Joint CHIPP/CHAPS meeting on Gravitational Waves

Steven Schramm

December 1, 2021

Setting the stage

A reminder, from last year's CHIPP/CHAPS joint meeting (I was not present at the time)

Charge of the Working Group

- Long term: Ascertain long term interest in grav waves research in both communities
- Short term: contribution to the roadmaps
- Bigger picture: Other areas of common interest ?
  - CTA

Composition:

- CHIPP Members: Adrian Biland, Peppe Iacobucci (represented today by Federico Sanchez), Michele Maggiore
- CHAPS Members: Philipp Jetzer, Stephano Paltani, Alexandre Refregier

15.10.2020 CHIPP Board 03 6

Gravitational Waves

Collaboration between communities possible on:

- The scientific quest
  - Multi-messenger astrophysics / astro particle physics
- Instrumentation
  - Electronics, cryogenics, optics, data acquisition …
- Computing
- Ground based, space based , both ?

15.10.2020 CHIPP Board 03 7

Short-term goal achieved: possibility for collaboration mentioned in both roadmaps

Revisiting the long-term goals

- Stated long-term objectives:
  - Ascertain long term interest in grav waves research in both communities
  - Bigger picture: other areas of common interest?
  - Collaboration between communities (scientific, instrumentation, computing)
- A year later, it's worth revisiting these objectives and identifying next steps

- Many recent developments relating to the Einstein Telescope at UniGe
  - This was our original motivation to request a follow-up CHIPP/CHAPS meeting
- However, very curious to understand how the situation has evolved elsewhere
  - Also would be very useful to hear about status of other related activities (LISA or otherwise)

- To get started, next slide is brief overview of the UniGe inter-departmental effort

Cross-departmental activities at the University of Geneva

Growing interest and effort in Gravitational Wave physics at UniGe
- In particular, recent ESFRI approval of Einstein Telescope has galvanised activity across departments
- Proposed creation of a "Center for Gravitational-Wave Science" to the Faculty of Science, proponents listed below

Georges Meynet, full professor
Department of astronomy
- Stellar computational astrophysics
- Modelling of massive star evolution
- Head of UniGe Stellar Evolution group
- Considering Einstein Telescope activity

Anastasios Fragkos, assistant professor
Department of astronomy
- Theoretical/computational astrophysics
- Research on compact object formation
- Leading UniGe participation in Einstein Telescope INFRA-DEV proposal, WP8

Federico Sanchez, full professor
Department of particle & nuclear physics
- Accelerator-based neutrino physics
- T2k international spokesperson
- Director of the UniGe DPNC
- Considering Einstein Telescope activity

Steven Schramm, assistant professor
Department of particle & nuclear physics
- High-energy collider physics
- ATLAS Collaboration member
- Leading UniGe participation in Einstein Telescope INFRA-TECH proposal, WP5

Michele Maggiore, full professor
Department of theoretical physics
- Gravitational wave physics
- Chair of the Einstein Telescope Observational Science Board (OSB)
- Member of ET Steering Committee

Antonio Riotto, full professor
Department of theoretical physics
- Cosmology and astroparticle physics
- Director of the UniGe DPT
- Convener of Einstein Telescope OSB Division 3: Population Studies

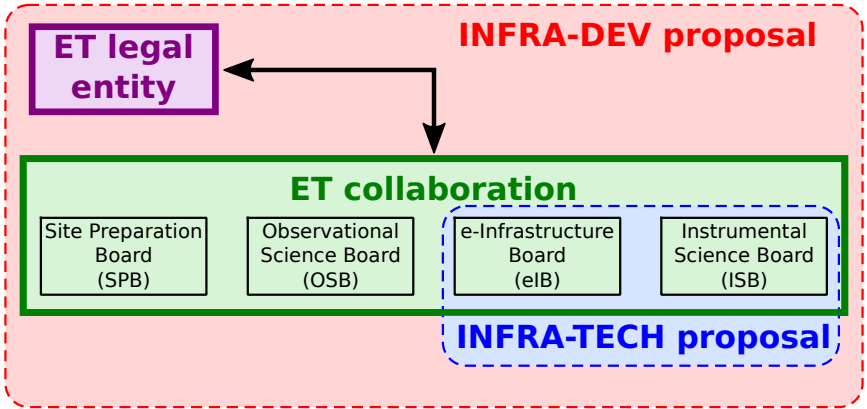
Einstein Telescope status

- A lot has changed for ET in the past year, including becoming an ESFRI project in June
- With ESFRI status, ET has entered the next stage
  - Many large-scale efforts and kickoffs have occurred
  - The legal entity and collaboration structure are being prepared
  - Two large ESFRI-related funding proposals are underway
- It is important for Switzerland to discuss the extent to which it wishes to be part of ET

- I will start with an overview of the ongoing ET activities
  - I'll follow this with the current UniGe perspective on each individual ET activity
  - Would be very useful to hear also from other Swiss groups on their plans

ET activities overview

- ET collaboration has four "boards" defining primary work areas, ramping-up activities
  - OSB kickoff Sept 21 – 22 (link), eIB kickoff Nov 30 – Dec 1 (link)
- Additionally, two ongoing EU INFRA-* proposals are underway
- Brief overviews of most of these in next slides, plus UniGe planned involvement



ET legal entity

- Involves project directorate, coordinators, and funding agencies
- Specific aspects for our involvement:
  - Board of Scientific Representatives (BSR): Anastasios is serving as the Swiss representative
  - Board of Governmental Representatives (BGR): Currently no Swiss representative
    - Normally a ministerial staff member, probably someone from SERI in our case
    - It is expected that we do not yet have a representative as not yet heavily involved in ET project
    - Potentially SERI delegates a representative via CHIPP/CHAPS in the interim?

