

# Young stellar objects and their variability with Rubin LSST:

combining observations and 3D models for a more inclusive Science

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“Young stellar objects and their variability with Rubin LSST: combining observations and 3D models for a more inclusive Science”

1. Investigating the physics of star forming regions (SFRs) and young stellar objects (YSOs), including their variability at different time scales (from hours to years), in preparation for the future data of the Vera C. Rubin Observatory Legacy Survey of Space and Time (LSST).

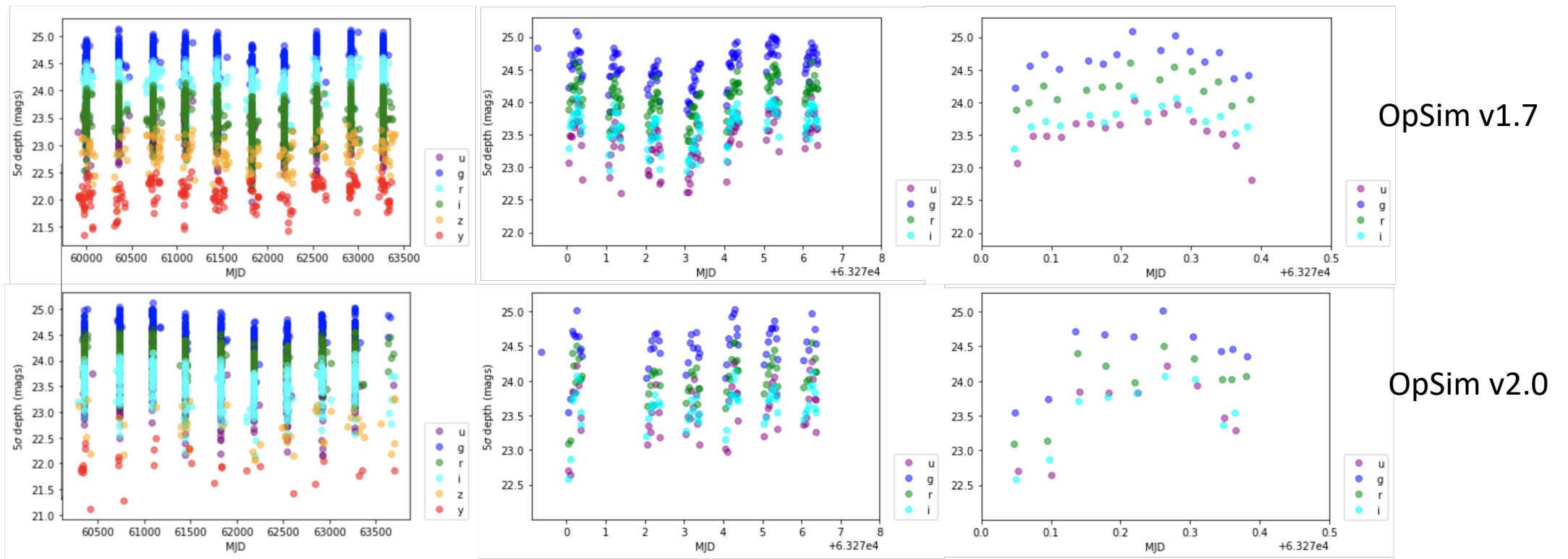
2. Exploring 3D models to investigate the variability in young stellar objects due to accretion, mass ejections, rotation, etc. The activities include 3D rendering and printing to help in the research dissemination towards visually impaired members of the community.

1. Investigating the physics of SFRs and YSOs, including their variability at different time scales (from hours to years), in preparation for the future data of Rubin-LSST.

- Transients and Variable Stars Science Collaboration (TVS SC) member: TVS telecon
- Rubin Science Platform (RSP) use and Data Preview 0 (DP0) Delegate: DP0 Delegate Assembly, Stack Club, tutorials, notebooks
- Workshop 2022 March 28-30: From Data to Software to Science with the Rubin Observatory LSST (remote attendance to the plenaries and contribution to 2 white papers)
- Metrics – Cadence Note Bonito & Venuti et al. 2021 ApJS
- Investigate properties of YSOs and their variability by analysing the light curves (mainly in the u, g, r, i bands), using already available data sets as a preparatory work for future Rubin LSST data
- Classification of the light curves using machine learning: collaborations

