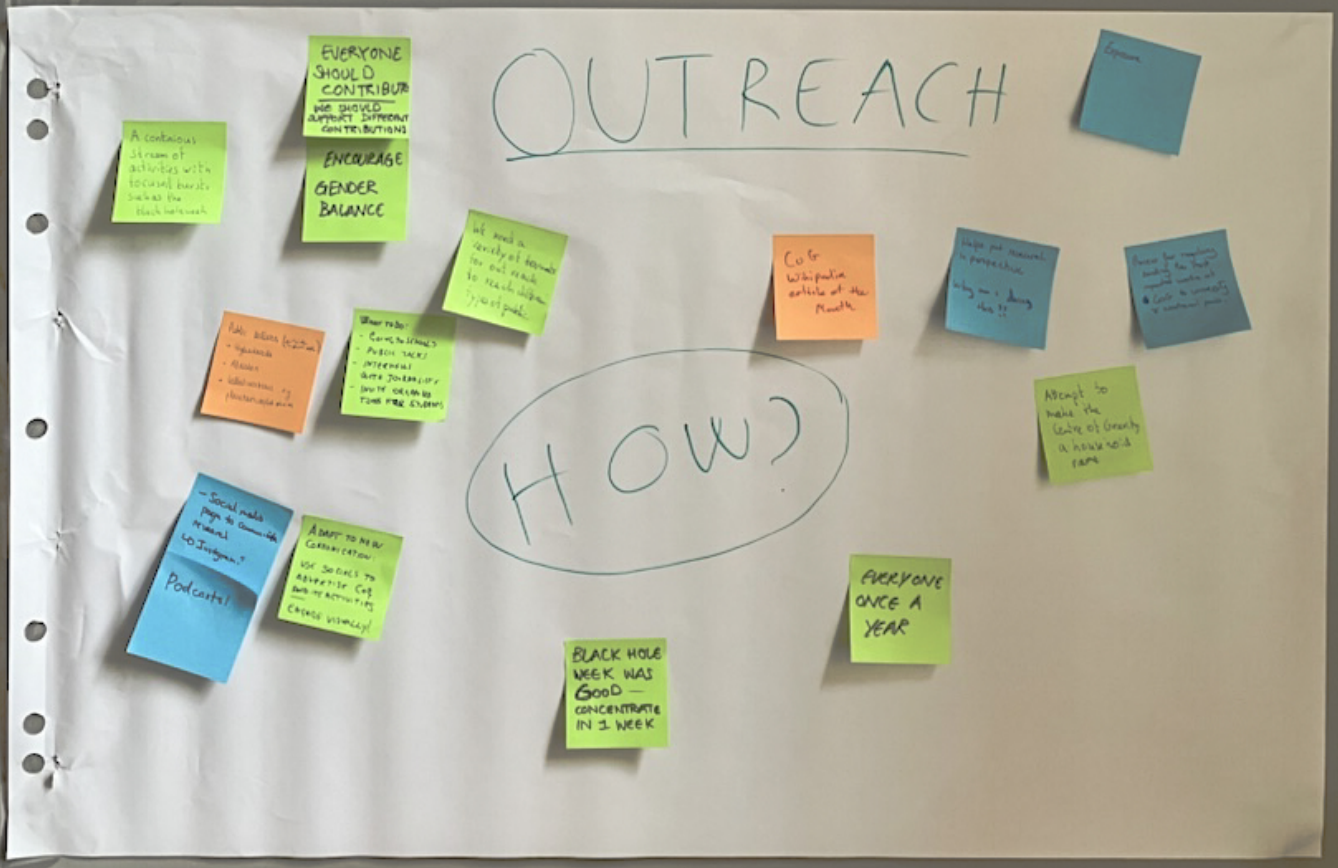
All tables discuss:

How to best organize outreach at CoG?

What outreach activities can we do?

How many should we do?


