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## Light pollution, a complex real-world problem to be tackled through an interdisciplinary approach

Samuel Challéat, Matthieu Renaud, Kévin Barré, Rémi Bénos, Christian Brouat, Mathieu Delsaut, Nicolas Farrugia, Hélène Foglar, Magalie Franchomme, Jérémy S P Froidevaux, et al.

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# MITI

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Transverses et Interdisciplinaires



# Light pollution, a complex real-world problem to be tackled through an interdisciplinary approach

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XXXII IAU GA, WG Dark and Quiet Sky Protection meeting, Cape Town, South Africa, August 15<sup>th</sup> 2024



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# What disciplines have shaped "the ALAN problem"?

1971

**Star Bright, Street Light, Which Will They See Tonight?**  
 Science 171, Number 4088

**Light Pollution**  
 It is a growing threat to astronomy.  
 Karl W. Weigt

**SCIENCE**  
 Vol. 173, Number 4088

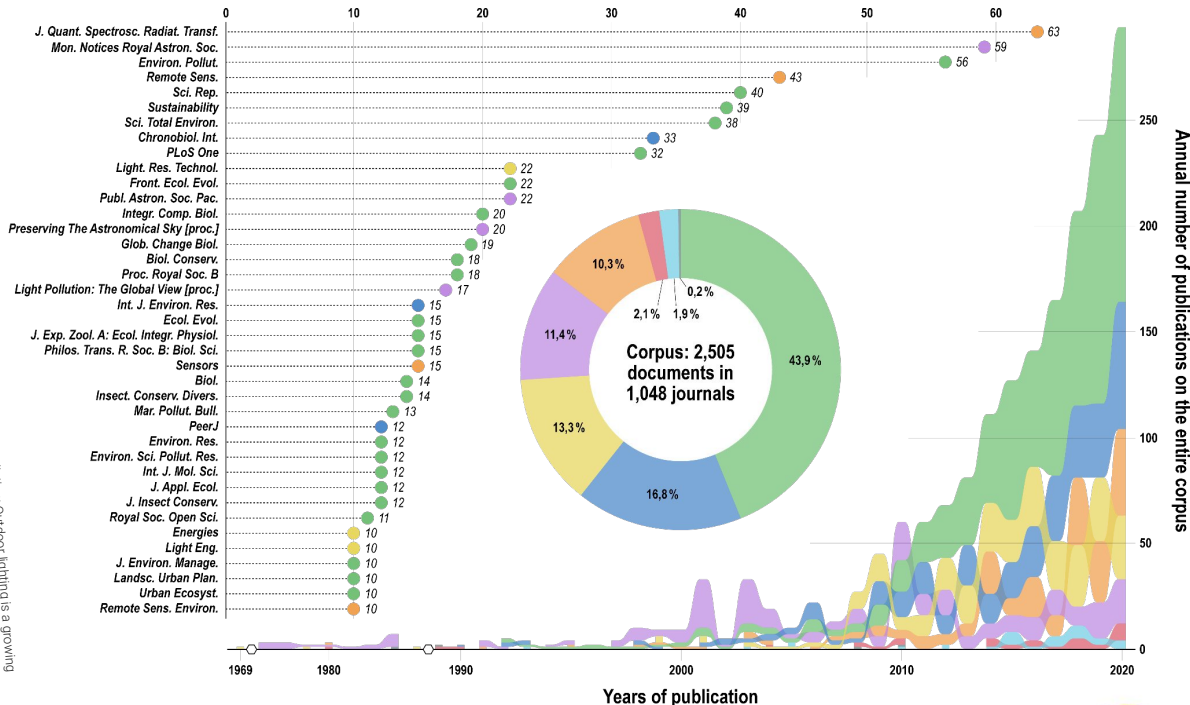
**Light Pollution**  
 It is a growing threat to astronomy.

**Light Pollution**  
 It is a growing threat to astronomy.

**Light Pollution**  
 It is a growing threat to astronomy.

1973

Number of publications by journal with 10+ papers on light pollution between 1969 and 2020



■ Natural Sciences
 ■ Health Sciences
 ■ Engineering sciences
 ■ Sciences of the Universe
 ■ Modeling & geographic information sciences
 ■ Social sciences
 ■ Territorial sciences
 ■ Radical interdisciplinarity



# The nocturnal environment, a new object for a transdisciplinary approach



2023

Science, special issue, 16 June 2023.

