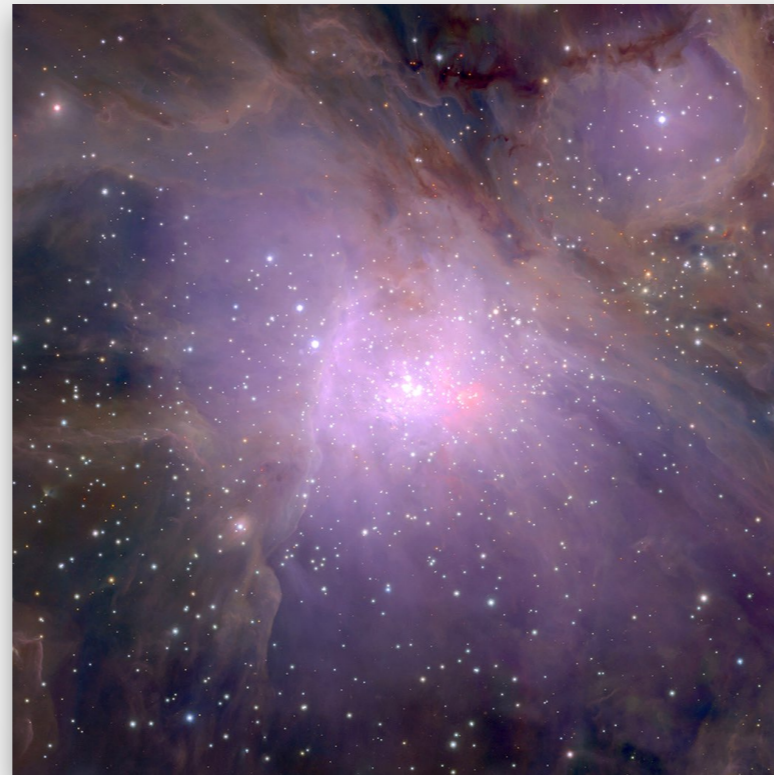


VISIONS

VISTA Star Formation Atlas



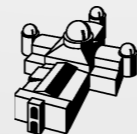
Stefan Meingast

João Alves (PI), Herve Bouy

Joana Ascenso, **Amelia Bayo**, Emmanuel Bertin, Anthony Brown, Jos de Bruijne, Jan Forbrich, **Josefa Großschedl**, Alvaro Hacar, Birgit Hasenberger, Jouni Kainulainen, Jens Kauffmann, Rainer Köhler, Karolina Kubiak, Kieran Leschinski, Marco Lombardi, **Diego Mardones**, Andre Moitinho, Karla Peña Ramirez, **Monika Petr-Gotzens**, Timo Prusti, Luis Sarro, Thomas Robitaille, Ronny Ramlau, Rainer Schödel, Paula Teixeira, Eleonora Zari, Werner Zeilinger



