VIALACTEA

The Milky Way as a Star Formation Engine

M.Molinaro, INAF-OATs IA2 & the VIALACTEA project members

Outline

- The VIALACTEA project
- Scientific Goals
- Technical content
- VO requirements

The Project

▶ *[…] exploit the combination of all the new-generation Infrared-to-Radio surveys of the Galactic Plane from space missions and ground-based facilities, using a novel data and science analysis paradigm based on 3D visual analytics and data mining framework, to build and deliver a quantitative 3D model of our VIALACTEA Galaxy as a star formation engine that will be used as a template for external galaxies and study star formation across the cosmic time.*

▶ Project participants
  ▶ INAF
     ▶ (IAPS, OATs, OACt, OACn)
  ▶ University of Leeds
  ▶ MPIA-Heidelberg
  ▶ MTA SZTAKI
  ▶ Cardiff University
  ▶ LAM
  ▶ University of Strasbourg
 ▶ Nagoya University
  ▶ University of Exeter

36 Months
Oct. '13 kick-off
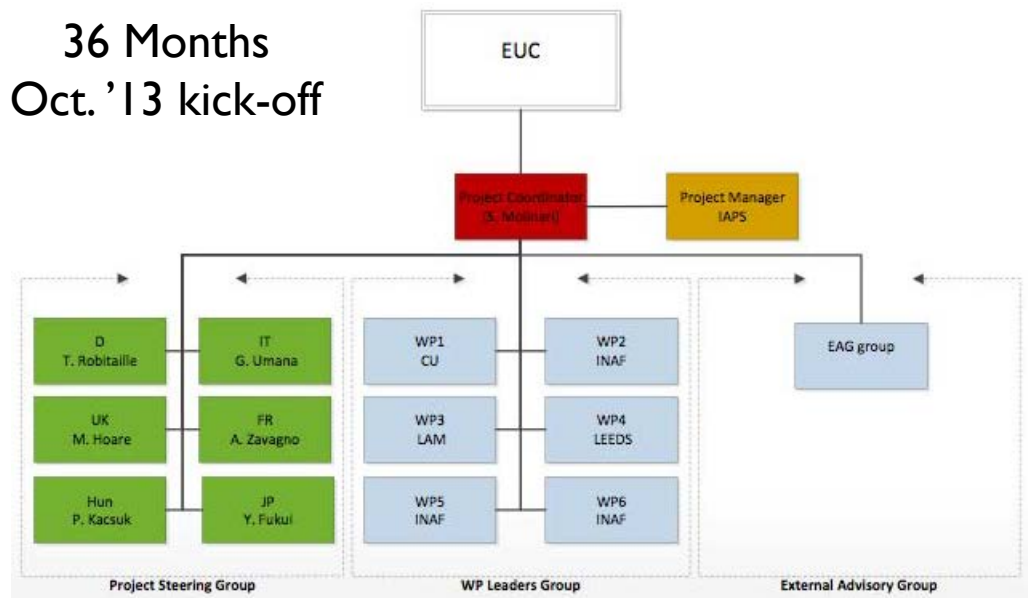
▶ *morphological and physical characterization of diffuse emission structures from continuum as well as spectroscopic maps of the Galactic Plane*

▶ Objectives → tasks:

1. tool for filament extraction from spectroscopic and continuum maps

2. automated tool for the identification of bubble-like structures from continuum maps

3. morphological analysis of the extended structures revealed

4. physical characterization of the revealed structures through radiative transfer modeling
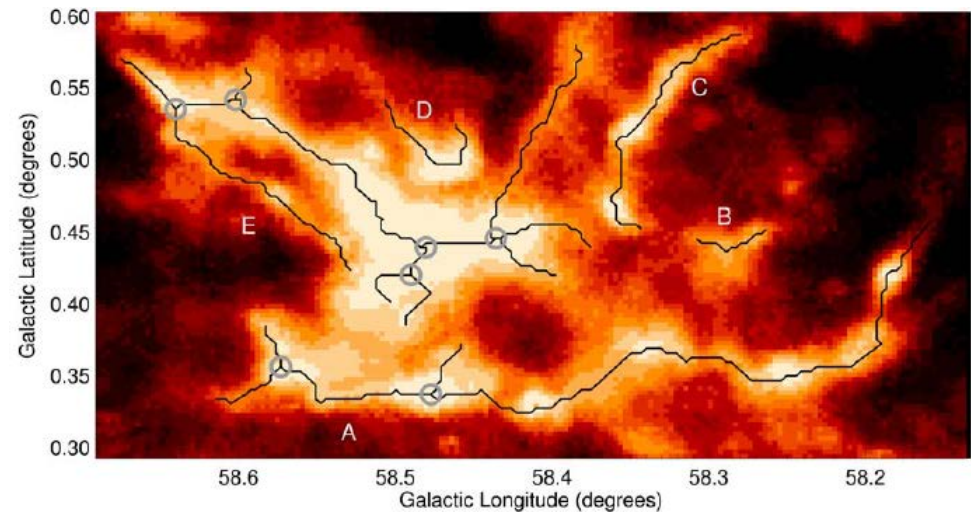
Schisano & al. 2014, submitted