## URBAN LIGHTING STUDIES

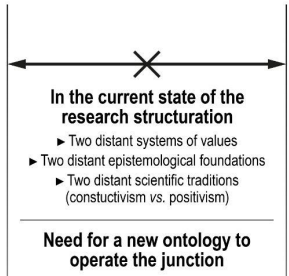
- ALAN as an urban amenity
  - Sociotechnical systems
  - Safety, salubrity, aestheticism
  - Urban lighting & energy savings
    - Social acceptability
  - Mainly in urban ordinary areas

*Weak environmental approaches*

## LIGHT POLLUTION STUDIES

- ALAN as an anthropogenic pressure
  - Measurement, modelling and spatialisation of light pollution
  - Knowledge of the negative effects of ALAN (global ecology, health)
  - Institutionnalisation of protected areas

*Weak social & territorial approaches*



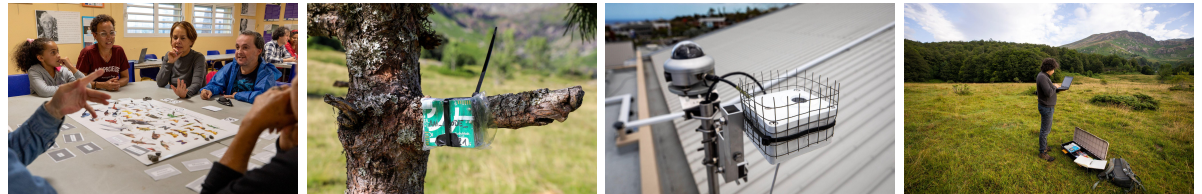
## NOCTURNAL ENVIRONMENT STUDIES

- Consideration of the needs of ALAN and darkness, from human and non-human points of view
  - Social-ecological system approach
  - Holistic view, interactions and feedbacks

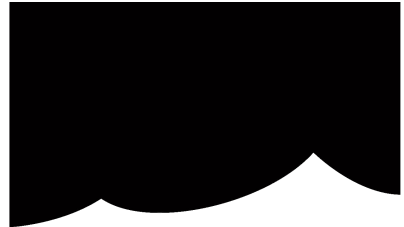
**Need for interdisciplinary & participatory approaches to integrate and create new links with reality (Stengers, 1997)**



# The Nocturnal Environment Observatory (NEO), a device to enable, facilitate and organize interdisciplinarity



- Created in 2021, **23 members** from 4 CNRS Institutes
- 3 axes around **nocturnal socio-ecological systems** :
  - Socio-territorial approaches*
  - Ecology, metrology and modeling*
  - Support for territorial initiatives to preserve the nocturnal environment*



