

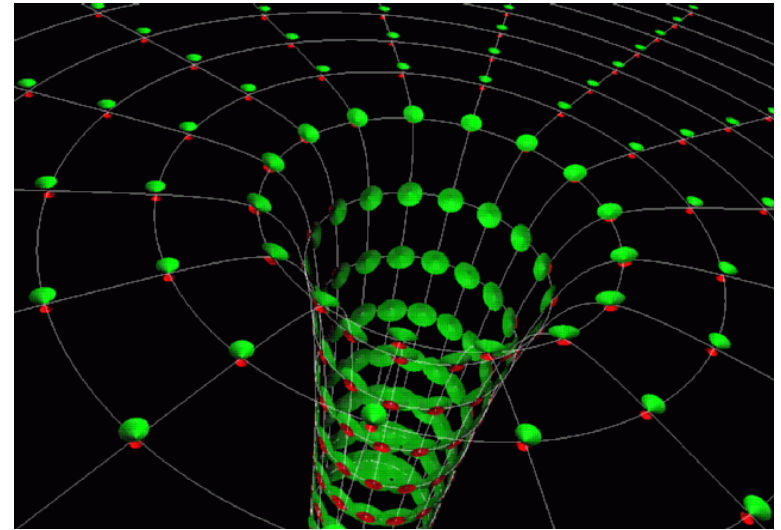
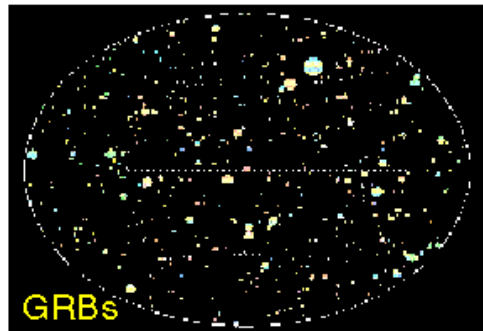
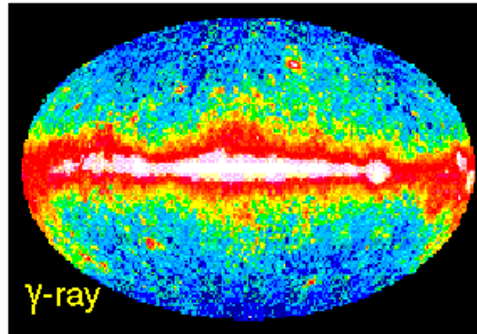
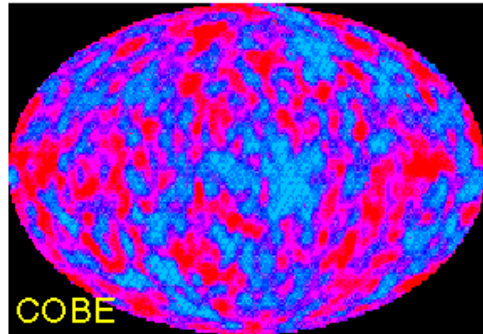
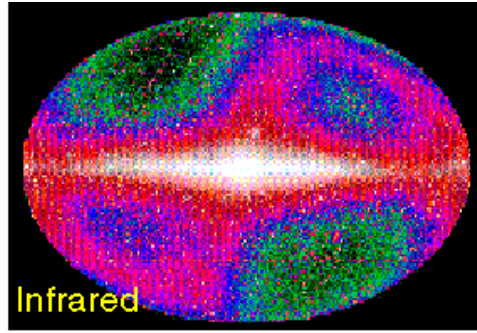
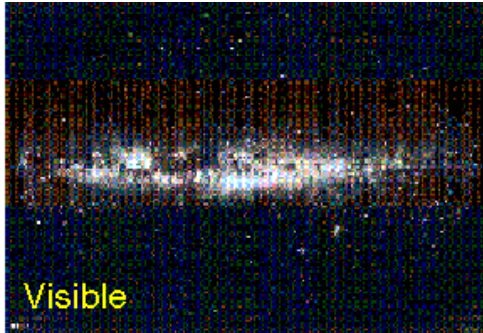
Models for Governance of Scientific Megaprojects

Gary H Sanders, Caltech

CERN meeting

September, 2017

A New Window on the Universe



Gravitational Waves will provide a new way to view the dynamics of the Universe

What is your vision for 3rd Generation GW or for a longer future

- Single world GW laboratory with multiple sites
 - Vision extends beyond 3rd generation
- Vision of 3rd generation only
- Coordination or unified management of technology development
- Only one 3rd generation IFO design deployed at multiple sites
 - One construction project
- Diverse designs deployed at different sites but coordinated in operation and production of science
 - Construction managed separately
 - ...
- Have you already opened the field of gravitational wave astrophysics with the current generation or is the 3rd generation when that threshold will be realized or ...
- These overwhelmingly influence the proposed governance model
- Who are you and what do you want to be?