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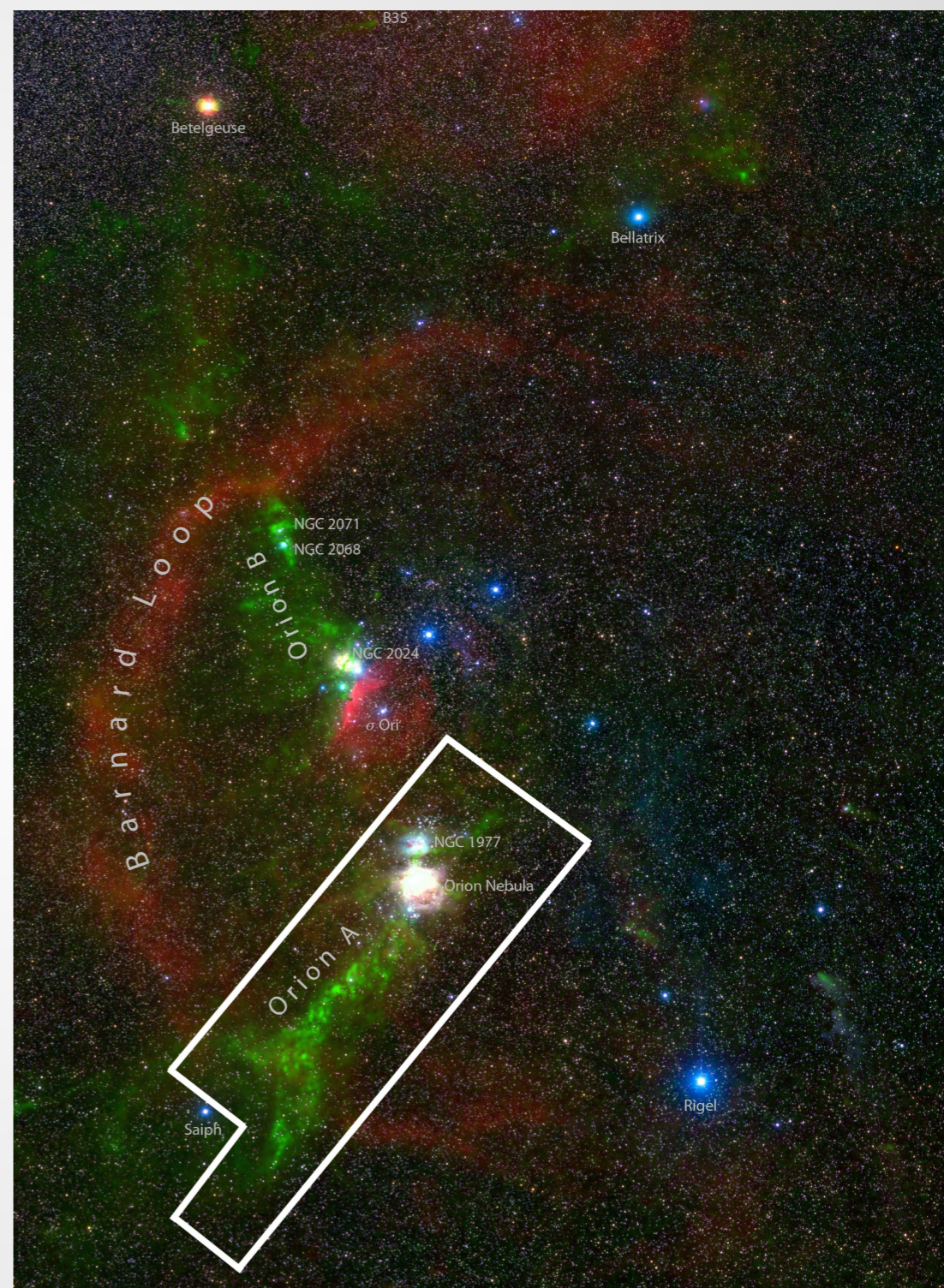
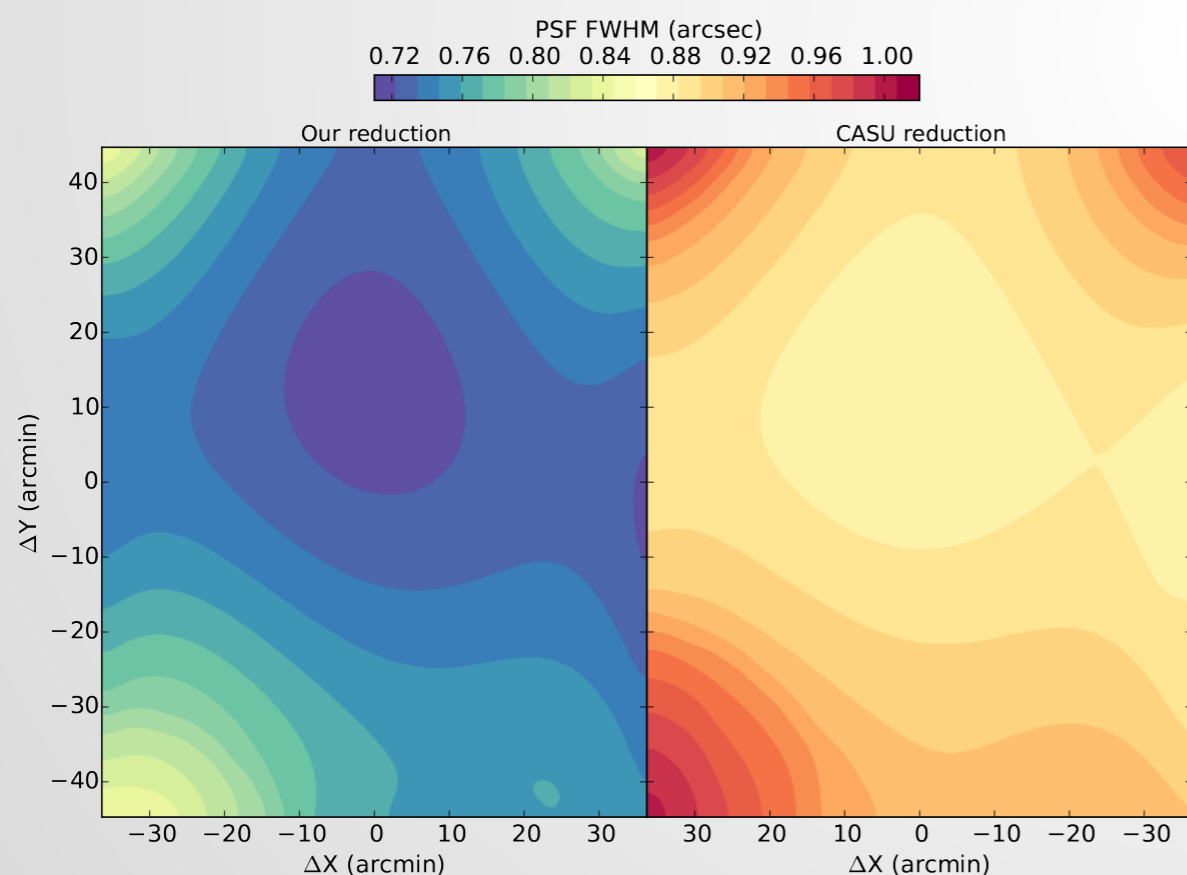


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VISIONS - How it started

- VISION (Meingast et al. 2016)
33h VIRCAM@VISTA
J/H/K_s survey of Orion A (18.2 deg²)
- Data reduction improves pipeline
20% better image quality
- Completeness @19-20 mag
(3-4 mag deeper than 2MASS)