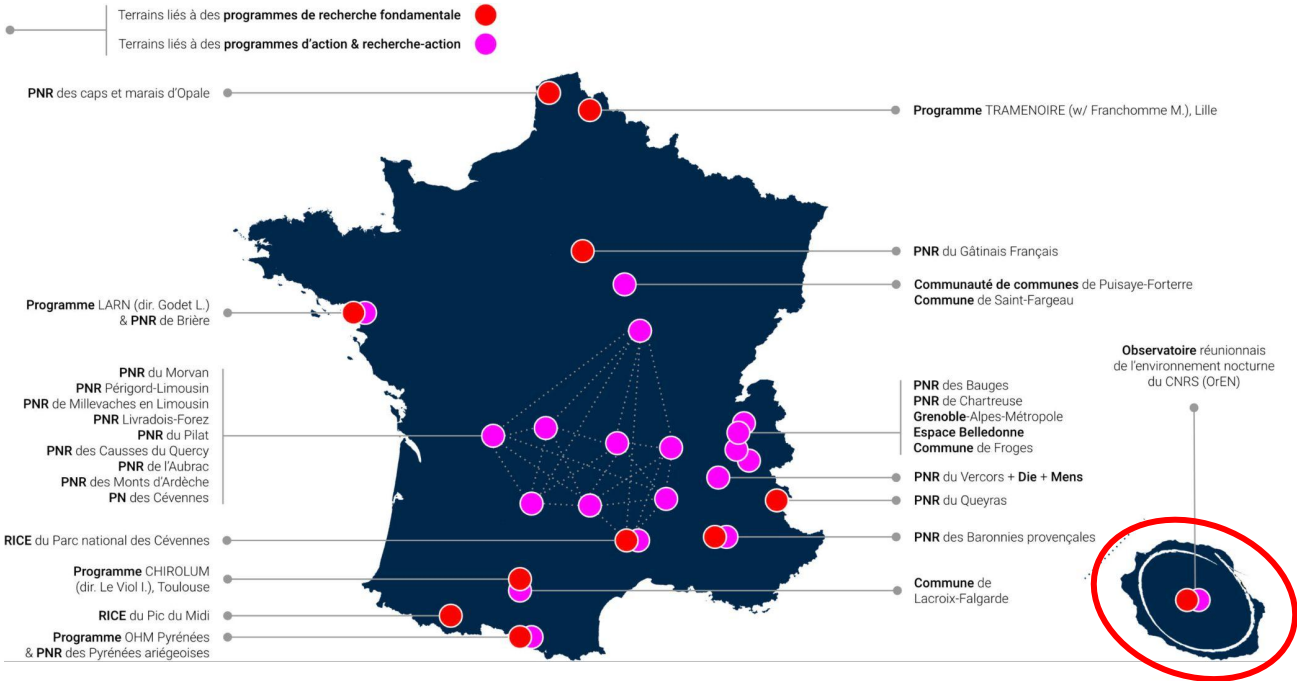
## OBSERVATOIRE ENVIRONNEMENT NOCTURNE

-  SCIENCES HUMAINES & SOCIALES
-  ÉCOLOGIE & ENVIRONNEMENT
-  TERRE & UNIVERS
-  SCIENCES INFORMATIQUES



# A device in direct touch with the territories of preservation of the nocturnal environment

- Type 1: **environmental protection areas** (regional and national nature parks)
- Type 2: (peri-)urban and rural **“ordinary spaces”**
- Type 3: **larger territorial units**, a kind of **“workshop areas”** for NEO’s activities





# An example of "workshop area" for NEO: Reunion Island

- **Historically, a monodisciplinary approach** focused on nocturnal avifauna
- To enrich the repertoire of public action: **cultural relations to darkness specific to Reunionese populations**
- *Fenwar* as a soundscape?





# An example of "workshop area" for NEO: Reunion Island

- Implementation of transdisciplinary **workshops** around the "nocturnal soundscapes"
- **Step 1:** Meet the inhabitants, explain the method and distribute pre-programmed acoustic recorders



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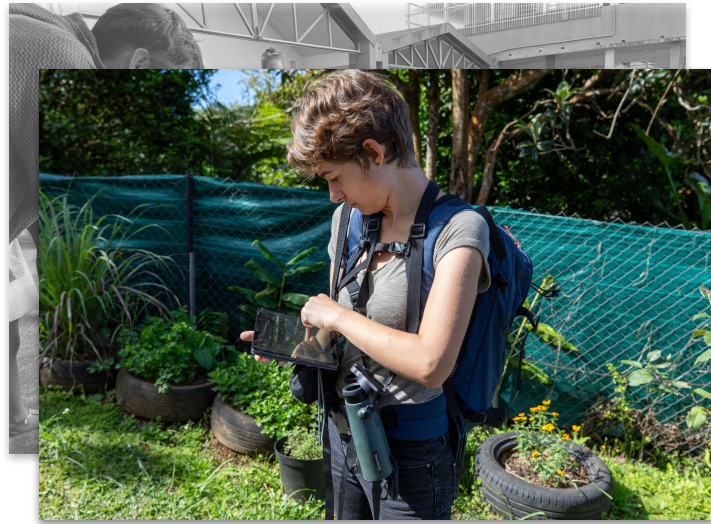
The **OUTRENOIR** program has received financial support from the CNRS through the MITI interdisciplinary programs.





