

BINA and beyond

10 years of successful scientific collaboration in astronomy

Peter De Cat

Royal Observatory of Belgium (ROB), Brussels, Belgium

<Peter.DeCat@oma.be>

Santosh Joshi

Aryabhata Research Institute of Observational Sciences (ARIES), Nainital, India

<santosh@aries.res.in>

Connection Belgium - India



Santosh Joshi
(ARIES, India)



Subject: Re: KASC WG3: K2 mission and other updates (reminder)
Date: Mon, 27 Jan 2014 09:25:19 +0530 (IST)
From: Dr. Santosh Joshi <santosh@aries.res.in>
To: Peter De Cat <Peter.DeCat@oma.be>

Hi Peter,
Please let me know if you are interested in the following programme:
http://www.dst.gov.in/whats_new/whats_new13/cop_belcall2014.pdf
Regards
Santosh
(<http://www.aries.res.in>)



Peter De Cat
(ROB, Belgium)



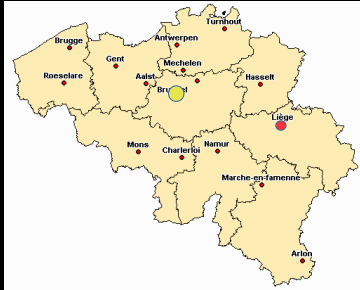
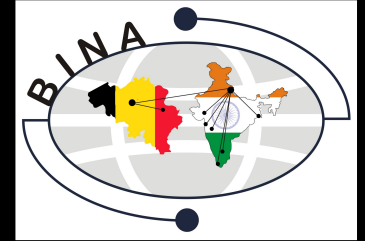
Indo-Belgian telescopes (cf. talks Olivier Pirnay, Jean Surdej)



Connection Belgium - India

- Belgo-Indian Network for Astronomy and astrophysics

➔ BINA-1 (2014-2018) Focus on instrument development (DOT+ILMT)

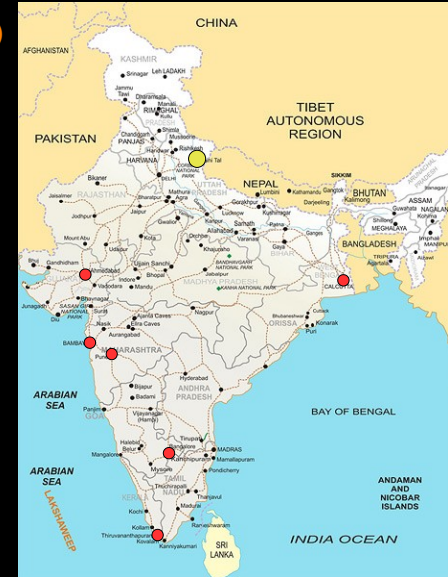


- Belgian partners (PI: Peter De Cat)

- ROB (Royal Observatory of Belgium; Brussels)
- ULiège (Université de Liège; Liège)

- Indian partners (PI: Santosh Joshi)

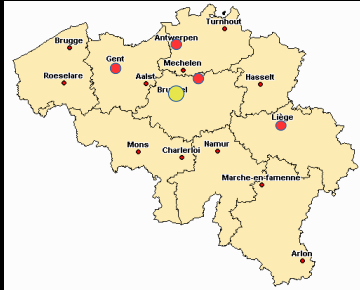
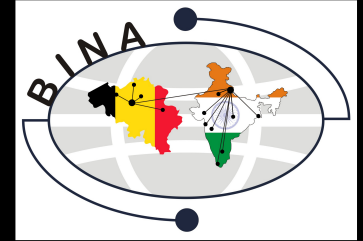
- ARIES (Aryabhata Research Institute of Observational Sciences; Nainital)
- IIA (Indian Institute of Astrophysics; Bangalore)
- IIST (Indian Institute of Space Science & Technology; Trivandrum)
- IUCAA (Inter-University Centre for Astronomy and Astrophysics; Pune)
- PRL (Physical Research Laboratory; Ahmadabad)
- SBNBCBS (S.N. Bose National Centre for Basic Sciences; Kolkata)
- TIFR (Tata Institute of Fundamental Research; Mumbai)



Connection Belgium - India

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- ➔ BINA-1 (2014-2018) Focus on instrument development (DOT+ILMT)
- ➔ BINA-2 (2018-2023) Focus on scientific projects (telescopes of interest)