Multi-epoch
near-infrared imaging

Reddening law

550 deg²

Cluster formation

2017 - 2020

Dust properties

J/H/Ks

VISIONS
VISTA Star Formation Atlas

Jets/Outflows

552h 37m 24s

Wide multiples

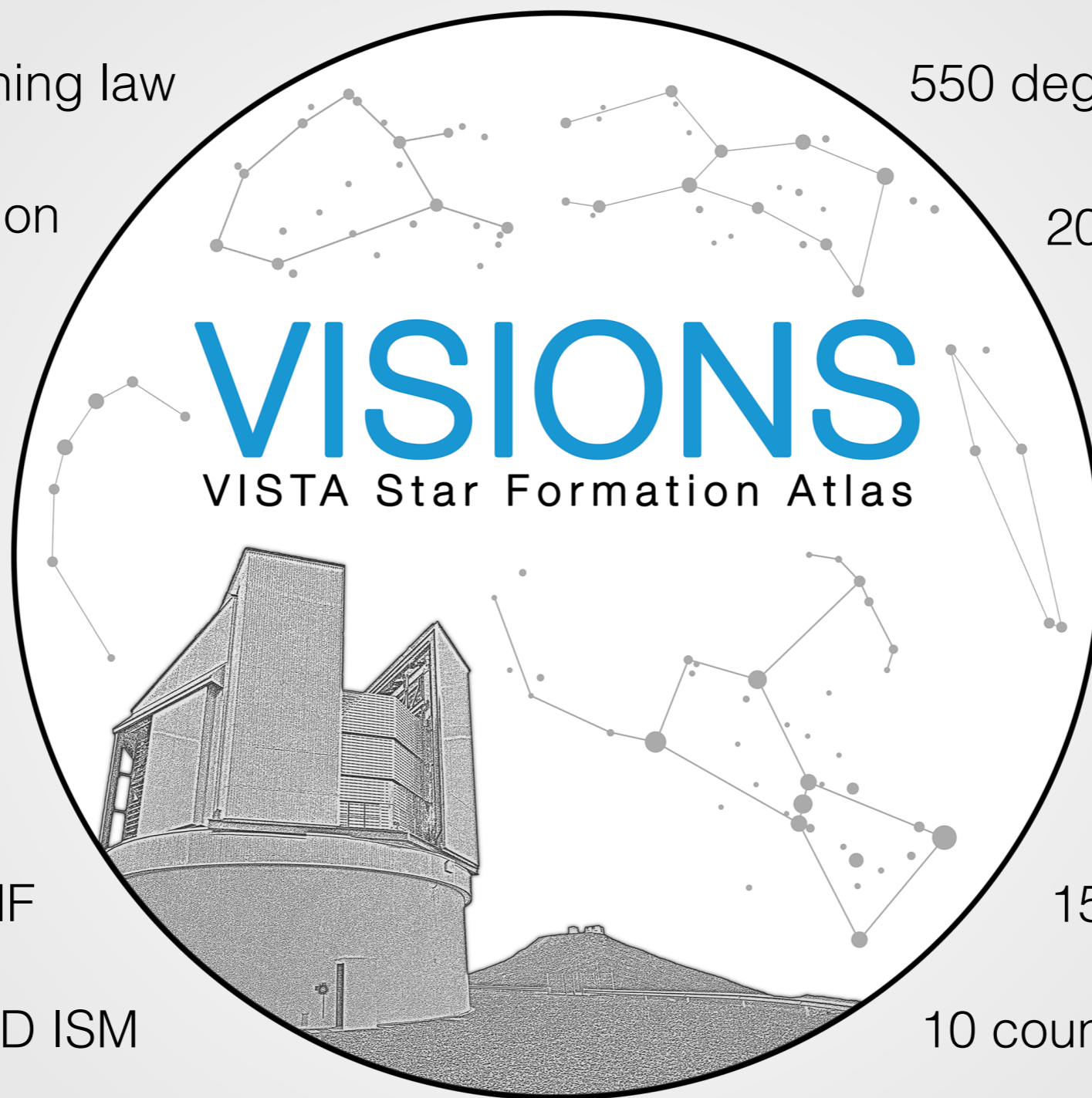
30 members

CMF/IMF

15 institutes

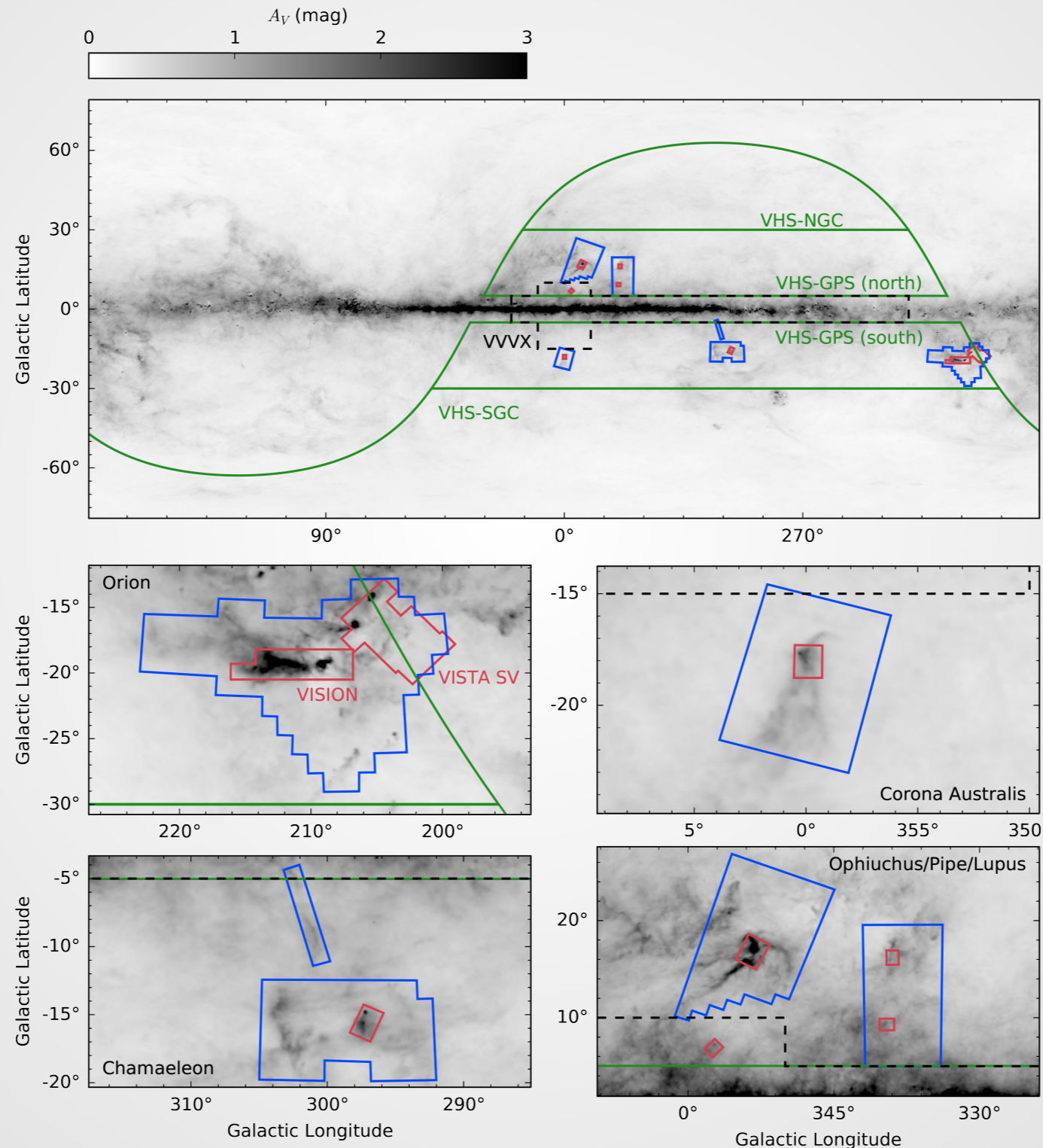
3D ISM

10 countries



VISIONS in a nutshell

- **Wide survey**
6 epochs
proper motions
complementary to VHS
7 - 10 yrs baseline
- **Deep survey**
VISION-like
Single epoch high S/N
- **Control survey**
high S/N extinction-free
- **P99**
Ophiuchus, Lupus,
Corona, Chamaeleon
- **DR1 end of 2018**
Final DR 2020-2021