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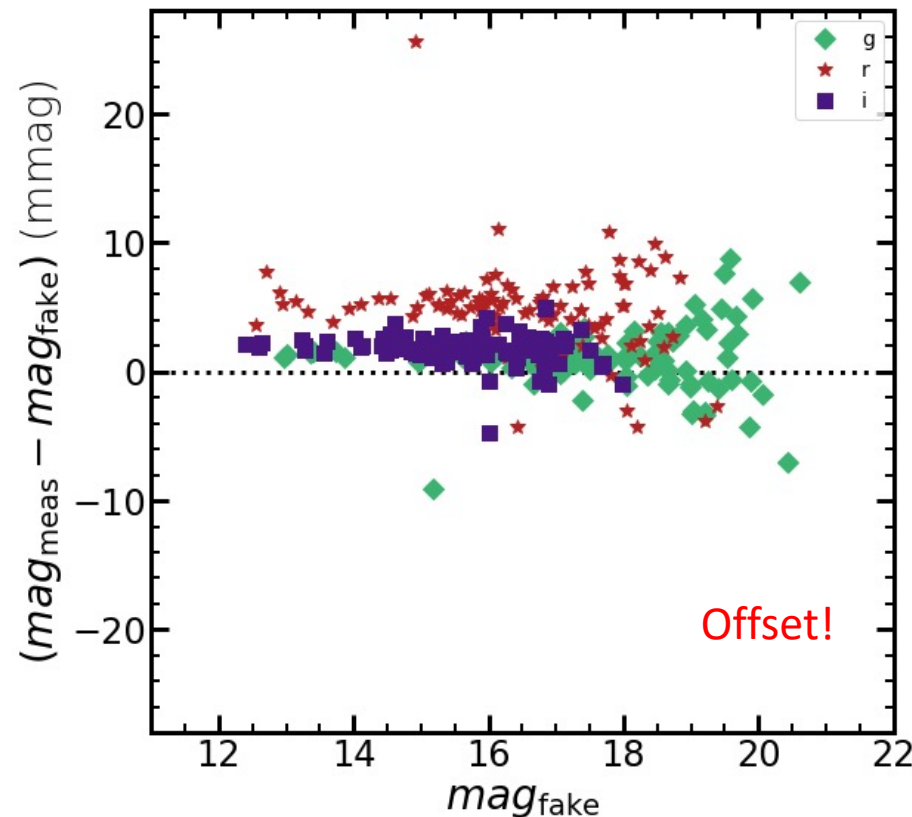
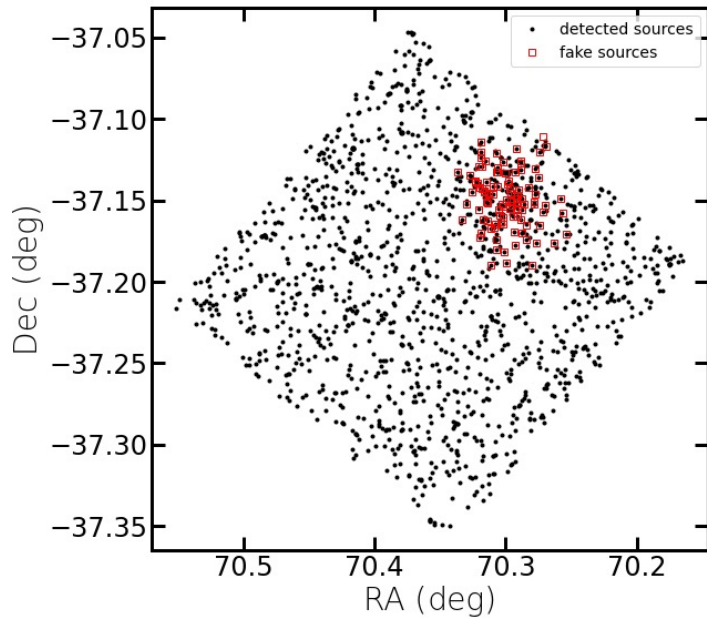
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**Figure:** Simulated number of visits for the carina OpSim v1.7 (upper panels) and v2.0 (lower panels) across different coverage times: the entire survey duration (left column), during a specific observing week (middle column) and for a specific night (right column).

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Python notebook (RSP)

- Injecting sources selected from the PanSTARRS catalogue in a LSST simulated image
- Identify the sources and compare the measured with the injected magnitudes (instrument response)

+ Variability (different time scales)  
-> light curves  
+ Other sources (different catalogues)

## 2. Exploring 3D models to investigate the variability in YSOs due to accretion, mass ejections, rotation, etc.

- 3D Visualization and Rendering subgroup in the TVS SC
- 3D printing: 2 proposals focused on the acquisition of a 3D printer; test with local printer
- Catalogue of models: accretion disk and jets (from existing numerical models), warped disks (artistic model based on what we know)
- Presentation in international meetings: EAS 2022 and SEA 2022
- 3D rendering and printing to help in the research dissemination towards visually impaired members of the community.