# An example of “workshop area” for NEO: Reunion Island

- Implementation of transdisciplinary **workshops around the “nocturnal soundscapes”**
- **Step 2:** Retrieve recorders, carry out an in situ ecological & landscape diagnosis

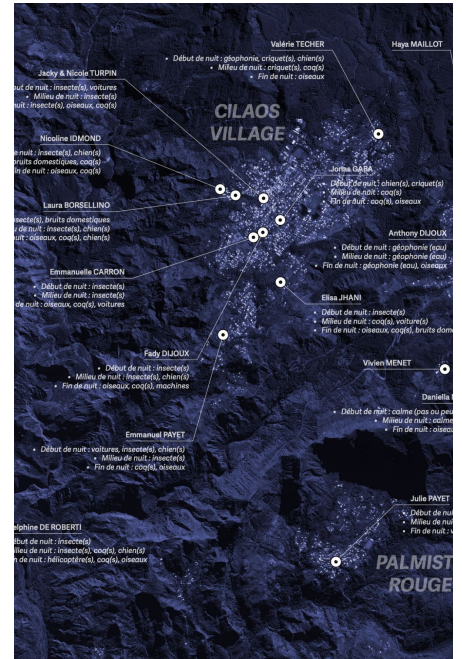
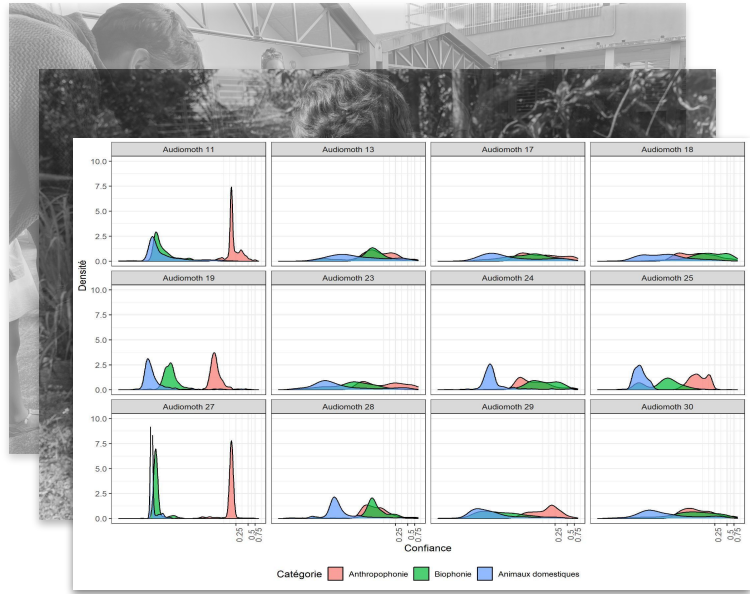


The **OUTRENOIR program** has received financial support from the CNRS through the MITI interdisciplinary programs.



# An example of "workshop area" for NEO: Reunion Island

- Implementation of transdisciplinary **workshops** around the "nocturnal soundscapes"
- **Step 3:** Data pre-processing through AI recognition and classification of sound events



The **OUTRENOIR** program has received financial support from the CNRS through the MITI interdisciplinary programs.



# An example of “workshop area” for NEO: Reunion Island

- Implementation of transdisciplinary **workshops** around the “nocturnal soundscapes”
- **Step 4:** Listen, annotate and play around nocturnal soundscapes — *Where? When? With whom?* (human & non-human otherness)

