

LVC Electro-Magnetic Followup MOU Framework

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30 August 2013**

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11 Sep 2013**

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MOUs

The following is information the EM MOU committee has been discussing in preparation for the LOI conferences. LVC is considering many of these issues, and feedback is welcome.

Basic Concept

- Confident detection of first few GW signals will require time and care—need to avoid misinformation/rumors/media circus
- Partners who sign MOUs will receive GW triggers promptly
- After 4 GW events have been published, further high-confidence events will be released promptly to the public
- Want uniform, straightforward MOUs
- Two modes of participation: Independent and Coordinated

Confidentiality of GW and EM information

- Create a “bubble” of trusted partners
- Encourage communication within bubble, prohibit outside

MOUs (cont)

Sharing of information:

- LVC will send the same GW alert information to all partners
- All partners will share info about observations made, and any candidate counterparts found
- Coordinated partners will also share observing plans to carry out coordinated strategy
- Info is shared with all partners and LVC

Data ownership:

- Partners retain ownership of their own data
- Partners are expected to analyze and interpret their data
- Coordinated partners might share data for cross-checking (?)

No legal obligations for “deliverables”, but scientific imperative

- Partners are expected to contribute appropriately and follow the rules established for the project

Criteria for MOU Partners

- **LVC goal is to welcome people/ groups with established observational expertise who are expected to:**
 - bring observing resources
 - be able to observe when needed
 - analyze data promptly and reliably
 - share information about observing status and any candidates
 - contribute scientifically to analysis
 - agree to and respect conditions of MOU
- **Only professional astronomers, at least for now**
 - Will consider appropriate ways to engage amateurs

Modus Operandi

The LVC distributes alerts associated with GW candidate events. The position of the source estimated from GW data is given by a posterior probability skymap.

Observing strategy

Independent: The EM partner decides its own observational strategy

Coordinated: A joint LVC-EM working group processes the skymap and agrees on assigned target coordinates to the Coordinated EM partners; also organizes multiband photometry and spectroscopy for possible counterparts, etc.

Observation status (prompt response required)

Independent: The EM partner reports to the LVC-EM joint working group about the status of follow-up observations. Was the alert followed with observations? Provide locations of any detected counterparts.

Coordinated: The EM partner reports to the LVC-EM joint working group about the status of follow-up observations. Was the alert followed with observations? When? What region and to what depth in what band, etc.? Provide locations of any detected counterparts, and coordinate plans for further follow-up.

Modus Operandi (cont)

Analysis results and EM data sharing

Independent: The EM partner reports on the observations carried out, but not necessarily the result details, other than presence/position of candidate counterparts. Papers relying on LVC-provided information will follow publication policy below.

Coordinated: The EM partner shares with the LVC the result of EM transient search in the follow-up observations along with the science-ready data-products (including raw data, calibration data, calibrated data and source list). Those data products are available to the joint LVC-EM working group for cross-checking. (Is this acceptable to Coordinated partners?)

Publications

- **No MOU group may publish or announce results from GW-triggered observations before LVC discovery paper is published.**
 - This restriction does not apply to un-triggered observations (e.g., regular survey) as long as no GW association is claimed.
 - Exception may be made if the result is unrelated to the GW trigger (e.g., unrelated optical transient found serendipitously)
- **EM counterpart papers must follow GW discovery paper**
 - Note: first few GW discovery papers may take a long time—we will appreciate your patience!
- **Discovery GW paper will typically not include EM data (and co-authors), but could by mutual agreement if the science calls for it**

Publications (cont)

- LVC will share drafts of GW detection papers with partners, if the detected event(s) were sent as GW alerts
- A publication draft about any EM follow-up related to a GW trigger or triggers should be shown to LVC; only the GW information will be reviewed by LVC.
- The LVC reserves the right to be co-authors on EM follow-up papers.
 - In those cases, EM authors would be first.
- **For Coordinated groups, publications should probably reflect consortium nature of the group. Author policy for joint papers?**
 - Everyone enrolled as Coordinated? *(Could be many people!)*
 - Contributors to the event being reported? *(All who observed [even if they pointed to empty sky] or played significant role in organizing)*
 - Only those who positively detected the event?

Communication

- All partners nominate a liaison from their team as point of contact with the LVC. (The liaison may be an LVC member.)
- GW alerts will be sent as VOEvents over private GCN/TAN, VOEventNet, and/or SkyAlert feeds
 - Partners will need to know how to decode the VOEvent
- Planning to set up something like a "private ATEL" (maybe just a mailing list) for communication among partners and LVC
- Both Independent and Coordinated partners are expected to share information on what observations have been made.
- LVC-EM Coordinated group may set up an "event advocate" system to assign a person to each event for tracking activity
 - May also need tools to keep track and visualize observations

How will the Coordinated group work?

- **Basically, a consortium for partners who want to coordinate observations**
 - e.g. if your telescope can only cover part of the GW error region (divide up area with other scopes)
 - or if you simply want someone else to recommend where and when to use your telescope or facility
- **Consists of observers (outside and inside LVC) who want this, plus some LVC members involved in alerts and organization**
- **Will need to develop and implement coordinated observing strategies**
 - Recommend (not require) where members should observe
 - Should communicate freely and be flexible to fill in gaps
- **Self-organized management? Or form a steering committee?**

Applications and Approvals

- **Will ask potential partners to submit an application**
 - Those of you who submitted a letter of interest (thanks!), but also open to others in the community
- **Intend to accept all qualified applicants**
- **MOU remains active indefinitely until ended**
- **Open for applications Oct/Nov, deadline in January?**
 - Then accept new applications in cycles at least once per year
- **No preference will be given to LVC members, or Coordinated vs. Independent, assuming contribution makes sense**

Working with Shared Facilities

- **Partners intending to apply for telescope time are allowed to join conditionally**
 - But won't send them GW triggers if they don't get the time
- **If more than one group wants to apply to the same facility, LVC will discuss with groups to see what might work. However, LVC will not attempt to select between them nor “broker” an unwanted merger**
 - If both submit proposals, TAC will have to decide
- **How to deal with confidentiality for public facilities (e.g., observatories) where non-MOU people need to be involved in the TOO's?**
 - Keep principle of strict confidentiality, OR
 - Allow such people to be enlisted if the science calls for it and if they agree to confidentiality?

Comments/Suggestions?

- **These are draft plans, which will continue to be discussed by members of the LVC EM MOU committee, as well as with the full collaborations at the LVC meeting later this month**
- **Comments/suggestions from potential partners welcome**

Issues for Discussion

- How freely/rapidly should information be shared within the “bubble”?
- Does the “private ATel” communication model sound OK?
- How can the Coordinated group work effectively?
 - Should the LVC nucleate a Coordinated group at all, or just assume that observers will self-organize?
- How does the desire for confidentiality apply to TOO observations at shared facilities?
- How can we keep track and visualize all the observations that have been made?
- How should co-authorship work among the many partners?
 - Everyone enrolled as Coordinated? (Could be many people!)
 - Contributors to the event being reported? (Who observed or coordinated)
 - Only those who positively detected the event?
- In what cases should LVC be co-authors on follow-up papers?