OUTREACH
WHY?
WEIRD AND FUN
IT'S FUN
Helps you understand your science better
MAKES YOU BETTER AT EXPLAIN SCIENCE!
Staying connected to society
- Big picture
- Deeper understanding
- Non-appreciation (reasoning)
Every physicist
AVOID
ENCOURAGE A SENSE OF CURIOSITY & WONDER
Public behind
Public support for funding


OUTREACH
HOW?
EVERYONE SHOULD CONTRIBUTE
WE SHOULD SUPPORT DIFFERENT CONTRIBUTIONS
ENCOURAGE GENDER BALANCE
A continuous stream of activities with focused bursts such as the black hole week
CoG Whipsalia article of the Month
Podcasts!
ADAPT TO NEW COMMUNICATION
USE SOCIALS TO ADVERTISE CoG AND ITS ACTIVITIES
CHANGE VISUALLY!
EVERYONE ONCE A YEAR
BLACK HOLE WEEK WAS GOOD — CONCENTRATE IN 1 WEEK

CoG Seminars and Meetings

Tuesdays at 12:15 (with lunch!)

Meetings

(Hb1 – Sep 15, Sep 29, etc.)

- Internal speaker
- Rotation amongst researchers
- Present ongoing work and new ideas

- Aim to connect our research groups
- Format to encourage discussion
- Learn from and inspire each other

- Starting with new members of the CoG
- Volunteers to present always welcome

Seminars

(Auditorium A – Sep 22, Oct 6, etc.)

- External speaker
- Suggested by groups
- Supported by local host

- Subjects from across the CoG
- Pedagogical introduction
- Accessible discussion

- Suggestions for Spring 2027 are welcome
- Excellent speakers with interesting topics

In coordination with the Center of Gravity Colloquia (cf. Giada's presentation).

Practical organisation

Meetings

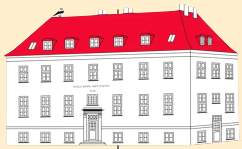
1. Make lunch arrangements (divided in teams)
2. Allow new members to present
3. Encourage volunteers
4. Ensure a diversity of topics
5. Send out reminders with subject
6. Set the speaker up for the meeting
7. Introduce the speaker very briefly
8. Follow-up on new exciting ideas

Seminars

1. Invite speaker in close coordination with host
2. Follow-up with details once confirmed
3. Get travel dates – update spreadsheet
4. Update various calendars and websites
5. Ready the visiting researcher agreement (TBC)
6. Send seminar announcements by email
7. Set speaker up for their seminar
8. Check speaker dinner organization

Looking for volunteers from all groups to join the organisation!

The CoG Colloquia



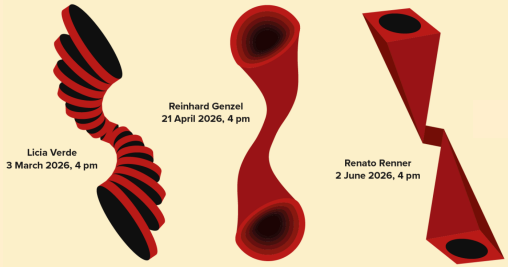
WHEN & WHERE
Tuesdays · 4 PM - Auditorium A

THE SCIENCE
High-profile speakers
Topics spanning all areas of gravity

THE EXPERIENCE
Reception after every colloquium

The past

Very successful first edition led by Jann Zosso.



The future



+ Barry Barish and Claudia de Rham in 2027, and more TBC.

ORGANIZING A COLLOQUIUM

1. Collect speaker suggestions + get board approval.
2. Contact the speaker and put them in contact with Fanny for practical arrangements.
3. Communicate with Ana Carvalho for posters/webpage.
4. On the day:
   - Welcome the speaker.
   - Make sure technical setup is working.
   - Keep everything running smoothly.









CoG PhD Days

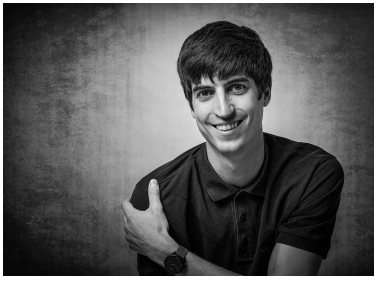
- Students present their projects (status seminar)
- Feedback
- Soft skills (networking, job applications)
- Organized by the students (**need volunteers**!)
- Team building
- 14-15 January 2027?