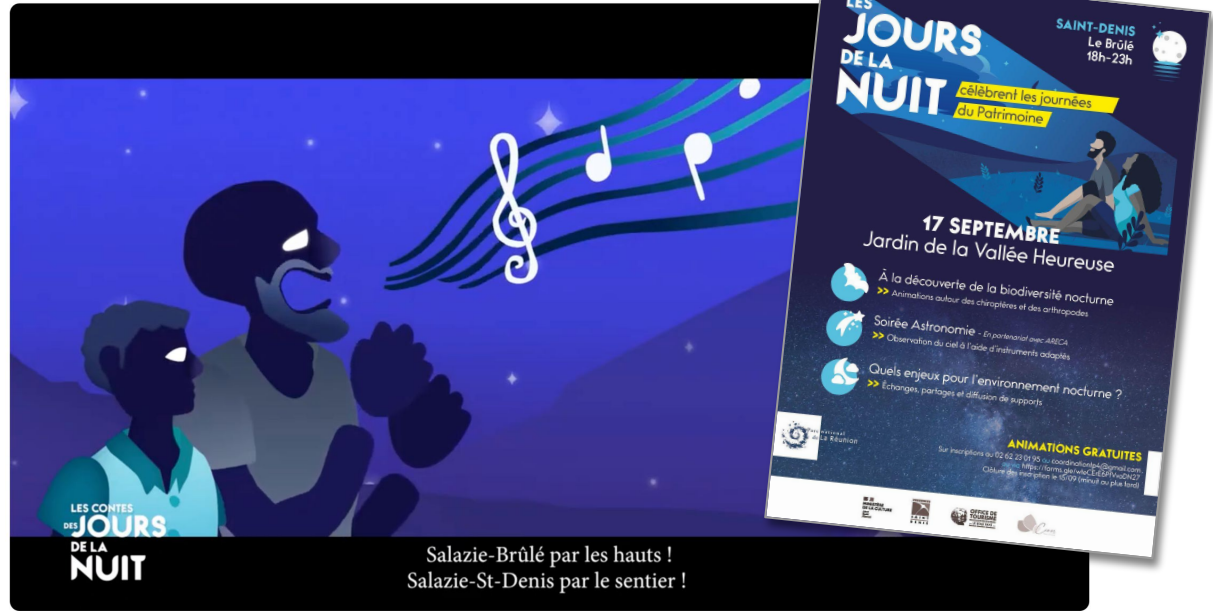


The **OUTRENOIR** program has received financial support from the CNRS through the MITI interdisciplinary programs.



## What effects will this transdisciplinary research have on the territory?

- **Appropriation of the theme** by La Réunion National Park
- Training of the Park staff
- Implementation of “The Days of the Night”, an event program built on a **social-ecological approach to the nocturnal environment**



Salazie - Brûlé par les hauts, un conte des Jours de la Nuit



S'abonner



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Source: Reunion Island National Park (2022).



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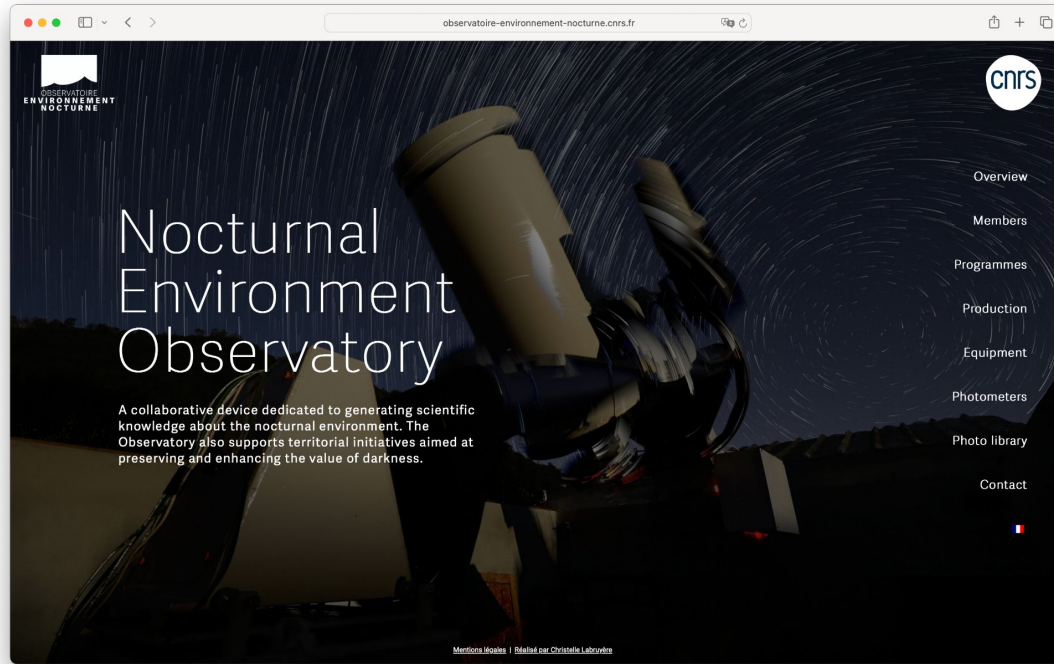