Options for Global Project Governance

- Intergovernmental (treaty) organization (**strongest**)
- International partnership of existing executive organizations via legal member corporation
- International collaboration of existing executives via single nonbinding member association
- International collaboration with multiple nonbinding agreements with multiple existing executive organizations
- International coordination of separate, but related, existing executive organizations
- Non-coordinated separate, but related, existing executive organizations (**least strong**)

Intergovernmental (treaty) organization (IGO)

- Governed by treaty
- Very powerful and stable over long periods of time
- Virtually assures that the scientific field will do well
- Stable funding stream by treaty though subject to sovereign funding availability
- Hierarchically matched – countries to countries
- Diplomatic immunities and privileges in host country and for staff of organization
- Bureaucratic and political
- Full top down control over staffing, procurement, financial policies
- Responsibility for tariffs, taxes, duties, and legal liabilities
- Procurements are political – “juste retour” of “noble work”
- Protective of privilege and status
- Examples – CERN, ESO, ITER, goal for SKA
- Some countries may not join IGO’s as full signatories

International partnership of existing executive organizations via legal member corporation

- True binding legal partnership if signed by financial authorities of members (funding agencies,...)
 - Except for limitation subject to sovereign funding availability
- Stable over long periods of time due to binding nature of agreements
- Several international corporate structures exist that can achieve this model with full international recognition (GmbH, Delaware LLC,...)
- Full control within corporation over staffing, procurement, financial policies as in a commercial corporation
- Full responsibility for tariffs, taxes, duties, and legal liabilities
- Members (funding agencies) can assign their performing organizations (national labs, institutes,...) to act for them in partnership
- Can even mix national governments and private Nongovernmental Organizations (NGO's) though this raises hierarchical issues
- Examples – TMT, current SKA preconstruction phase project

Single international collaboration of existing executives via single nonbinding member association

- Nonbinding agreement shifts performance burden towards “best effort by scientific collaborators”
- Financial contribution agreements are also best effort
- Less stable over long periods of time
- Preserves independence and “sovereignty” of collaborating executive organizations
- Requires existing executives to be fully responsible for legal actions such as hiring, contracting, tariffs, duties, intellectual property and liability
- Collaborating executives can assign their performing organizations (national labs, institutes,...) to act for them in partnership
- Can even mix national governments and private Nongovernmental Organizations (NGO’s) though this raises hierarchical issues
- Examples – ALMA

International collaboration with multiple nonbinding agreements with multiple existing executive organizations

- Nonbinding agreements shift performance burden towards “best effort by scientific collaborators”
- Financial contribution and in-kind contribution agreements are also best effort
- Less stable over long periods of time
- Preserves independence and “sovereignty” of collaborating executive organizations
- Requires existing executives to be fully responsible for legal actions such as hiring, contracting, tariffs, duties, intellectual property and liability
- Collaborating executives can assign their performing organizations (national labs, institutes,...) to act for them in partnership
- Can even mix national governments and private Nongovernmental Organizations (NGO’s) though this raises hierarchical issues
- Examples – Typical high-energy physics collaborations