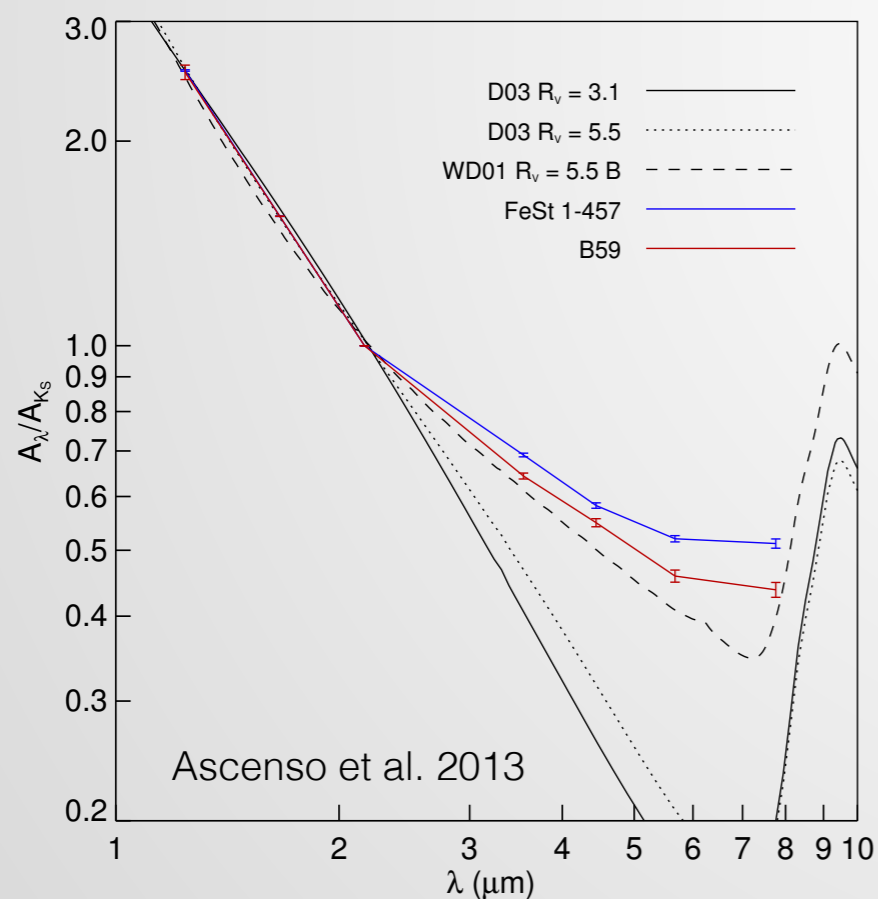
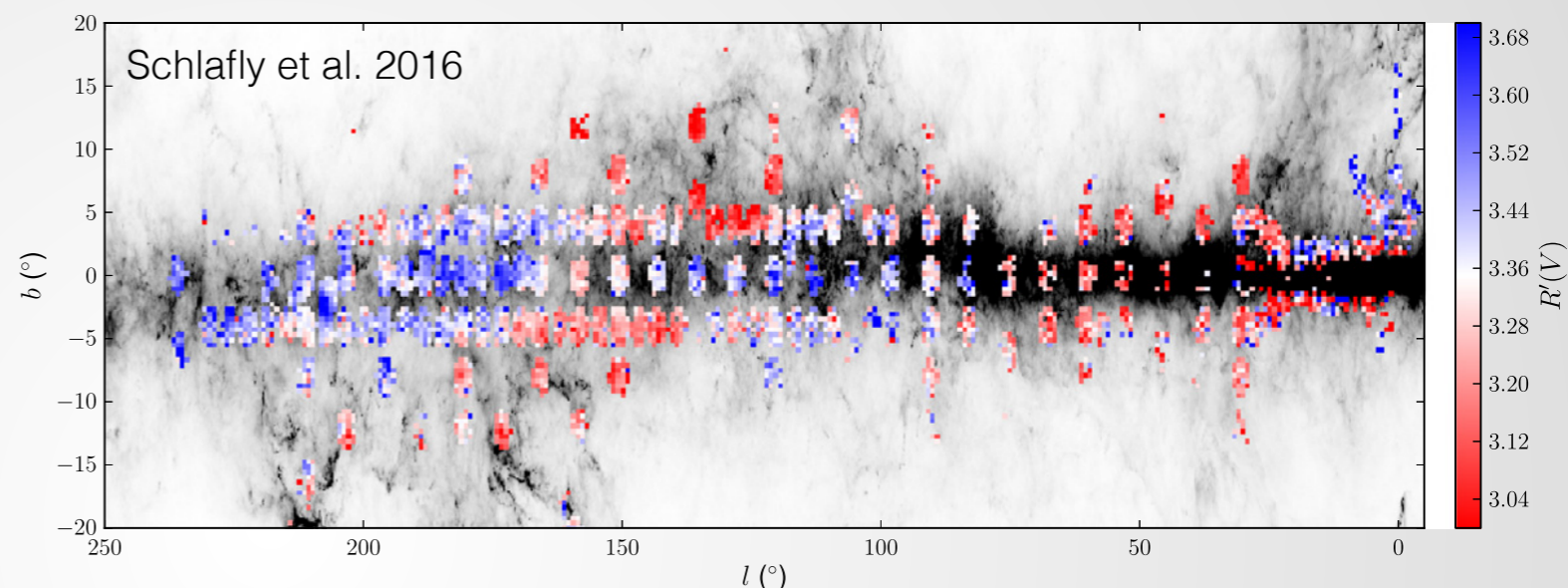


- **Orion**
171 deg², 152h
- **Chamaeleon**
84 deg², 90h
- **Corona Australis**
38 deg², 42h
- **Ophiuchus**
140 deg², 150h
- **Lupus**
105 deg², 111h
- **Pipe**