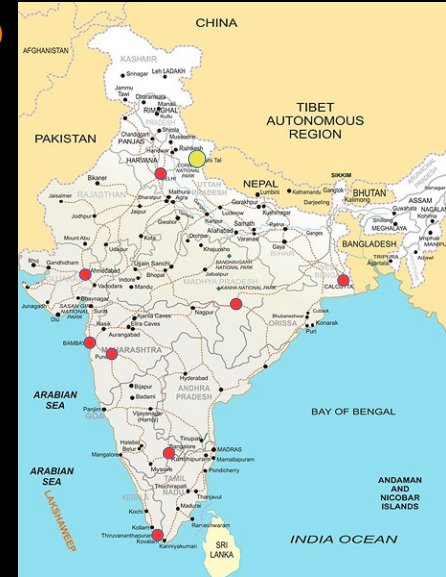


- Belgian partners (PI: Peter De Cat)

- ROB (Royal Observatory of Belgium; Brussels)
- KU Leuven (Katholieke Universiteit Leuven; Leuven)
- UAntwerp (Universiteit Antwerpen; Antwerp)
- UGent (Universiteit Gent; Ghent)
- ULB (Université Libre de Bruxelles; Brussels)
- ULiège (Université de Liège; Liège)

- Indian partners (PI: Santosh Joshi)

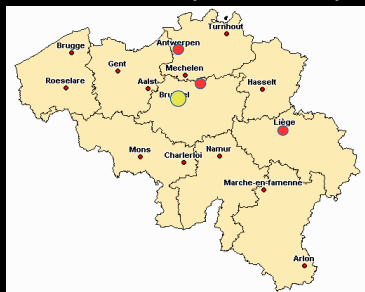
- ARIES (Aryabhata Research Institute of Observational Sciences; Nainital)
- DU (Delhi University; Delhi)
- HBCSE (Homi Bhabha Centre for Science Education; Mumbai)
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- KU (Kumaun University; Nainital)
- NCRA (National Center for Radio Astrophysics; Pune)
- PRL (Physical Research Laboratory; Ahmadabad)
- RSU (Pt. Ravi Shankar University; Raipur)
- SBNCBS (S.N. Bose National Centre for Basic Sciences; Kolkata)
- TIFR (Tata Institute of Fundamental Research; Mumbai)



Connection Belgium - India

• Belgo-Indian Network for Astronomy and astrophysics

- ➔ **BINA-1** (2014-2018) Focus on instrument development (DOT+ILMT)
- ➔ **BINA-2** (2018-2023) Focus on scientific projects (telescopes of interest)
- ➔ **BIPASS** (2022-2026) **Focus on spectroscopy** (data products and science)



Network activities

Belgian Science Policy Office
(BELSPO; Govt. of Belgium)

International Division,
Department of Science and Technology
(DST; Govt. of India)



• Belgian partners (PI: Laurent Mahy)