- Something we should discuss as INFRA-DEV and INFRA-TECH proposals move forward: both foresee SERI participation due to current EU association status (more on this later)

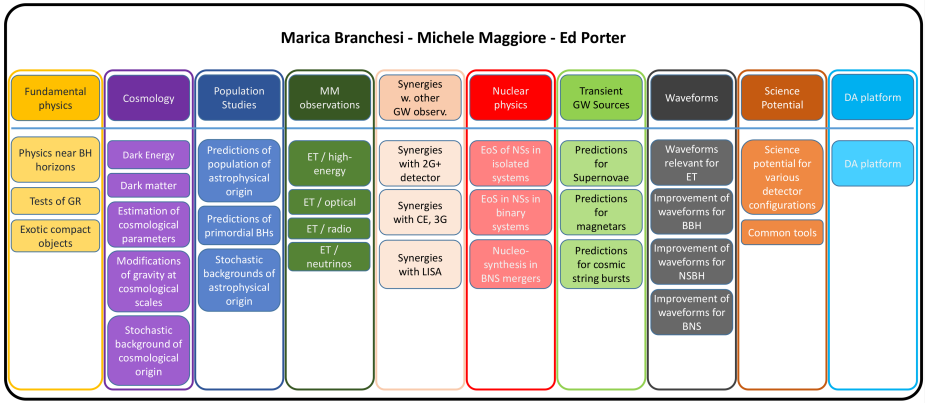
ET site preparation board (SPB)

- Involved in deciding the site of ET, two full candidates
  - One in Italy (Sardinia), one on Belgian/Dutch/German border (Maastricht)
- Other candidate(s) under discussion, but only preliminary

- This board is likely to be heavily dominated by the candidate countries
  - Don't currently foresee any significant contribution of Switzerland to this board

ET observational science board (OSB)

OSB: Observation Science Board



Involvement in ET OSB

- University of Geneva:
  - Michele Maggiore is one of the OSB chairs
  - Antonio Riotto is one of the conveners of Division 3 (population studies)
  - Anastasios and Steven are OSB members and are participating in initial activities
- Other foreseen Swiss involvement?

ET e-infrastructure board (eIB)

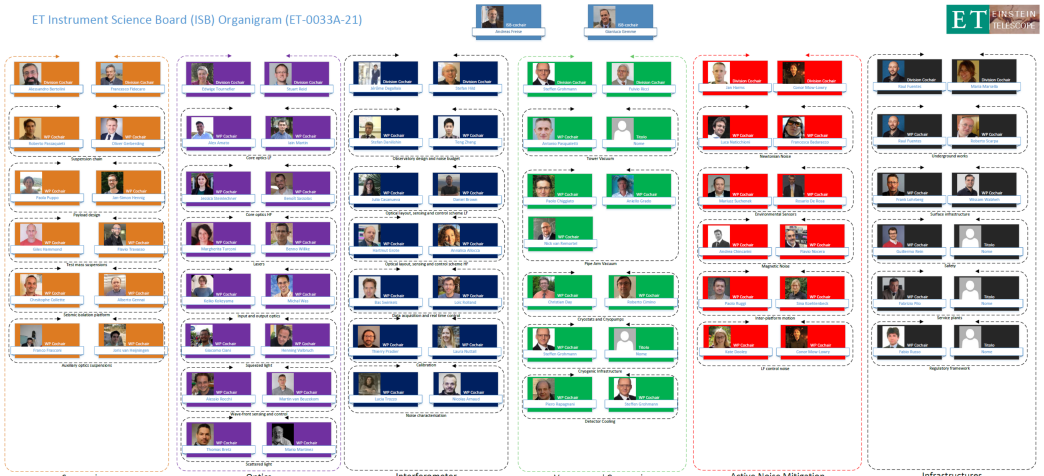
- Structure is still evolving, six domains discussed in last week's eIB meeting
  - Software and frameworks, data challenges
  - Services and collaboration support
  - Computing and data model
  - Multi-messenger alerts and low-latency infrastructure
  - Resource estimates
  - Technology tracking, HW and SW

- The eIB kickoff was yesterday afternoon and this morning
  - Anastasios joined in person, Steven joined remotely
  - This is the reason Anastasios cannot join us today, he is travelling back from the kickoff
  - He sends his apologies and will catch up on the discussion later

Involvement in ET eIB

- University of Geneva:
  - Planned joint involvement of the astronomy and particle physics departments
  - Experience in a variety of different domains of relevance to eIB activities
  - Working to identify exact area of involvement, now that kickoff has taken place
- Other foreseen Swiss involvement?