1.5 deg², 6h

VISIONS - Selected science cases

Molecular cloud properties

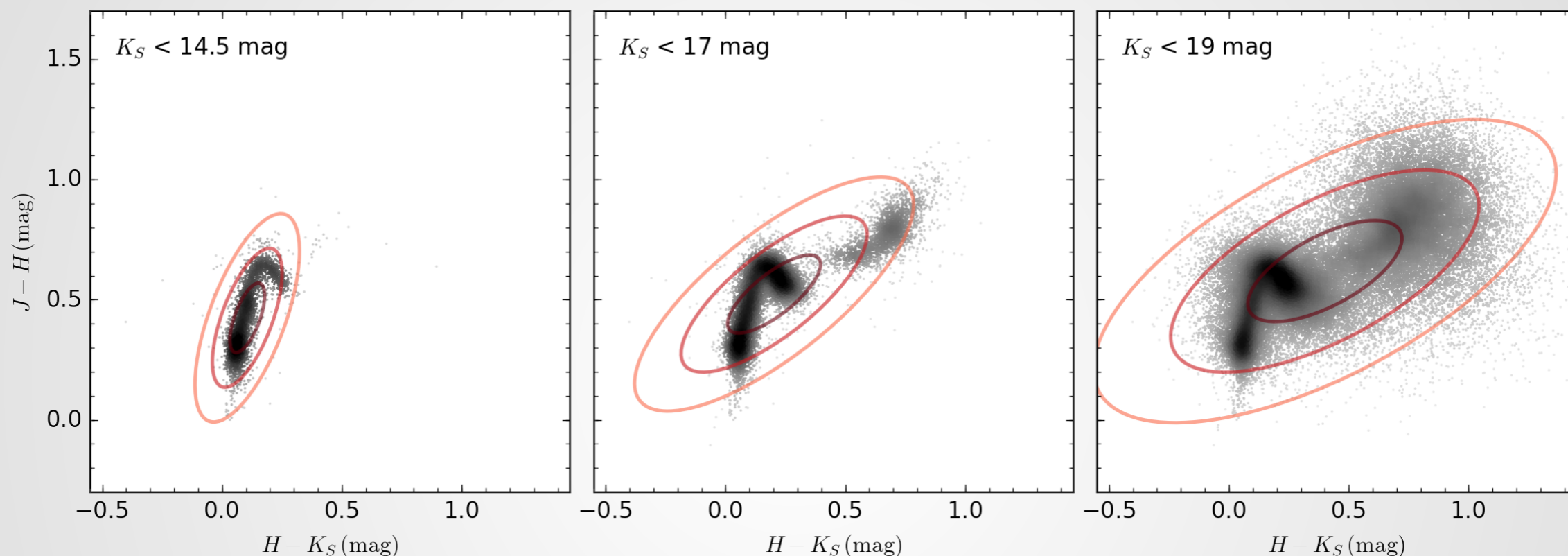
- **Wide-area $R(V)$ variations**
Schlafly+ 2016, Nataf+ 2016
- **Star-forming regions excluded**
Environmental dependency