## 2. Exploring 3D models to investigate the variability in YSOs due to accretion, mass ejections, rotation, etc.

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DATA VISUALIZATIONS AND CHARACTERIZATIONS, coordinators: Sabina Ustamujic, Sally Macfarlane

### Starting Members



**Sabina Ustamujic**  
INAF - Osservatorio  
Astronomico di  
Palermo



**David Buckley**  
South African Astronomical  
Observatory (SAAO)



**Rosaria Bonito**  
INAF - Osservatorio  
Astronomico di Palermo



**Jeff Cooke**  
Swinburne University of  
Technology



**Sally Macfarlane**  
South African  
Astronomical  
Observatory  
(SAAO)

### Aims

- To support and promote research into multi-dimensional visualisation and sonification of LSST TVS data
- To support and promote the use of multi-dimensional visualisation and sonification tools for the purpose of inclusive science communication, also for education and outreach purposes
- To research the effectiveness of multi-dimensional data visualisation and sonification
- To uphold all values as stated in the TVS Code of Conduct

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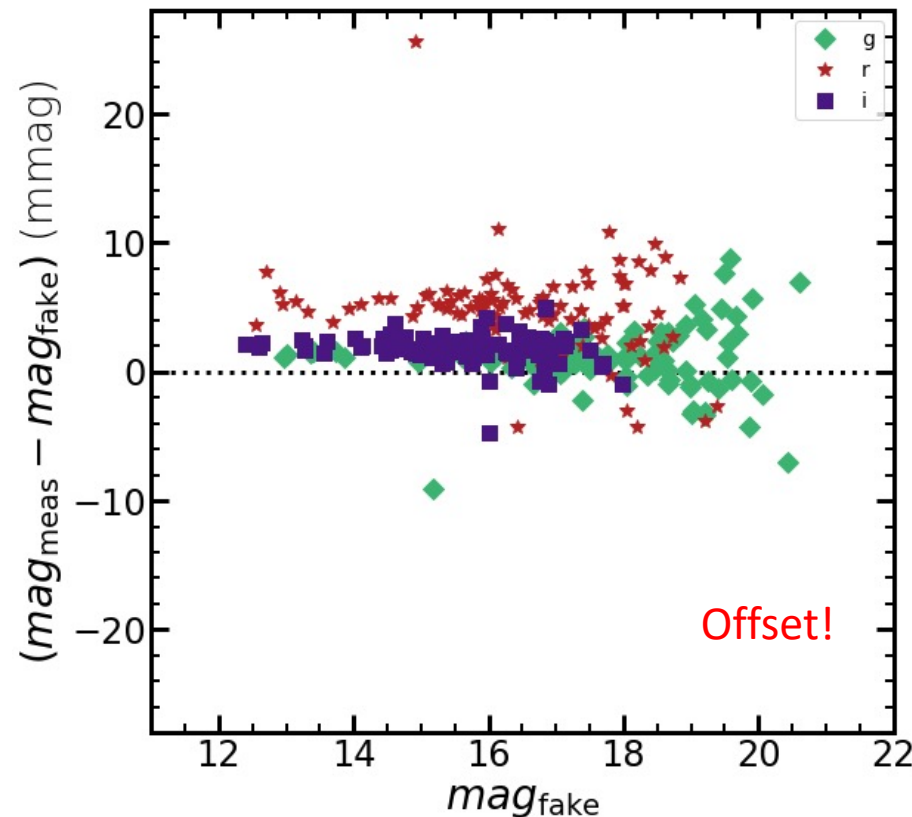
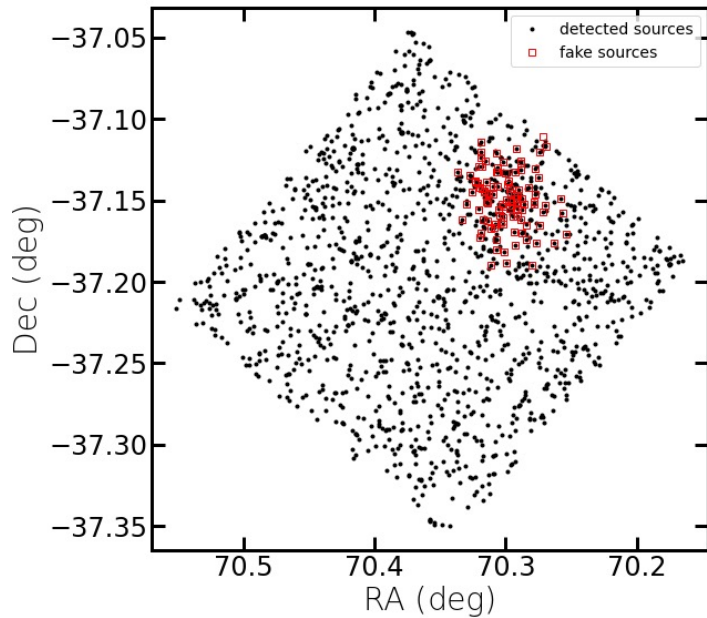
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New collection of models of the team in Sketchfab in preparation

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