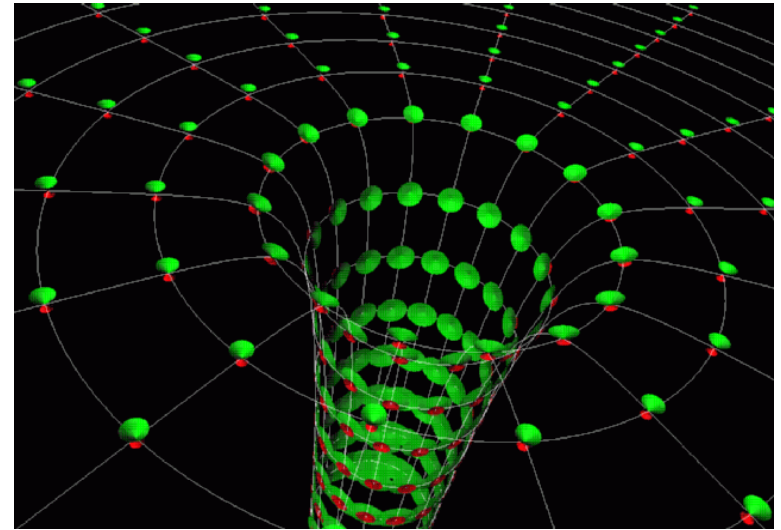
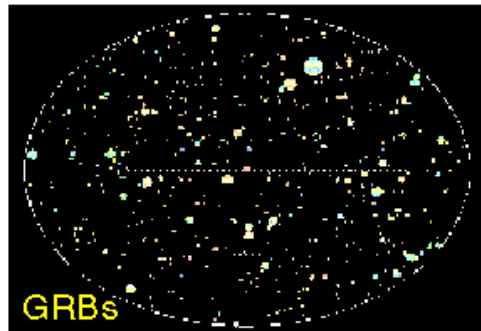
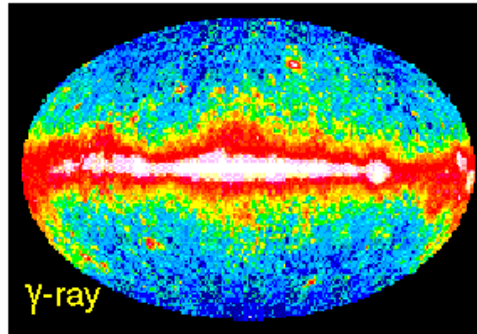
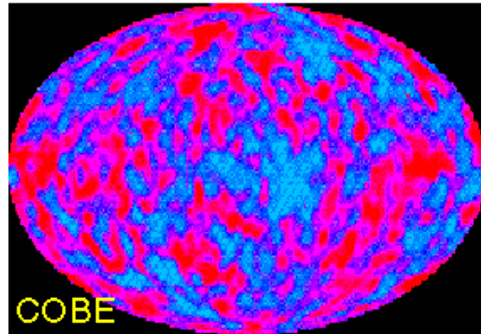
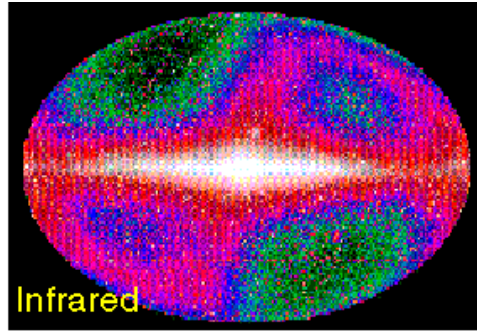
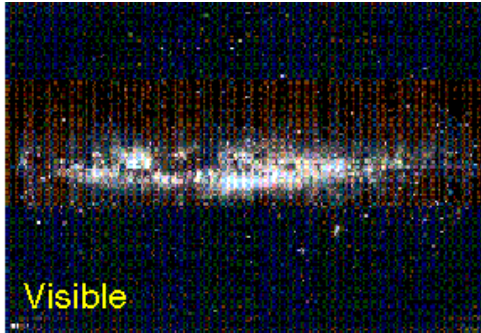
International coordination of separate, but related, existing executive organizations

- Similar to previous case though typical when different instrumentation or facilities are delivered and operated in a related and coordinated effort
- Example: LIGO, Virgo, LSC, VSC, GWIC

Non-coordinated separate, but related, existing executive organizations

- Examples: Underground laboratories such as Gran Sasso, Kamioka, SNO, US Sanford Lab
- (Advanced LIGO and Advanced Virgo) with KAGRA

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- Is the starting point of opening the field of gravitational wave astrophysics established by the current generation or is the 3rd generation when that threshold will be realized or ...
- These overwhelmingly influence the proposed governance model
- Who are you and what do you want to be?

Phases: One Example

- Conceptual
 - Development
 - Construction
 - Operations
 - Decommissioning and Restoration
-
- SKA has had the first two phases and is preparing the third phase
 - PrepSKA – conceptual design and technology development
 - Precursor arrays of antennas built and operated for astronomy as working full science prototypes in different countries with different designs
 - Governed as loose association and guided by top down funding agency consultations
 - Preconstruction phase – preparing for construction readiness, a legal member international corporation was set up and is coordinating design efforts funded by cash contributions from partners and disbursed as funded work packages to member executing organizations
 - IGO is being designed for construction phase
 - Construction and Operations phases will be executed by IGO as if it were CERN or ESO

Things To Consider

- Vision of future
 - One step or a path
 - Starting point
 - Nature of originators
 - Appropriate models
 - Collaboration parameters
 - Phase progression
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- Decide the leading options in your vision? Then the governance follows.