- **Universal NIR/MIR extinction law?**
Star-forming vs. starless cores
- **Origin of variations?**
Grain growth, influence of feedback
- **Synergy with Spitzer**
Comparing NIR and MIR

VISIONS - Selected science cases

Estimating Extinction using Unsupervised Machine Learning
(Meingast et al. 2017)



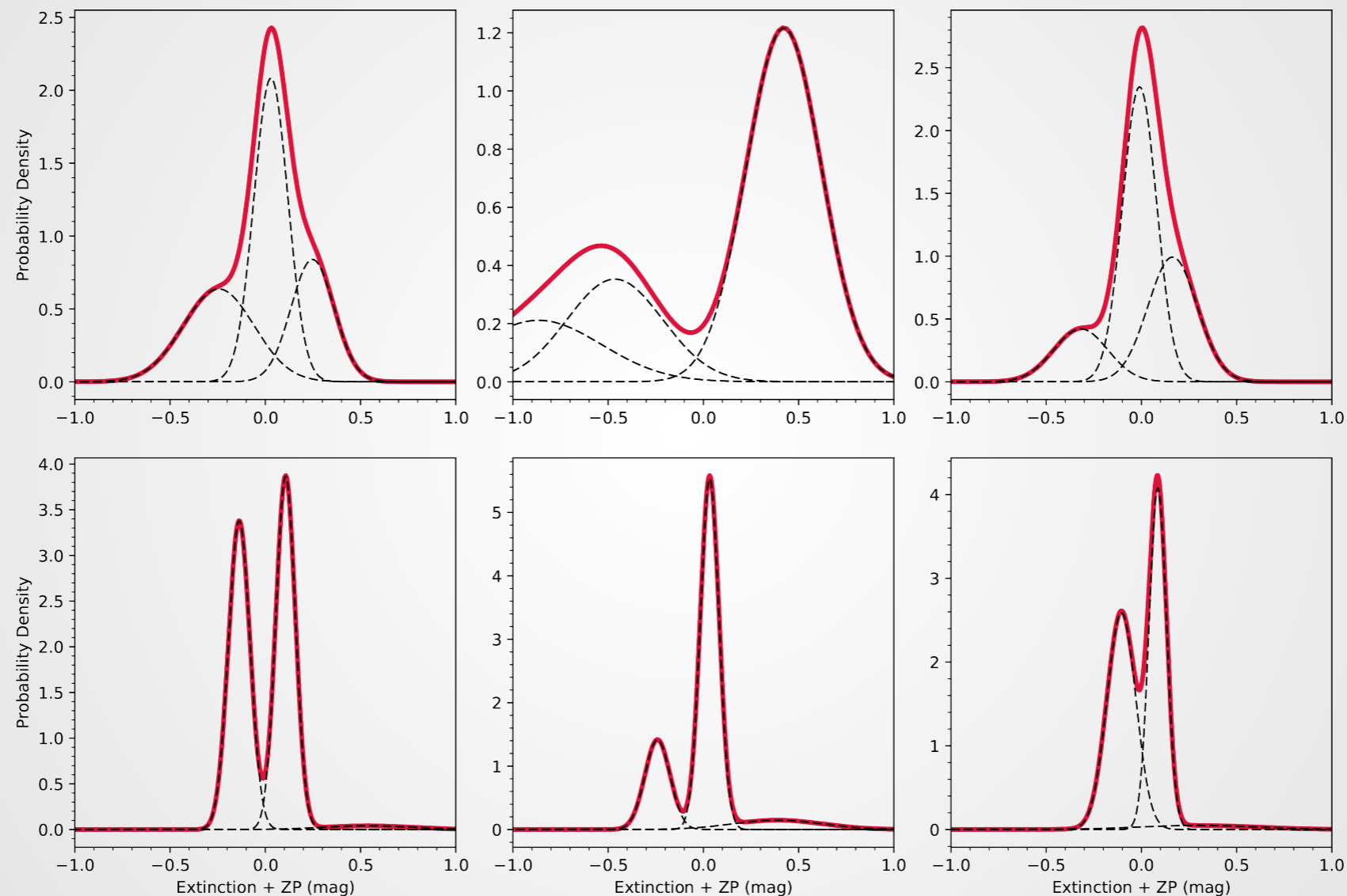
- **Dust thermal emission**
 - + large dynamic range
 - depends on dust properties
- **Molecular line emission**
 - + high resolution
 - optically thick emission

- **Dust extinction**
 - + independent of dust properties (NIR)
 - number of background sources

$$\begin{aligned} E(m_1 - m_2) &= (m_1 - m_2) - (m_1 - m_2)_0 \\ &= (m_1 - m_{1,0}) - (m_2 - m_{2,0}) = A_{m_1} - A_{m_2} \end{aligned}$$