WP2: Compact Source Analysis

▸ *extracting compact structures from Hi-GAL dust thermal continuum maps of the Galactic Plane and characterizing from the physical and evolutionary viewpoint the objects identified as star forming regions. Deliverables will be used to estimate the Star Formation Rate*

   ▸ Objectives → tasks:

      1. compact source extraction ──────────────→ Catalogue
                                                    Build in progress

      2. testing and validating SF evolutionary indicators

      3. synthetic protocluster evolutionary models

      4. star formation evolutionary classification tool

WP3: 3D Galaxy

▶ *estimate the heliocentric distance for all sources and structures and deliver a 3D model of the spiral structure of the Milky Way*

▶ Objectives → tasks:
1. kinematical analysis of radio spectroscopic surveys
2. 3D extinction mapping
3. galaxy rotation curve
4. automated tool for distance estimation

- Spectral Data Cubes
  - (10 surveys + 2 pointed archives)
- Vizier UCD driven catalogue search

▸ *acquire the outputs of the previous WPs and use radio spectroscopic and continuous ancillary data to implement the global Galaxy-scale recipe for star formation by analyzing SFR, SFE and SF thresholds in the context of spiral arms, expanding bubbles from evolved stars of HII regions. Estimate also the effect of the Galactic diffuse Cosmic rays distribution on the evolution of star forming clouds*

▸ Objectives → tasks:

1. identification and mapping of SF thresholds
2. role of spiral arms as agents of star formation
3. quantification of SF triggering at intermediate scales
4. quantification of SF triggering at small scales
5. mapping the effect of cosmic ray flux on the SFR
6. establishing a bottom-up recipe for global SF

Tools & Infrastructure – WP5

▸ *activities needed to ensure that a computing infrastructure and a set of data-mining/machine-learning, visual analytics and 3D visualization tools are in place according to astronomers specifications*

> ▸ Tasks:
>
> 1. Database & Virtual Observatory Infrastructure
>   - IA2 & LAM
> 2. Data Mining Systems
>   - INAF-OACn
> 3. 3D Visual Analytics Systems
>   - INAF-OACt
> 4. Science Gateway
>   - SZTAKI

VIALACTEA Infrastructure

- Science Gateway
  - WS-PGRADE/gUSE middleware
  - VisIVO backbone for client/server application development
    - Visualization and Visual analysis support
  - DAMEWARE infrastructure
    - Data Mining system support
  - VO compliant/derived access layer
    - Input data
    - Output data

VO requirements & interaction

- From a preliminary *survey* of scientific requirements
  - Data cubes search and manipulation
  - Catalogue generation and publishing
  - Global VIALACTEA DB
    - Data
    - Knowledge
  - public/private mixed setup
    - private limited to internal results on short term
  - Positional searches and characterization
- IVOA interaction needed
  - Quite obvious

…remarks
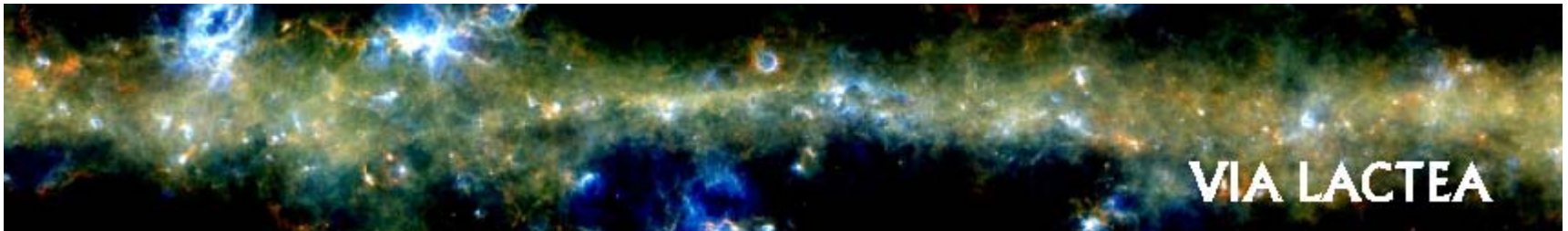
- plan to present VIALACTEA at Spring Interop
  - Tracking down an available scientific speaker
  - May fit one of the plenary/panel sessions?

- Hiring a person
  - 0.5 FTE on VIALACTEA VO tasks
    - 1.0 FTE on VO tasks
  - Deadline 31.03.2014
    - Ask me for more info

Thank you!

M. Molinaro
(on behalf of)

the

members