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AntBot: a Fully Insect-Inspired Hexapod Homing like Desert Ants

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► **To cite this version:**

Julien Dupeyroux, Julien Serres, Stéphane Viollet. AntBot: a Fully Insect-Inspired Hexapod Homing like Desert Ants. 4th International Conference on Invertebrate Vision (ICIV), Aug 2019, Bäckaskog, Sweden. . hal-02272156

HAL Id: hal-02272156

<https://amu.hal.science/hal-02272156>

Submitted on 27 Aug 2019

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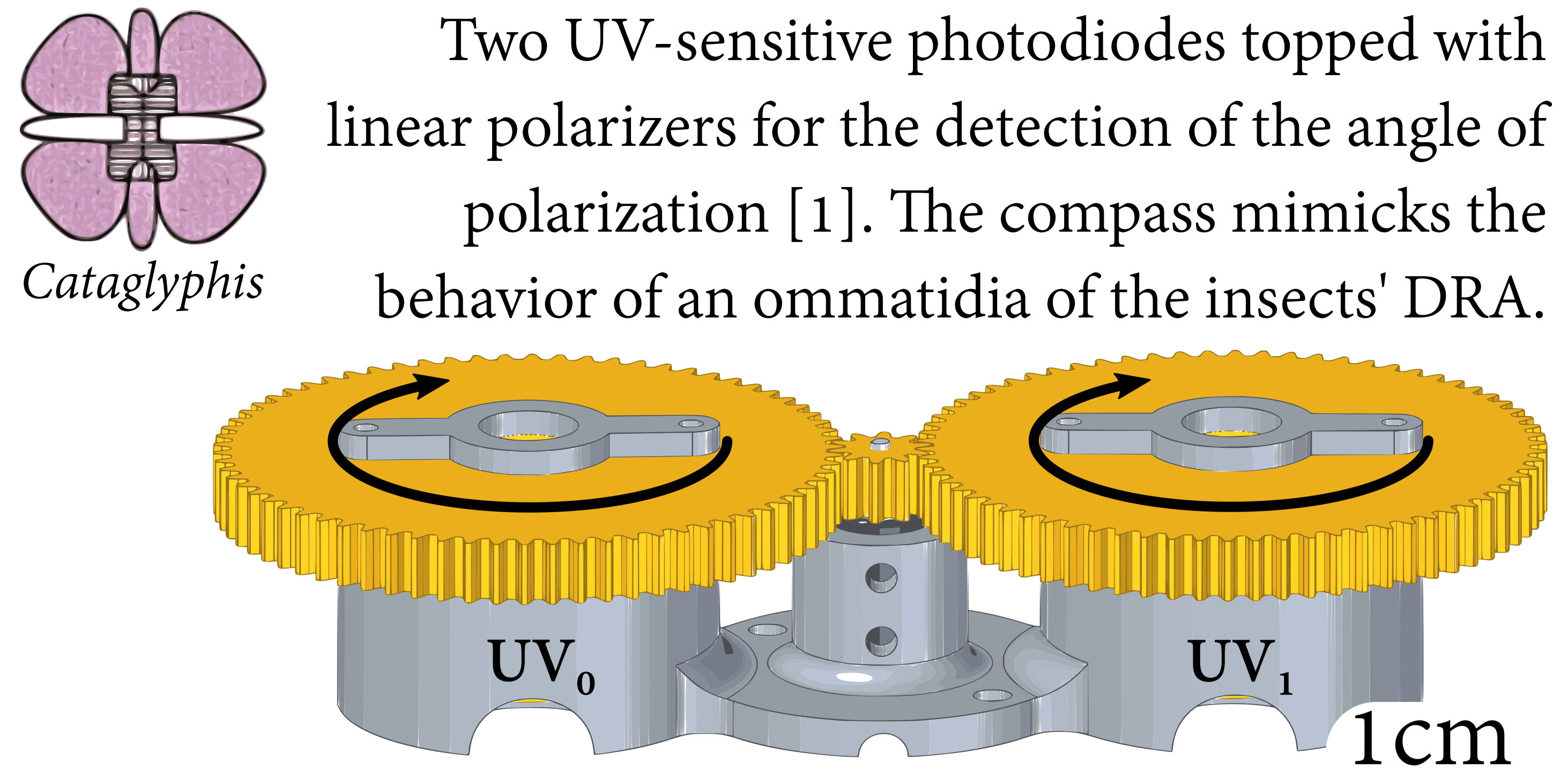
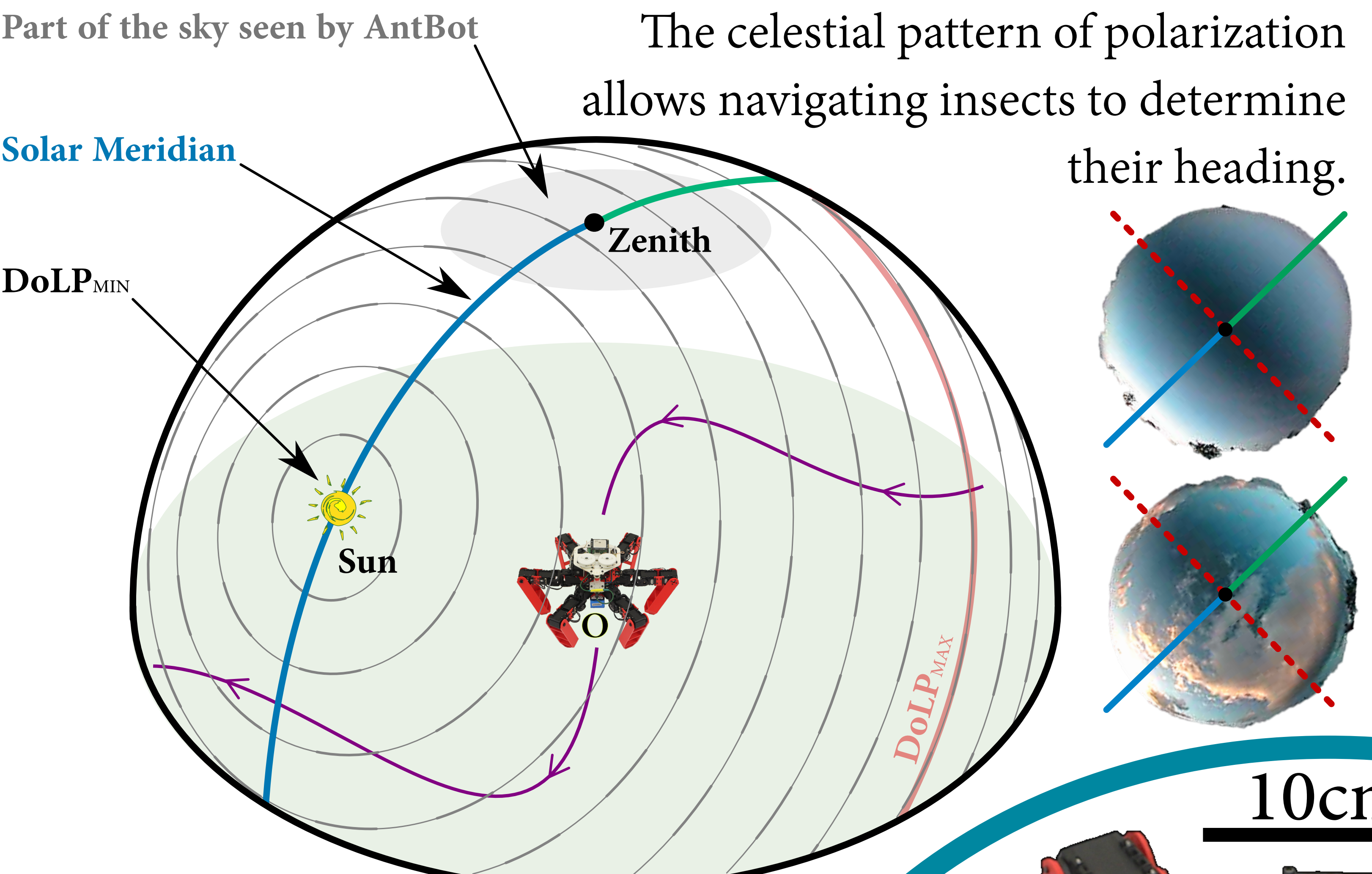
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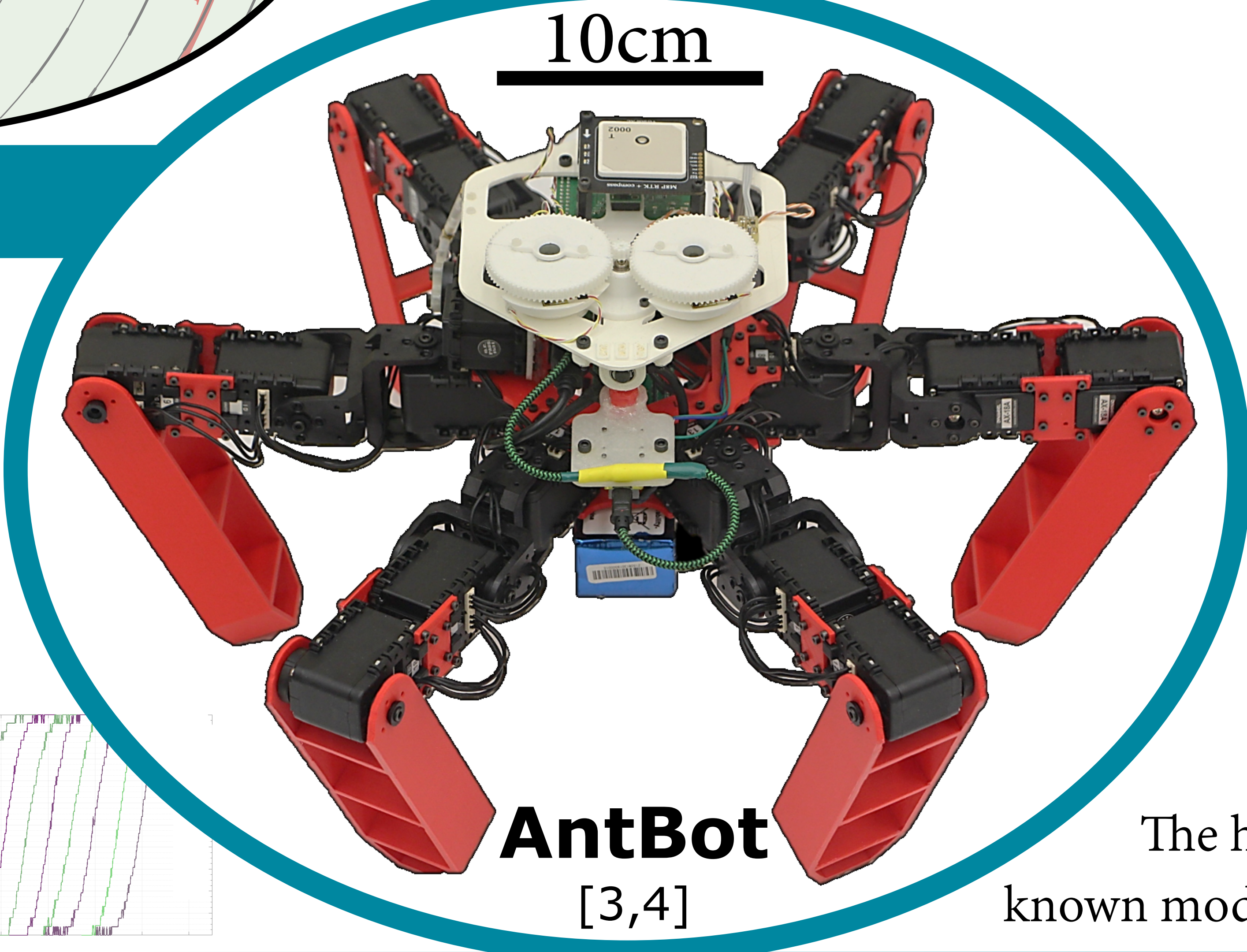
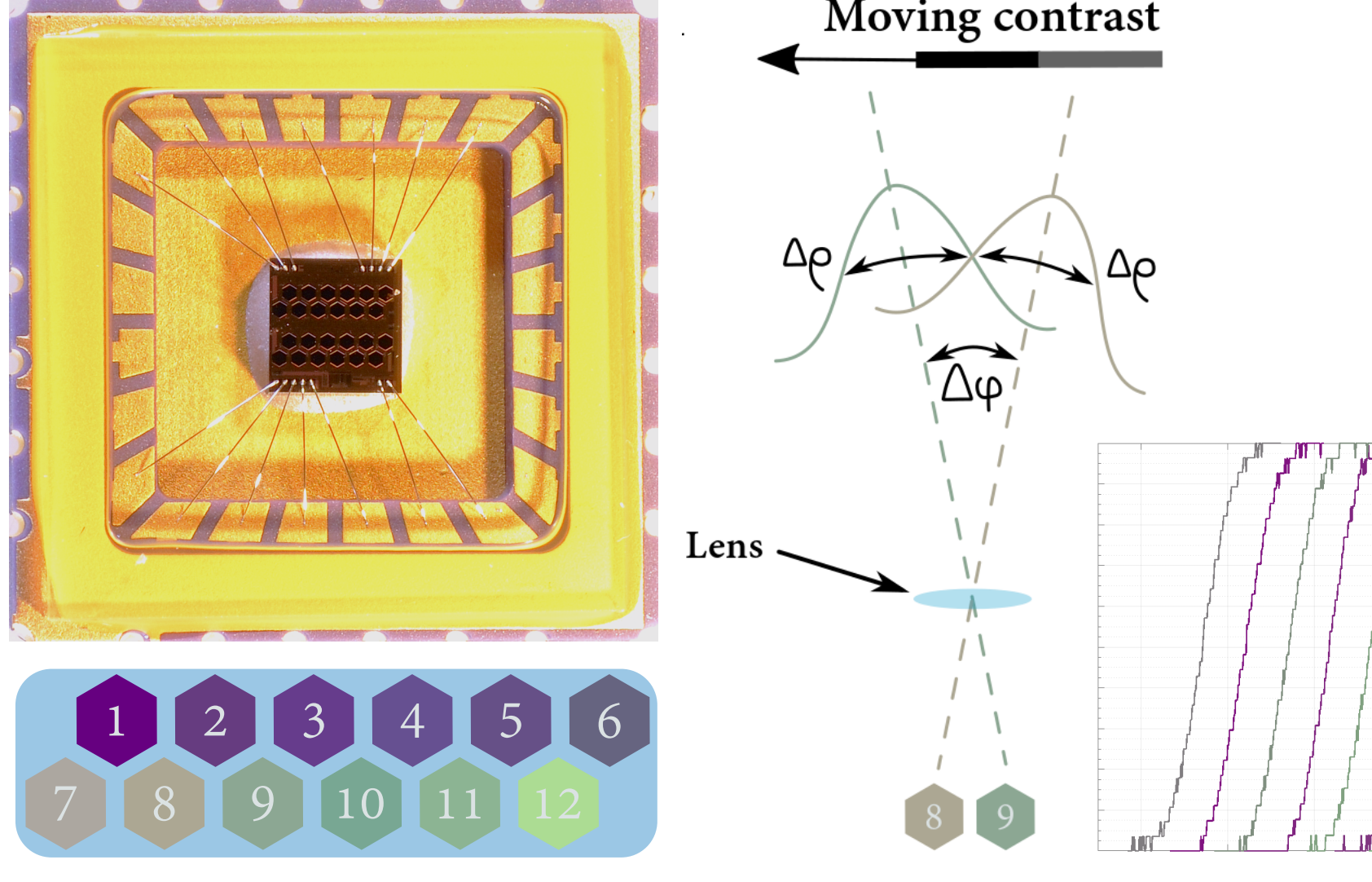
The celestial pattern of polarization