VISIONS - Selected science cases

Estimating Extinction using Unsupervised Machine Learning
(Meingast et al. 2017)



- **Unsupervised Machine Learning**
Statistically derived probability densities
Arbitrary feature combinations

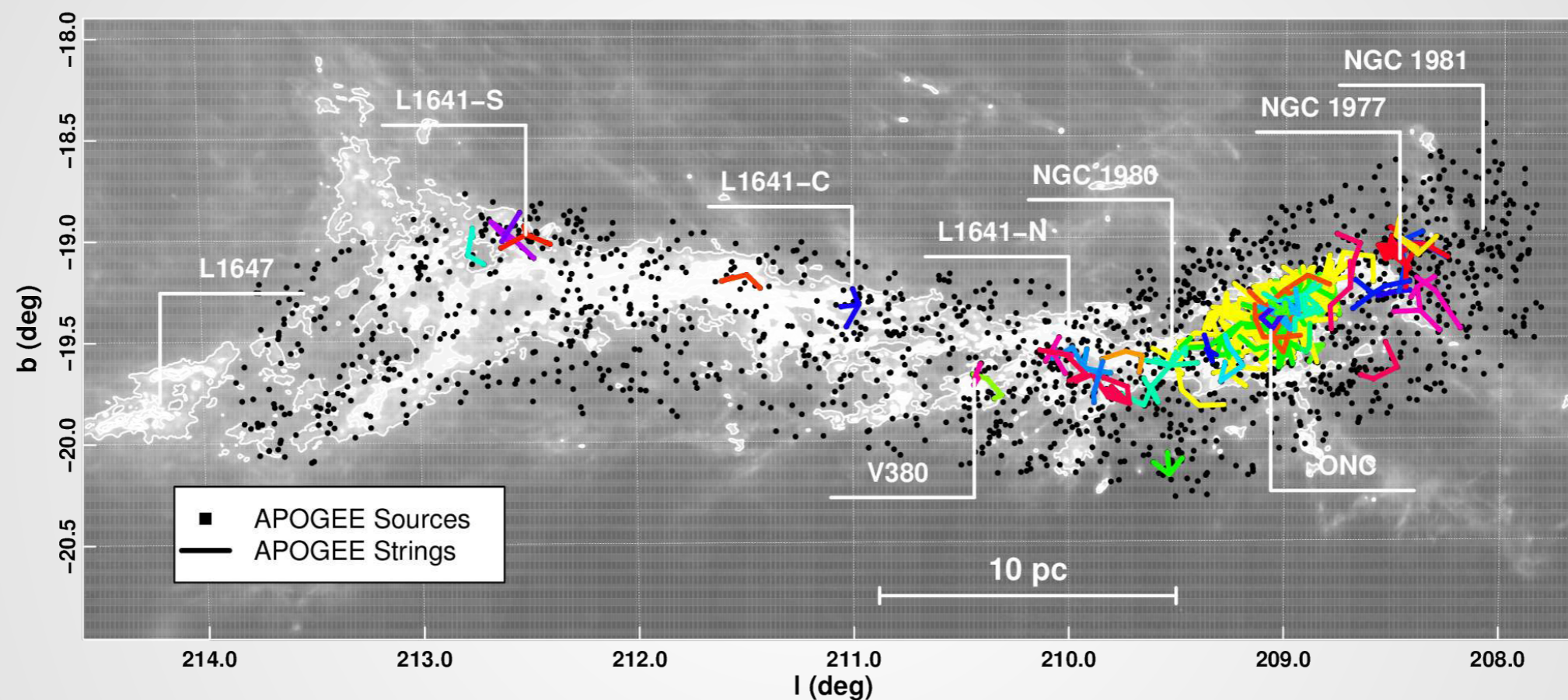
- **Open source Python code**
Fast and simple front-end