CoG Breakfast

- Hvornår: Wednesday, 8:45-9:15. Weekly gathering.
- Hvor: CoG Lounge
- Hvad: Brød med ost (but open to suggestions!)
- Hvordan: Take bread from Sinne Gas Bageri
- Hvorfor: Because we have a lot of fun (and we're hungry)



CoG Breakfast







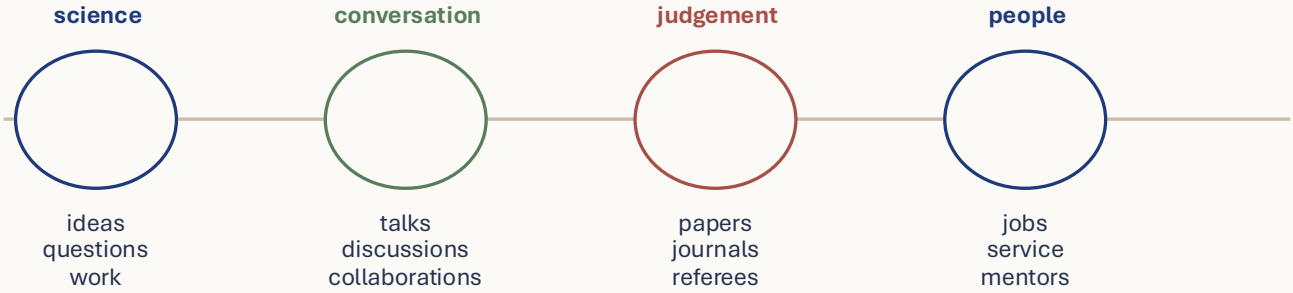


- Hvem: Originally Jaime, Lucia, Josè, me.
  Now Josè and me. Need help to keep it alive!

Navigating academia

Some things you can influence

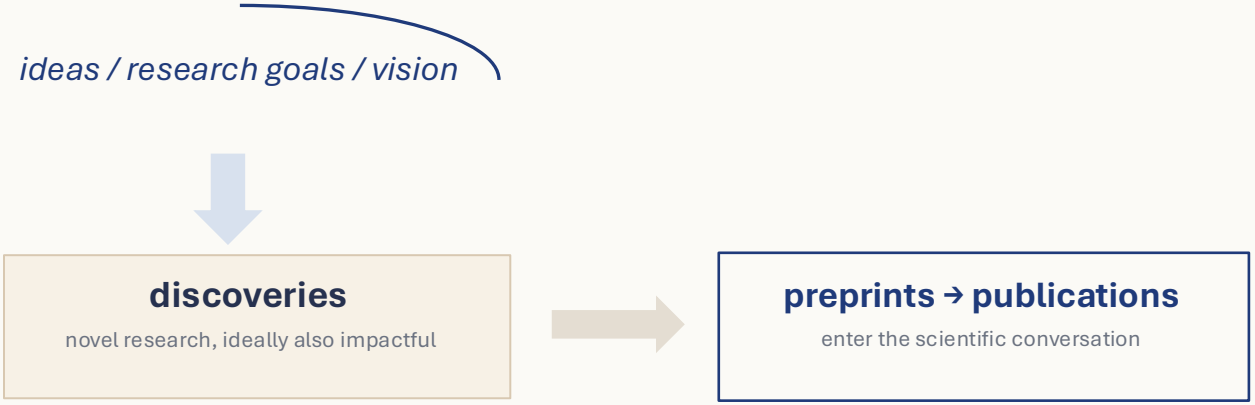
THE CENTER OF GRAVITY



No recipe; only a useful question:

What can I do well that improves the science and its chances?

Do good science — and let it travel



Visibility is not a substitute for content.

But good work does not automatically become known.

Aim for talks when there is something real to say; prepare them carefully.

Make deliberate choices — and do not do it alone

jobs

Keep applications, CV and opportunities alive before a deadline becomes urgent.

journals

Choose strategically: high enough, relevant enough, and worth the time.

Treat referee reports as a professional exchange, even when you disagree.

MENTORING

Do not leave career conversations to chance.

Schedule time to talk about direction — not only today's calculation. Seek more than one perspective.

Academic life is partly luck. Focus on what you can influence: quality · preparation · communication · judgement · generosity

What else matters?

Backup slide: a few points I kept in reserve

1. **Choose collaborators well**
   Scientific strength matters, but so do reliability, generosity, and whether the collaboration is a good place to do science.