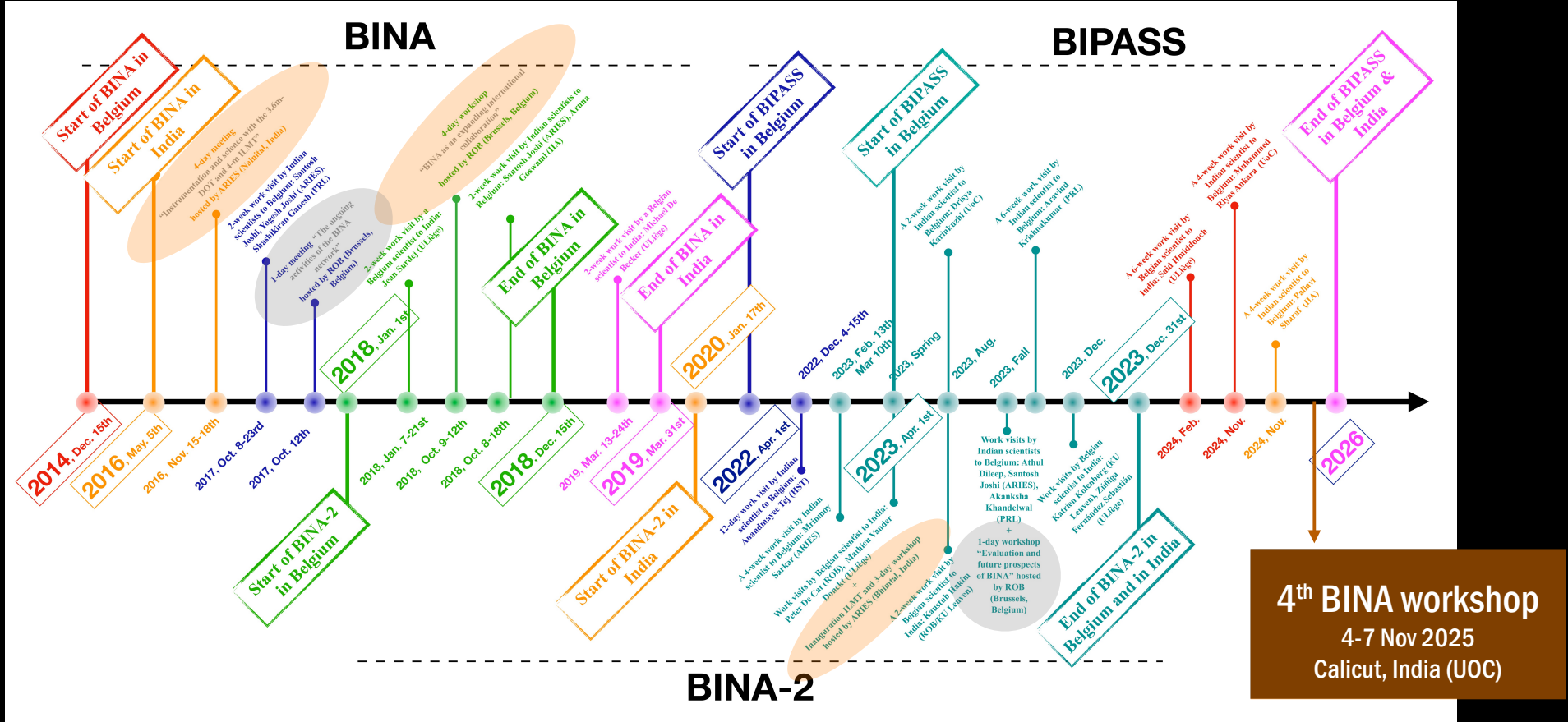
- **ROB** (Royal Observatory of Belgium; Brussels)
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- **UAntwerp** (Universiteit Antwerpen; Antwerp)
- **UGent** (Universiteit Gent; Ghent)
- **ULB** (Université Libre de Bruxelles; Brussels)
- **ULiège** (Université de Liège; Liège)
- **VUB** (Vrije Universiteit Brussel; Brussels)

• Indian partners (PI: Shashikiran Ganesh)

- **ARIES** (Aryabhata Research Institute of Observational Sciences; Nainital)
- **DU** (Delhi University; Delhi)
- **HBCSE** (Homi Bhabha Centre for Science Education; Mumbai)
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- **PRL** (Physical Research Laboratory; Ahmadabad)
- **RSU** (Pt. Ravi Shankar University; Raipur)
- **SNBNCBS** (S.N. Bose National Centre for Basic Sciences; Kolkata)
- **TIFR** (Tata Institute of Fundamental Research; Mumbai)
- **UOC** (University of Calicut; Calicut)



Network activities



Science topics

A large variety of
telescopes and
instruments

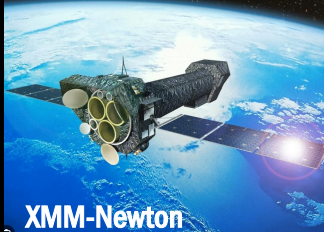
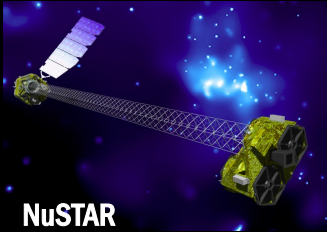
- Sun (our star)
- Solar System (planets, moons, asteroids, comets)
- Extrasolar Planets and Exomoons (planets and moons orbiting a star other than the Sun)
- Massive stars
- Asteroseismology (study of oscillations in stars to get indirect information about their interior)
- Nucleosynthesis (processes in stars and supernovae that create elements, composition of atmosphere of stars)
- Stellar multiplicity (stars that exist in multiple systems; e.g. binaries)
- Polars (a type of binary star system involving magnetic interaction)
- Optical Polarisation of Open Star Clusters (clusters of stars within the Milky Way)
- Transients (temporary astronomical events, often occurring in our galaxy or nearby galaxies; e.g. supernovae)
- Galaxies (study of galaxies in the universe)
- Gravitational lenses (multiple images of distant object due to light bending by gravity of massive object in front)
- Dark Matter (study of dark matter which affects galaxies and cosmic structures)