The insect-inspired celestial compass

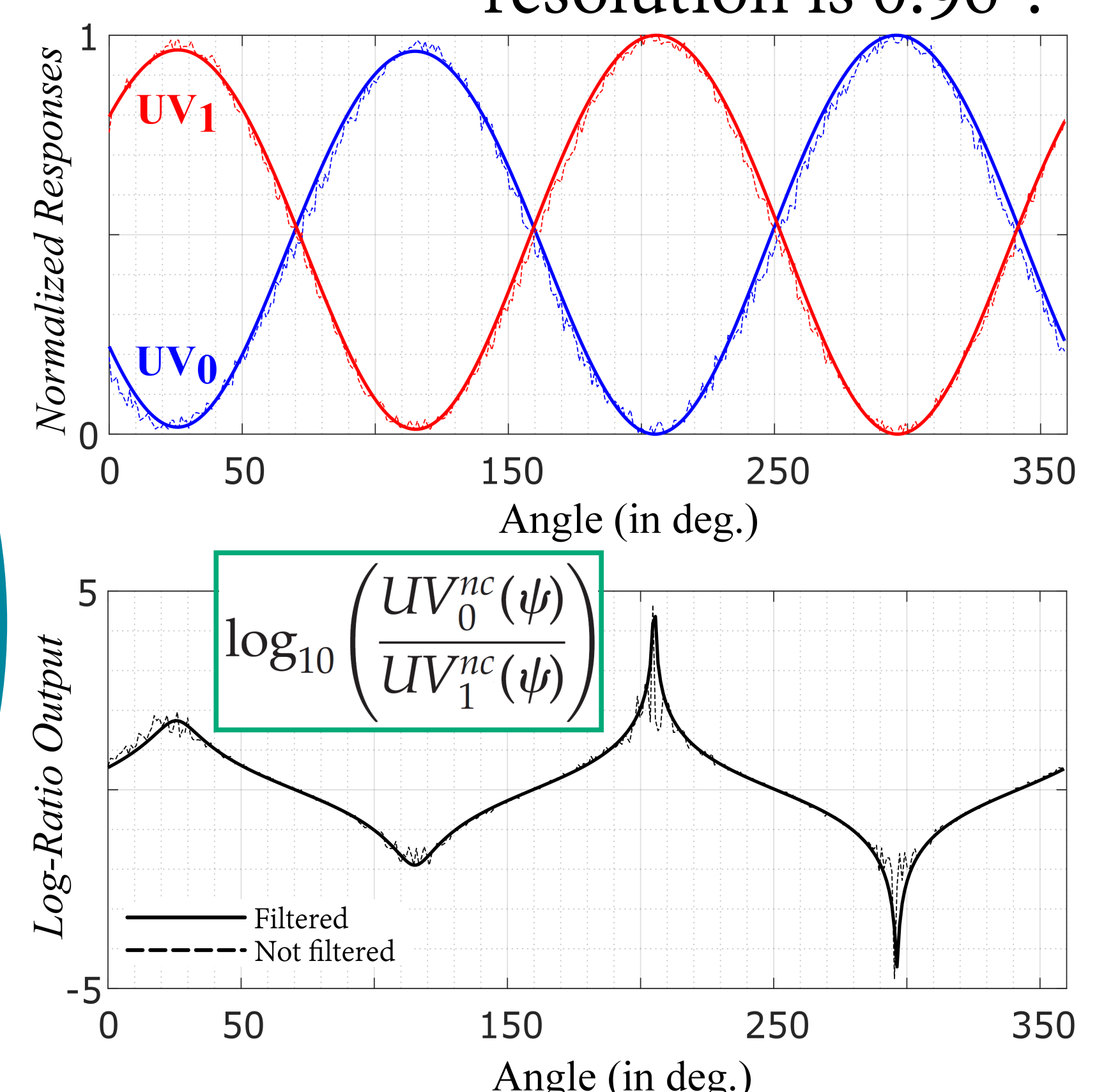


The optic flow sensor

The M²APix sensor: 12 Michaelis-Menten Auto-adaptive Pixels that can auto-adapt to light changes [2].