ET instrumental science board (ISB)



Involvement in ET ISB

- University of Geneva:
  - No involvement yet, but potential interest from particle physics department
  - Still need to better understand exactly what is useful/needed
- Other foreseen Swiss involvement?

ET INFRA-DEV proposal

- As a new ESFRI project, ET is submitting an INFRA-DEV proposal [structure below]
  - ∼3M euro over four years, 11 countries participating, primarily for legal and policy aspects
  - Timeline is very tight, deadline is January 20, 2022
  - Switzerland treated as non-associated third-country, participation supported by SERI

WP1 Coordination and Management

WP2 Organization, Governance and Legal Aspects

WP3 Financial Architecture

WP4 Site Selection

WP5 Project Office

WP6 Technical Design

WP7 Transfer of Technology

WP8 Computing and Data Access

WP9 Sustainable Development Strategy

WP10 Education, Outreach and Citizen Engagement

Involvement in ET INFRA-DEV

- University of Geneva:
  - Anastasios is leading UniGe and Swiss involvement in this proposal
    - Decision that INFRA-DEV has one institute per country, which should represent the country
  - Participating in WP8: Computing and Data Access, especially "computing and data model"

T8.1 T0 data center

Conceptual design of the center in close collaboration with the instrument science board. Definition of the services provided by the center, delimitation against services realized with distributed computing.

T8.2 Computing and Data Model

Development of the computing and data model in close cooperation with the instrument science board and observational science board of ET. Definition of the workflow from the instrument to the publication.

T8.3 Resources

Estimate of the computing resources (computing power and data storage), the personnel, and the operational cost required for all aspects of ET computing. The potential for mitigation must be addressed.

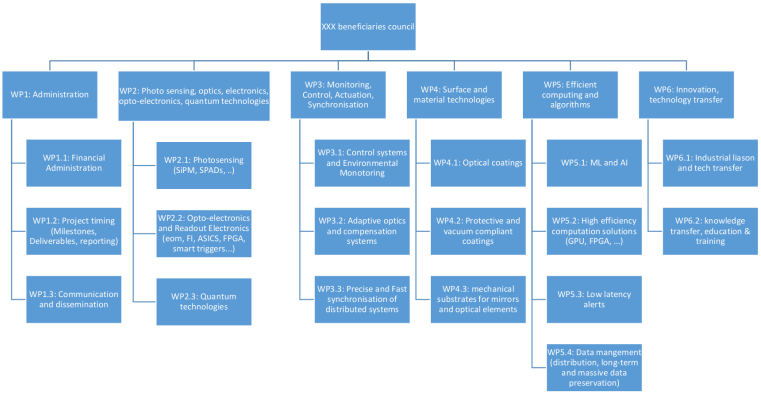
T8.4 Data Access Implementation

Guidelines for the data policy compliance, relevant to the data storage, access, process and distribution, on all relevant time scales, respecting the EU policies on open data.

- Other foreseen Swiss involvement?

ET INFRA-TECH proposal

- ET will participate in an INFRA-TECH proposal; requires 3+ research infrastructures
  - Proposal joint between ET and CTA, multiple options for 3^{rd} RI under discussion
- ∼10M euro, for enabling key European research infrastructure technologies
  - Timeline is a bit later (due April 20, 2022) and thus effort still getting started
  - Switzerland treated as non-associated third-country, participation supported by SERI



Involvement in ET INFRA-TECH

- University of Geneva:
  - Steven will be leading UniGe involvement in the ET part of this proposal
  - Plan to participate in at least WP5: efficiency computing and algorithms
  - May also contribute to other domains, discussions still underway
  - UniGe is also involved in the INFRA-TECH from the CTA side
- Other foreseen Swiss involvement?

Beyond ET

- The past slides focused on ET, as that is where we have been very active lately
- Our hope today is to learn more about what is going on in other groups and domains
  - In particular, would be great to hear how Swiss participation in LISA is progressing

Future of the CHIPP/CHAPS joint working group

- From the Geneva side, a lot has happened in the past year
  - ET has attained ESFRI status, which started a lot of activity
  - Active efforts in ET OSB, eIB, INFRA-DEV, and INFRA-TECH
- In addition, strong synergy between CHIPP and CHAPS research interests in GWs
  - Above work is a joint effort between astronomy, particle physics, and theoretical physics
  - Proposed the creation of UniGe "Center for Gravitational-Wave Science" to formalize this

- As we proceed, we think it is important to engage with the full Swiss community
  - Our efforts have been very ET-focused and based on local interests
  - Would be very useful to have an active CHIPP/CHAPS joint working group on GW physics

Backup Material

ET timeline

- ET timeline presented to ESFRI
  - As expected, the ESFRI approval boosted the activities at all the levels:
    - Scientists
    - Agencies
    - Governments