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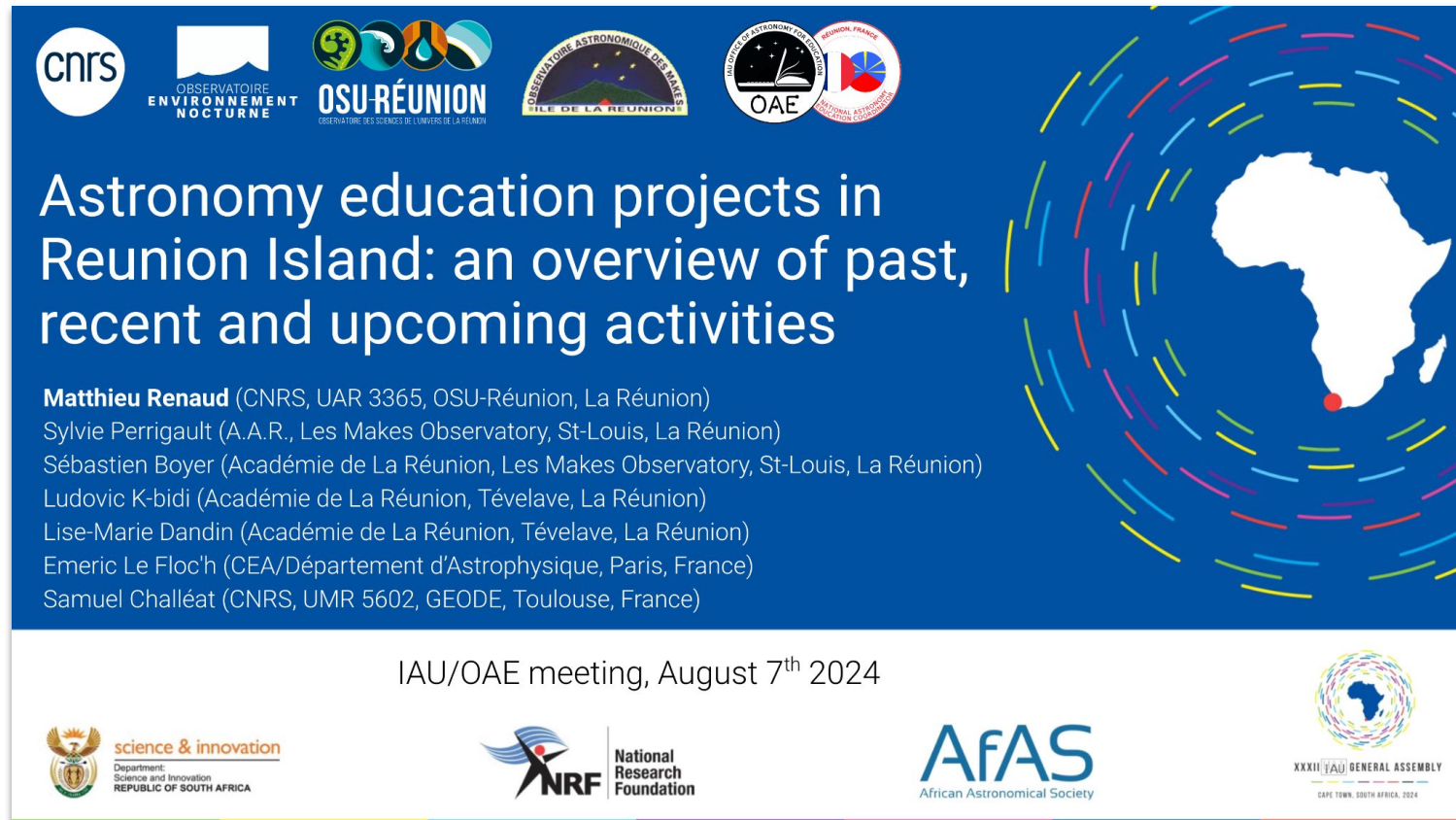
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*For more information on the educational activities carried out by the Nocturnal Environment Observatory on Reunion Island, see the communication by Renaud et alii:*




The slide features a dark blue background with a white silhouette of the African continent on the right side, surrounded by concentric, multi-colored dashed lines. At the top left, there are several logos: CNRS, Observatoire Environnement Nocturne, OSU-Réunion, Observatoire Astronomique des Makes Ile de la Réunion, OAE, and the logo for the Réunion France Regional Astronomy Commission. The main title is in large white font, and the list of authors is in smaller white font below it. At the bottom, there are logos for the Republic of South Africa (Department of Science and Innovation), NRF (National Research Foundation), AfAS (African Astronomical Society), and the XXXII IAU General Assembly (Cape Town, South Africa, 2024).


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# Astronomy education projects in Reunion Island: an overview of past, recent and upcoming activities


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Emeric Le Floc'h (CEA/Département d'Astrophysique, Paris, France)  
Samuel Challéat (CNRS, UMR 5602, GEODE, Toulouse, France)

IAU/OAE meeting, August 7<sup>th</sup> 2024

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