2. **Learn to say no**
   Some invitations are useful; some are simply distractions. Time and attention are finite resources.

3. **Build independence**
   At some point, it helps to become recognizable for your own questions, direction, method, or viewpoint.

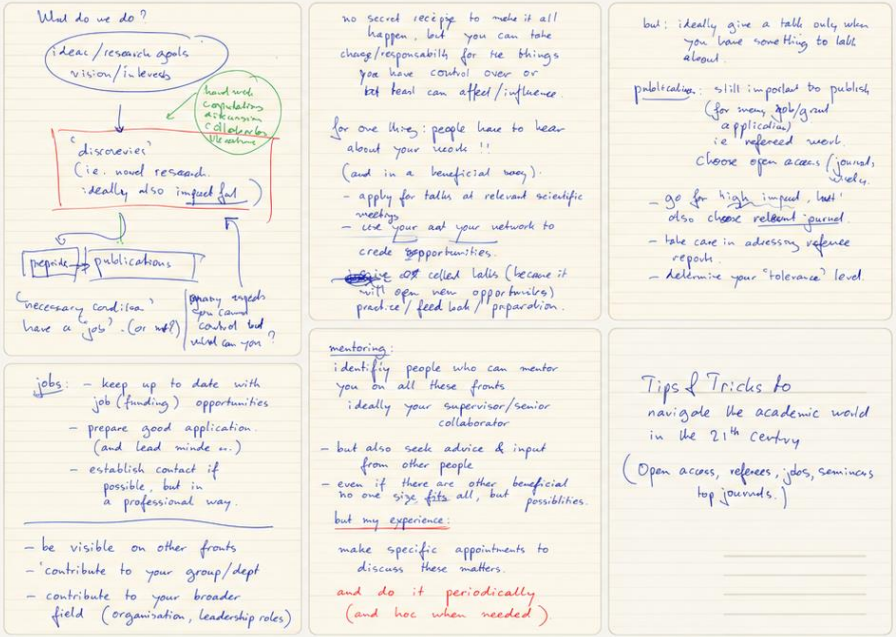
4. **Protect your reputation**
   Be serious, fair, reliable, constructive, and generous. These things last longer than individual outcomes.

5. **Adapt to the world with AI**
   Use it thoughtfully as part of the changing academic environment, without outsourcing judgement, originality, or responsibility.

The aim is not to optimize a career mechanically, but to create better conditions for good science.

Where it started

Backup slide: the original brainstorm behind this talk



- The initial brainstorm already contained the basic idea, structure, and emphasis.
- AI helped compress and shape it into slides.
- That is why it still felt like my presentation.

A quick brainstorm can already contain the structure of a talk.

What the audience added

The discussion produced a useful complement to the points in the talk. The post-it notes did not suggest a radically different picture; rather, they made several practical and human dimensions of academic life much more explicit.

Develop your own scientific identity

- Make your vision.
- Understand your strengths.
- Reflect on your own path from time to time, rather than only responding to the next immediate demand.

Learn the craft of research

- Research requires many skills.
- Learn how to read papers critically and how to write papers that people can actually learn from.
- Learn the craft of refereeing: how to approach a paper review fairly and constructively.
- Give grant writing enough time; learn where to apply, how projects are framed, and how funding systems work.
- Read the guidelines. Practical knowledge of the rules matters.

Build a professional community

- Networking matters.
- Teaching, outreach and grant applications are part of the broader academic skill set.
- Supervising students is itself something to learn: how, when and why to intervene.
- Clear communication of expectations is important in collaborations and supervision.

Learn to navigate academia

- Take advice seriously — much of the time there is at least some truth in it — while retaining your own judgement.
- Learn to deal thoughtfully with difficult people and situations.
- Learn to say no. A sustainable career cannot consist only of accumulating commitments.

Accept imperfection and failure

- Writing papers and giving talks can be daunting; experience matters.
- Accept that the result will not always be perfect.
- Learning through failure is part of becoming a researcher.

Protect the person behind the researcher

- Separate professional life from personal life where possible.
- Feedback on your work is not criticism of you as a person.
- Maintain boundaries between the job and the rest of life.