The signals measured by the POL-unit are first low-pass filtered and normalized. The angular resolution is 0.96°.



The heading is known modulo 180°:

$$\psi = \frac{1}{2}(\psi_1 + \psi_2 + \text{sgn}(\psi_1 - \psi_2))$$

The path integrator

PI Mode	Stride Counting	Ventral Optic Flow	Celestial Compass
PI-ST (blind)	×	×	
PI-Full	×	×	×

Distance Heading Distance Heading

The modes were tested over 26 outdoor navigation tasks.

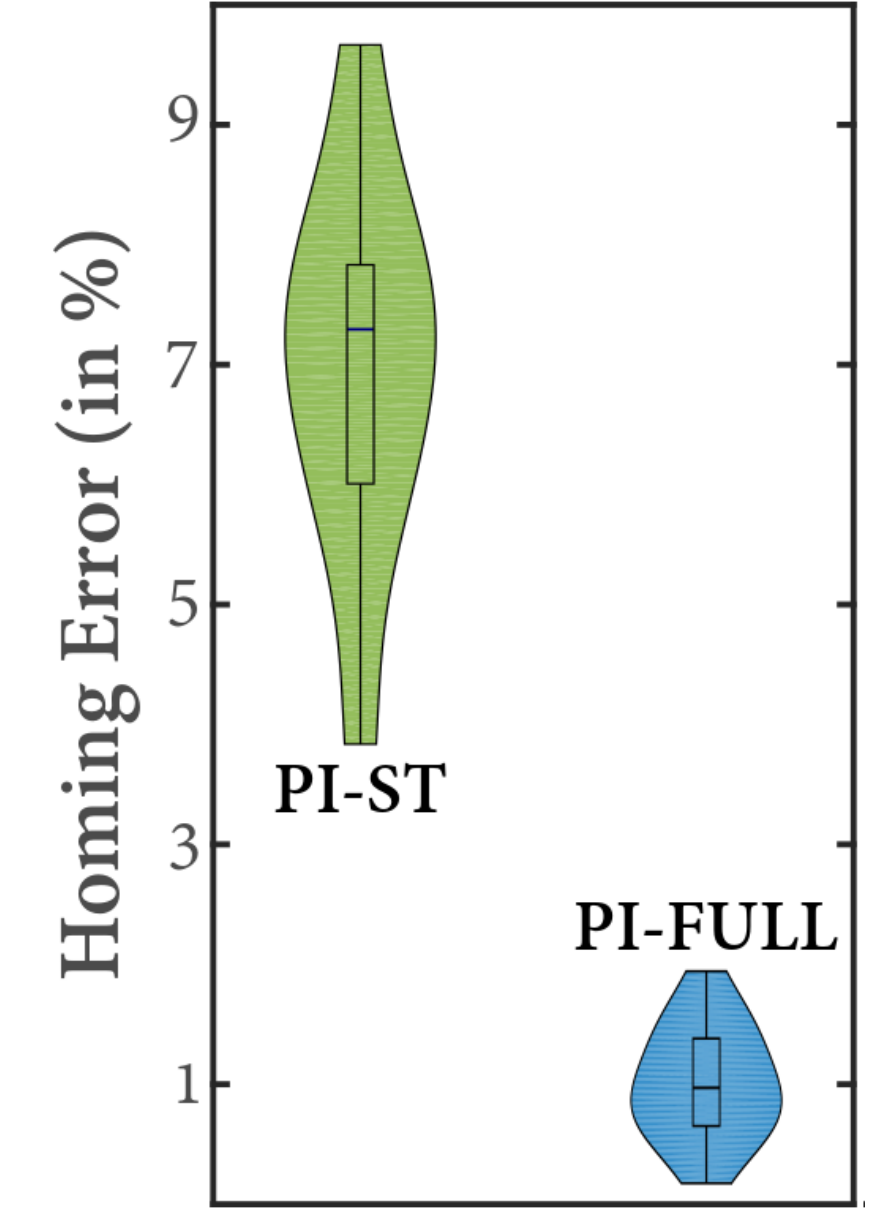
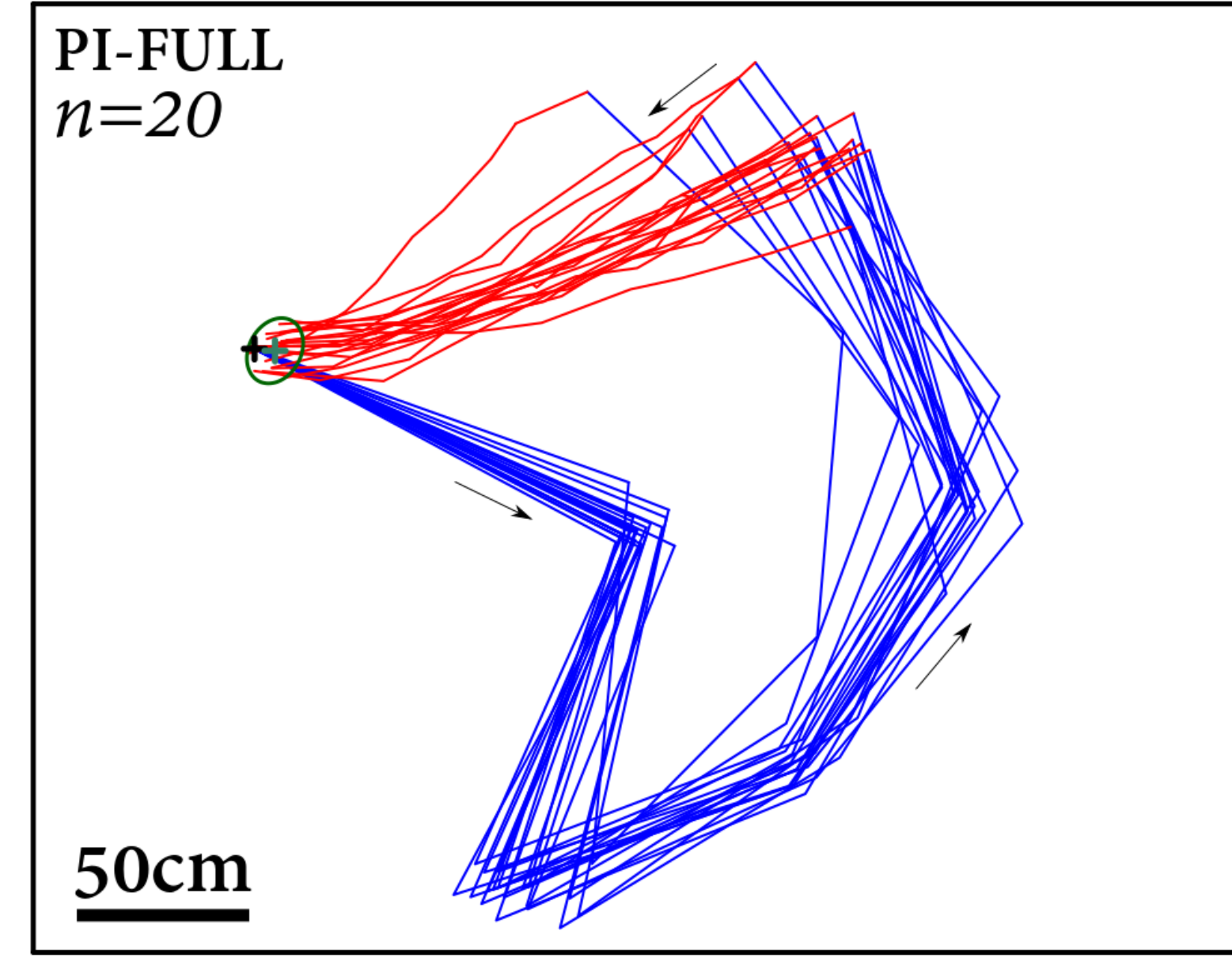
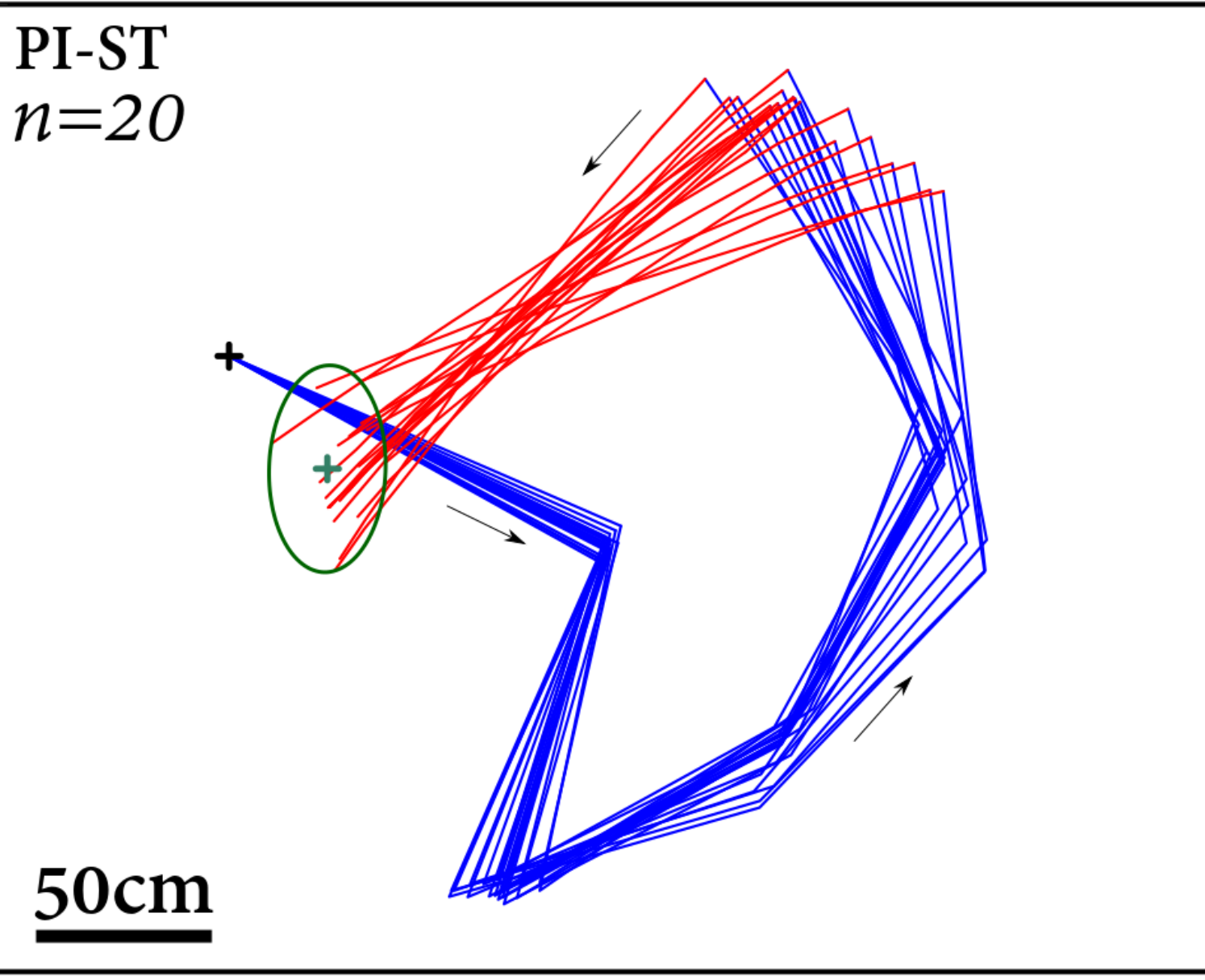
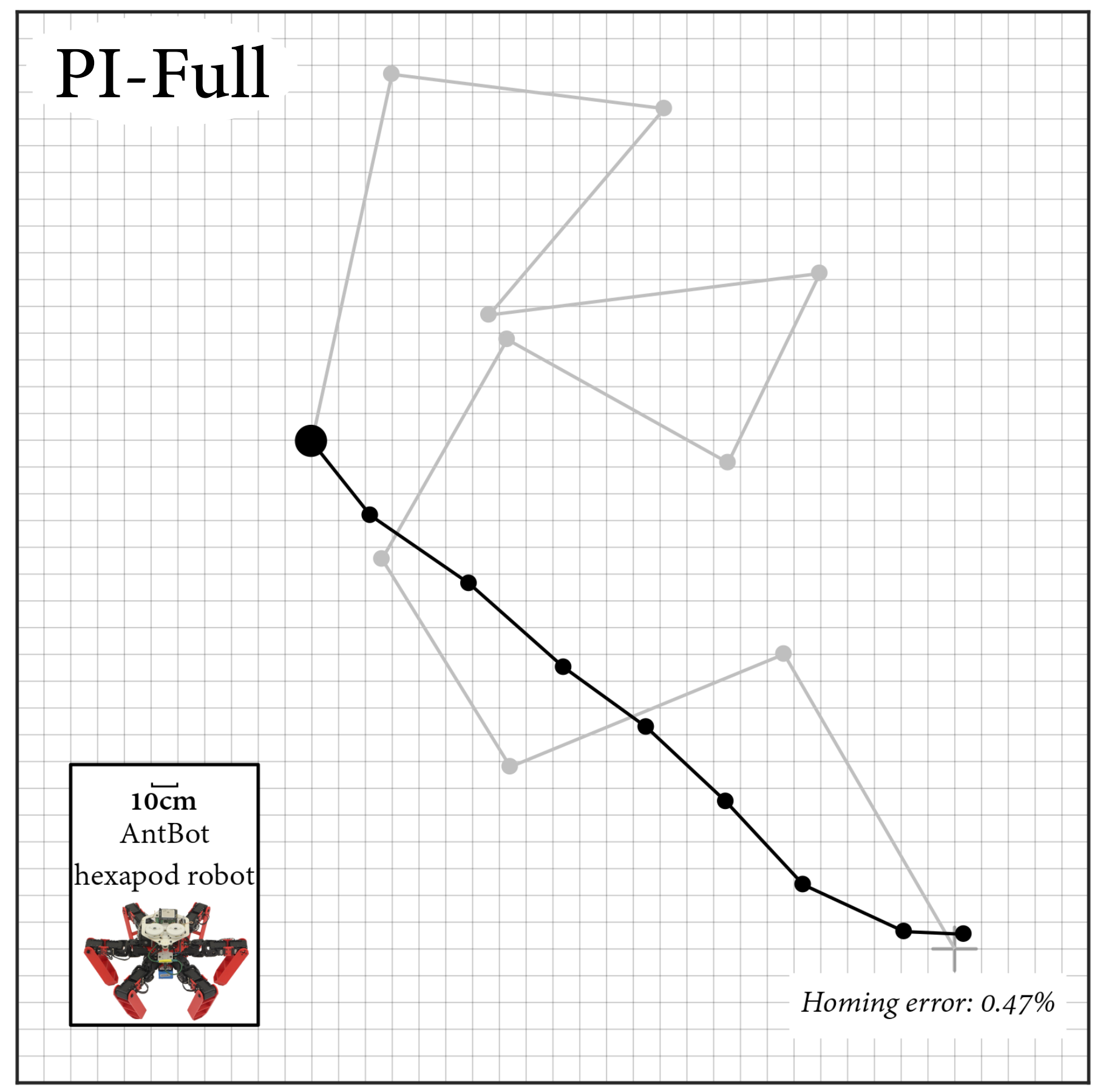