Collaboration STAR-ULiège (Liège, Be) - ARIES + IIST (Trivandrum, In)

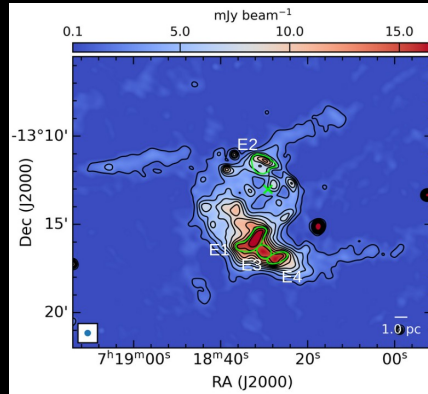
• Research in Massive Binaries

- Massive stars in binary systems with colliding winds
- Use of space telescopes (XMM-Newton, NuStar, Swift...) for X-rays (initiated in 2016)
- Use of ground-based telescopes (GMRT@NRCA-TIFR) for radio waves (initiated in 2018)



Memorandum of Understanding

Faculty/Student exchange, co-supervision of PhD theses, research collaboration



Wind-ISM interaction

(Saha et al., 2025, PhD thesis)



Prof. A. Tej
(IIST, In)



Dr. J.C. Pandey
(ARIES, In)



Prof. M. De Becker
(ULiège, Be)



M. Tasseroul
(ULiège, Be)



A. Blanco
(ULiège, Be)



Dr. A. Saha
(IIST, In)



Dr. B. Arora
(ARIES, In)
(ULiège, Be)
(IIST, In)

co-supervision

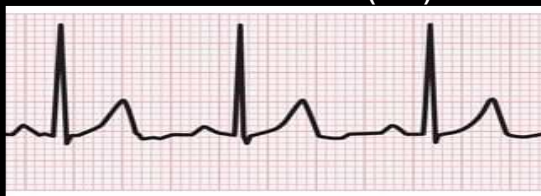
3-months stay at ULiège as PhD student (2018)

Wallonia-Brussels International post-doctoral fellowship (2022- 2024)

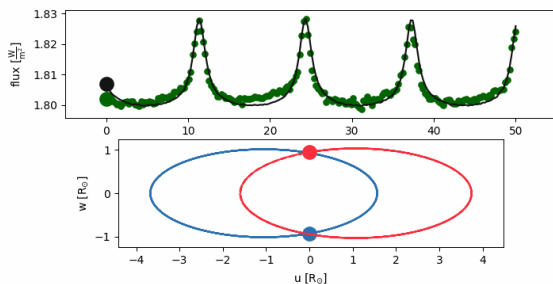
Collaboration between several partner institutes

- Research in **Chemically Peculiar Stars**
 - Composition of the atmosphere is different compared to the Sun
 - Search for short-period pulsations (δ Scuti-type star) $\Rightarrow$ **Asteroseismology**

Heartbeat of human (ECG)



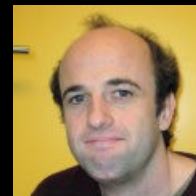
Heartbeat of **HD73619** (lightcurve)



(Joshi et al., 2022, MNRAS, 501, 5854)

Result:

Discovery of first
heartbeat chemically
peculiar star



Prof. M.-A. Dupret
(ULiège, Be)



Dr. P. De Cat



Dr. S. Joshi



Dr. P. Lampens
(ROB, Be)



M. Sarkar



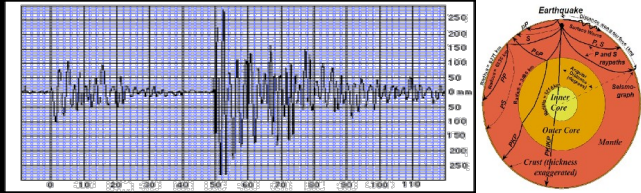
A. Dileep
(ARIES, In)