visions.univie.ac.at

VISIONS - Selected science cases

Evolution of star-forming regions

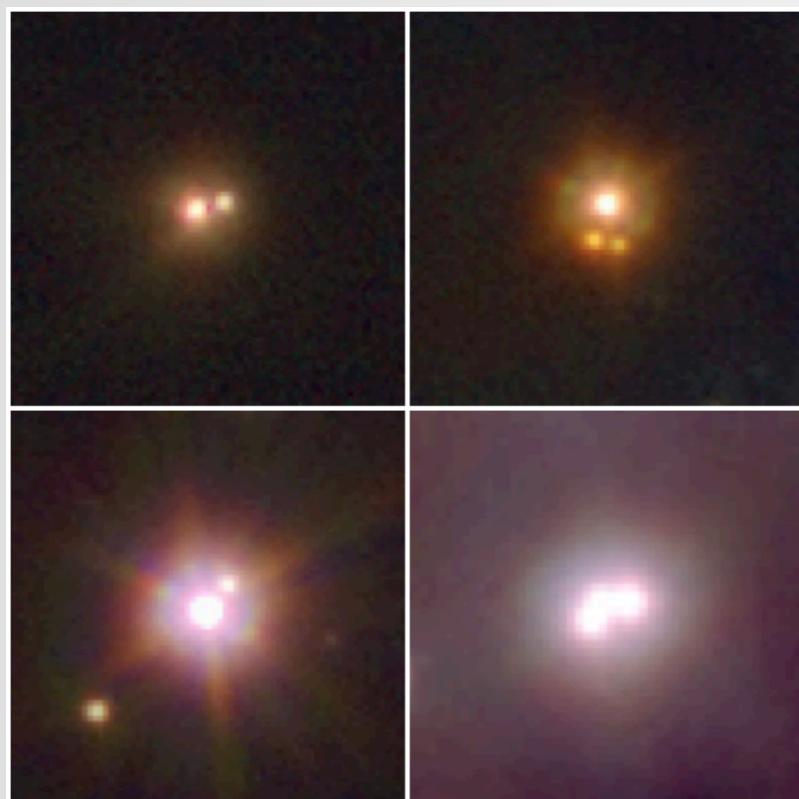


- Synergy with Apogee and Gaia
 - <10% of Protostars in Gaia
 - 3D space motion
 - 0.1-0.3 km/s transverse velocity

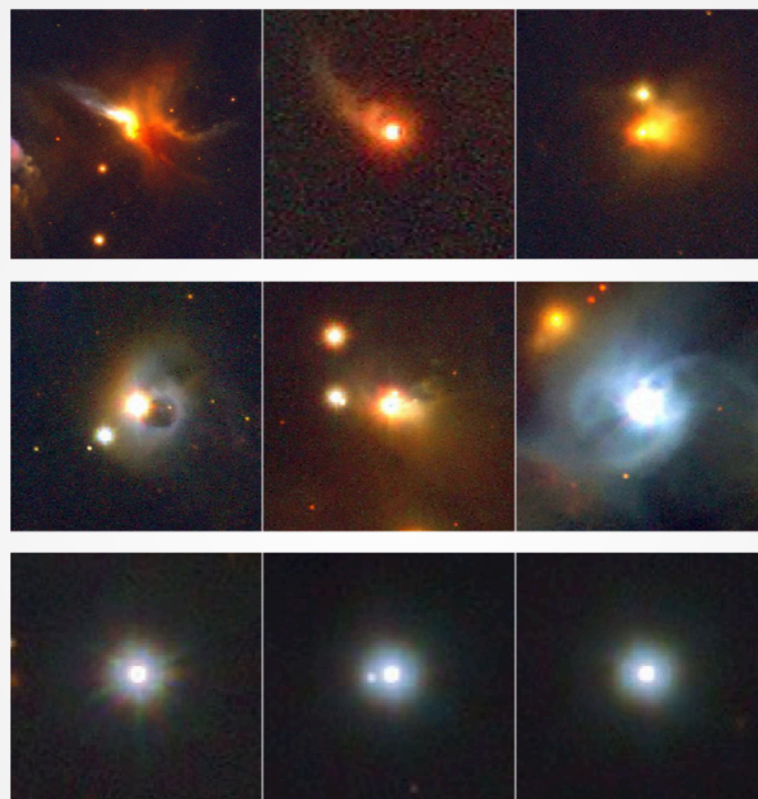
- Substructure at small scales
 - Apogee strings
 - RV correlation of YSOs and CO (Hacar et al. 2016)

VISIONS - Selected science cases

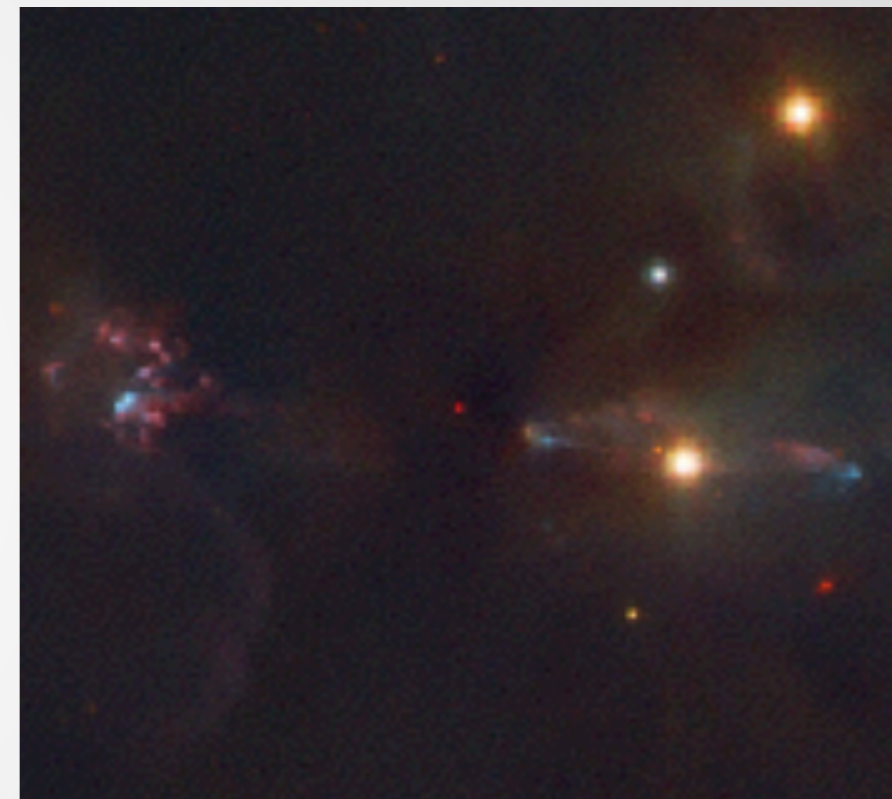
YSO imaging



Wide multiple systems



YSO Morphology



Jets and outflows