And keep enjoying it

- 'Having fun' was singled out as important.
- 'Keep enjoying your job' appeared independently and perhaps deserves to be taken as seriously as the more strategic advice.

Keep some perspective on the journey

One participant answered not with career advice, but with a quotation from Townes Van Zandt's Snowin' on Raton:

“When the wind don’t blow in Amarillo
And the moon along the Gunnison don’t rise
Shall I cast my dreams upon your love, babe
And lie beneath the laughter of your eyes?”

Perhaps a poetic reminder that an academic career is also a life. Careers involve roads taken, people encountered, places left behind, uncertainty, and things we cannot control. Not everything needs to be optimized. It is worth occasionally reflecting on the journey itself—and remembering the people, places and experiences that give it meaning.

Note: This final section is a synthesis of the audience post-it notes collected after the talk; it is deliberately kept distinct from the speaker's original advice.

Projects

Why all should apply?



Discussion: why all should apply?

- Why is it good for you?
- Why is it good for the center?
- Why is it good for science?

(10 minutes)

Where to apply?

In Denmark:

- DFF
  - International Postdoctoral Grant
  - Sapere Aude
  - Project1 and Project2
- Villum
  - (Young/Ascending) Investigator
  - Synergy?
  - International Postdoc
- Carlsberg
  - Semper Ardens Adv/Acc/Accom
  - Internationalisation Fellowship

International:

- EU
  - MSCA Indiv. Fellowship
  - ERC
- Local Funders, e.g.
  - DFG in Germany
  - NWO in Netherlands
  - IRC in Ireland

What (else) to apply for?

Funding for:

- Research Infrastructure
- Science communication
- Outreach
- Conferences/Workshops

How to do it

- **Read instructions/guidelines carefully**

  Format, fonts, size are very important:
  → if your application has the wrong format, it may be rejected right away without even going into the reviewing process
  → Format, fonts, size, regulations vary a lot across different grants
  Regulations also give details on what is needed, including in the application platform
  → if you do not know about that and you submit last minute, you risk having to write something extra in a rush because you were not aware of it
  Read evaluation criteria too, they can be useful in the writing process, they vary across grants/funders

- **A few key points**

  Tell a story – and make it exciting! why it is important, how it is connect to and advance current literature (gaps and how you fill them)
  Make it believable/concrete: proposal should be exciting and ambitious, but feasible!
  Support with clear implementation, plan/timeline, method description and risk assessment/mitigation
  Outline expected outcome, why you are the right person (mention earlier work, CV is also there for that)
  ***Much more*: really good material on kunet**, search for it!

- **Format, format, format**

  Do not write a plain block of text without spaces: no referee will like that, even if the content is good, *make it visually appealing*
  Referees are busy!!! Make their life easier in highlighting the key/important points, use clear structure
  Clean writing: no long sentences, highlight key info, make it easy to read, no jargon!

Timing

- **START EARLY: everything takes more time than you think**

  Marie-Curie/similar postdoctoral fellowships: ideally start thinking ~3-4 months in advance
  ERC/similar group leader grants: ideally start thinking ~6 months in advance

  → have a draft several months in advance, then pause, get feedback, then go through it again!

  → for some fellowships/grants (especially in prestigious institutes), there is a **competitive pre-selection process**, you may need to get in touch with university/institute many months before the deadline

- **Significant time from submission to award!**
  (6-10 months → have plan B, C, and D)

- **Usually very competitive, you may need to try several times**:
  getting a grant is an endurance game!

Feedback

- **Not everyone in a grant committee will be in your field**

  ⇒ very different viewpoints!
  ⇒ sometimes, even within competing fields

- **Very useful to ask for feedback very well in advance and to as many as possible**,

  ⇒ ideally: ≥2 from your sub-field, ≥2 from your broader field, ≥2 from outside of your field

  (especially for competitive grants like Marie Curie and ERC)

- **Structure at NBI/KU**:

  Very good feedback system, ask science people:

  Frederiksberg+ Campus – grant feedback:
  Christen Artagnan Sørensen (cas@adm.ku.dk)
  Casper Tai Christiansen (ctc@adm.ku.dk)
  General email: forskningsfinansiering-noerre@adm.ku.dk

Q&A