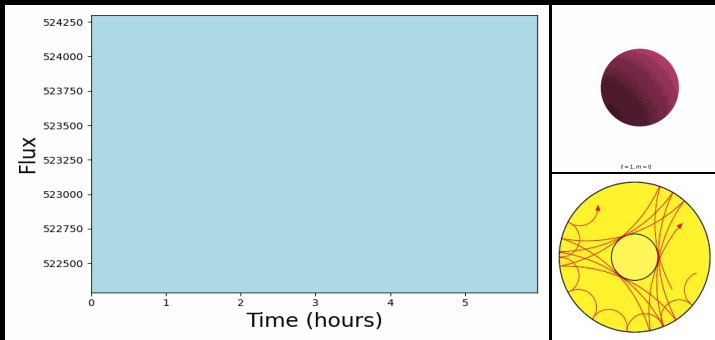
Collaboration between several partner institutes

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Seismology of Earth



Seismology of HD118660



(Sarkar et al., 2024, MNRAS, 532, 3211)



Prof. S.K. Ganesh
(PRL, In)



Dr. J. Adasurya
(UOC, Sri Lanka)

co-supervision
link to Sri Lanka

Result:

Mass = $1.77 M_{\odot}$
Radius = $2.06 R_{\odot}$
Age = 1.20 Gyr



Prof. M.-A. Dupret
(ULiège, Be)



Dr. P. De Cat



Dr. S. Joshi



Dr. P. Lampens
(ROB, Be)



M. Sarkar



Dr. O. Trust
(MUST, Uganda)

co-supervision
link to Africa



A. Dileep
(ARIES, In)



Collaboration between several partner institutes

- Collaboration on

- ➔ Science **Communication & Outreach**

- Public talks
 - Cultural astronomy research
 - Science & Society (Pune Knowledge Cluster, Pune Science Center)

- ➔ Astronomy **Education** (school and university level)

- Guest lectures of Indian and Belgian researchers
 - Development of lesson modules on telescope use etc.

- ➔ **Citizen Science**

- Best practices
 - Professional-Amateur Collaborations in Astronomy

- ➔ **Inclusive astronomy**

- Sonification techniques



Dr. P. Hasan
(MANUU, In)



Prof. A.K. Kembhavi
(IUCAA, In)



Prof. K. Kolenberg
(UAntwerp, Be)
(KU Leuven, Be)
(VUB, Be)



Long term view on Connection Belgium – India

• Belgian partner Institutes

- ROB (P. De Cat & L. Mahy)
- ULiège (M. De Becker)
- UAntwerpen
- KU Leuven
- ULB
- VUB



• Indian partner Institutes

- ARIES (S. Joshi)
- IIA
- IIST
- ISRO
- IUCAA
- KU
- MANUU
- NCRA-TIFR
- NIT-Rourkela
- PRL (S. Ganesh)
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- UOC

Belgo-Indian Network for Astronomy and astrophysics

Gather and stimulate all joint Indo-Belgian initiatives related to astronomy and space science

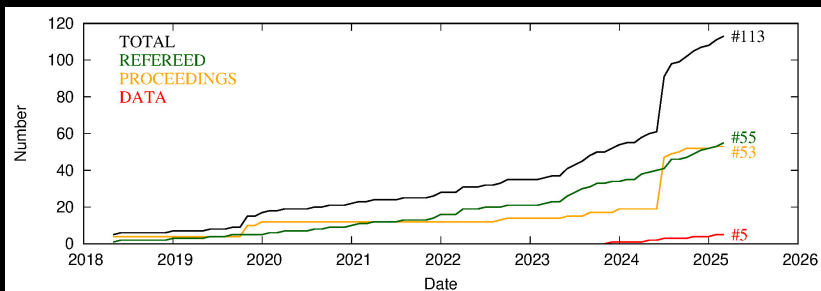
Network Activities

Research visits
Workshops

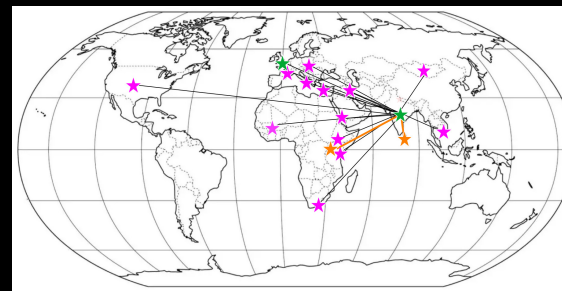
PhD students

Post-doctoral researchers

Education
Citizen Science
Outreach



bina.oma.be



Joint funding?

Thank
you!