Scalable Cyberinfrastructure to support Multi-Messenger Astrophysics
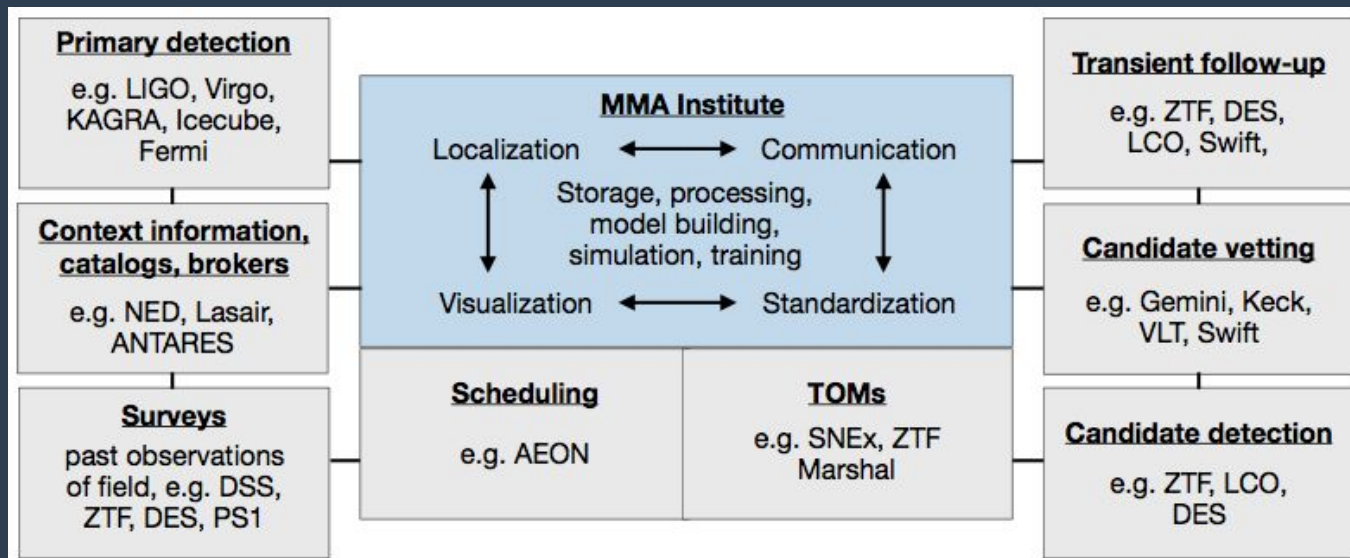
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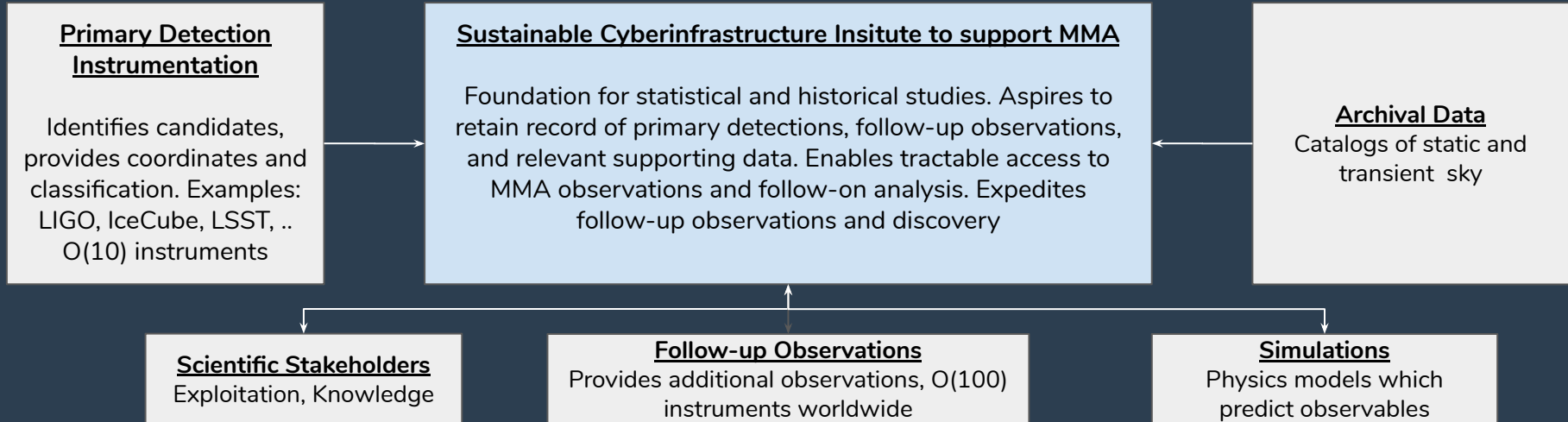# SCiMMA activities 2018-2019

- **Exploration & documentation of disiderata:**
  - **Workshops: Deep Learning @ NCSA, SCiMMA @ NYC, SCiMMA Inference @ UCSB.**
  - **Systems, Data Management, Inference & Machine Learning, Modeling and theory, Education & workforce development, Policies & Management.**

Data flow & collaborative network of people and instruments

Primary detection
e.g. LIGO, Virgo, KAGRA, Icecube, Fermi

Context information, catalogs, brokers
e.g. NED, Lasair, ANTARES

Surveys
past observations of field, e.g. DSS, ZTF, DES, PS1

MMA Institute
Localization ⟷ Communication
Storage, processing, model building, simulation, training
Visualization ⟷ Standardization

Scheduling
e.g. AEON

TOMs
e.g. SNEx, ZTF Marshal

Transient follow-up
e.g. ZTF, DES, LCO, Swift,

Candidate vetting
e.g. Gemini, Keck, VLT, Swift

Candidate detection
e.g. ZTF, LCO, DES

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SCiMMA activities 2019-2021

- **Framework for Data Intensive Discovery in Multi-messenger Astrophysics**
  - **Prototype solutions that address immediate needs**
  - **Baseline design for an institute to support MMA into the 2030s**

Primary Detection Instrumentation	Sustainable Cyberinfrastructure Insitute to support MMA	Archival Data
Identifies candidates, provides coordinates and classification. Examples: LIGO, IceCube, LSST, .. O(10) instruments	Foundation for statistical and historical studies. Aspires to retain record of primary detections, follow-up observations, and relevant supporting data. Enables tractable access to MMA observations and follow-on analysis. Expedites follow-up observations and discovery	Catalogs of static and transient sky

Scientific Stakeholders	Follow-up Observations	Simulations
Exploitation, Knowledge	Provides additional observations, O(100) instruments worldwide	Physics models which predict observables

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Prototype: SCiMMA HopSkotch

A scalable and reliable pub-sub system for sending alerts, messages, data around quickly and reliably

Meet the requirements of early-warning of compact binary mergers via gravitational waves allowing the detection of the earliest phase of the electromagnetic counterpart.

Build on experience from ZTF and LIGO-Virgo with pub-sub systems