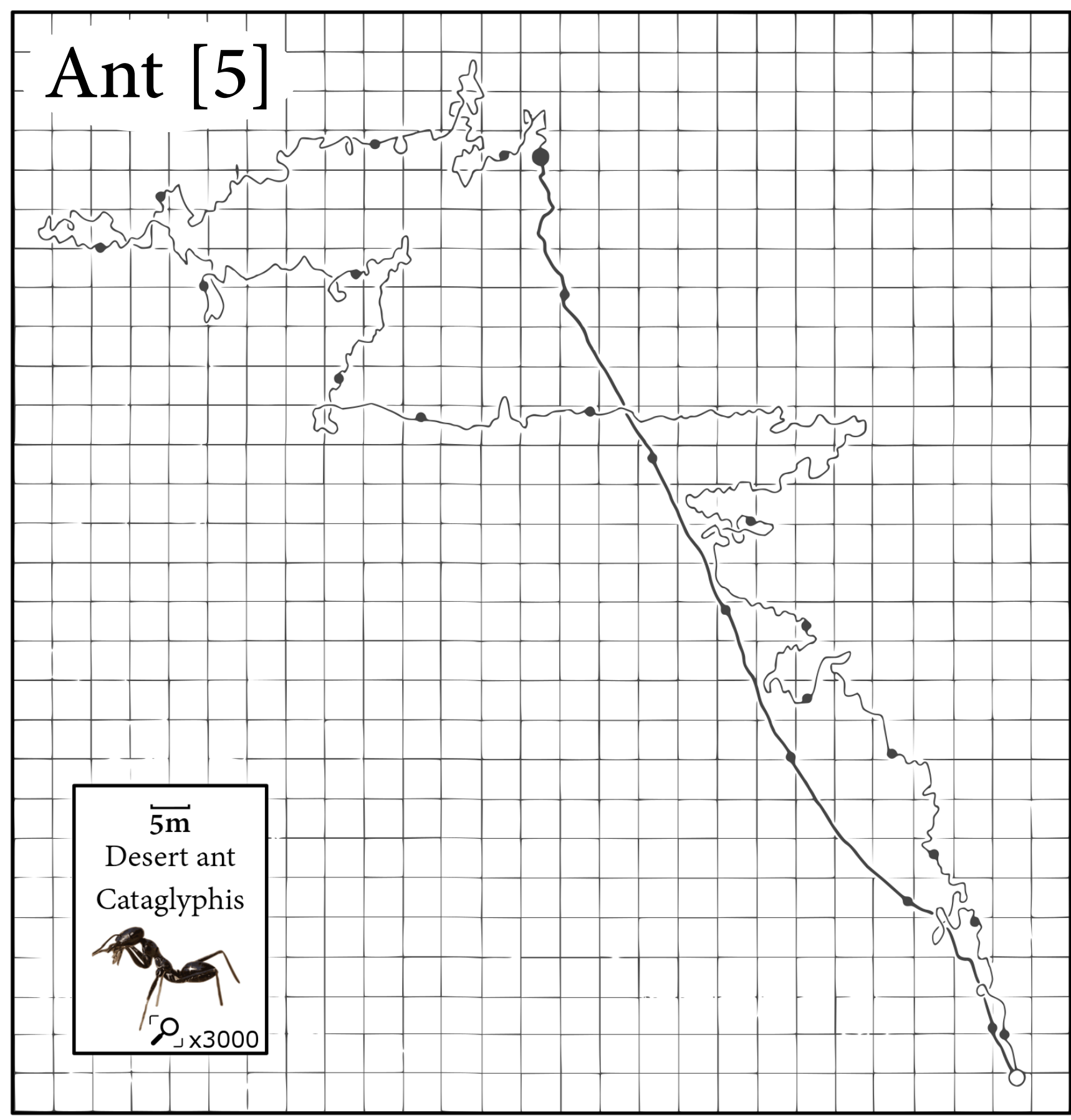
Mode	Mean	sd
PI-ST	9.65%	3.45%
PI-Full	0.67%	0.27%

n=26 for each PI mode

The ant-based mode PI-Full yielded strong navigation performance with a high resilience toward:

(i) the trajectory shape and length;

(ii) the meteorological conditions.



[1] Dupeyroux et al. (2019) J. Roy. Soc. Interface, 16 (150), 20180878.
 [2] Mafria et al. (2015) Optics Express, 23(5), 5614.
 [3] Dupeyroux et al. (2019) Science Robotics, 4(27), eaau0307.
 [4] Dupeyroux et al. (2019) Robotics and Autonomous Systems, 117, 40-56.
 [5] Wehner & Wehner (1990) Ethology, Ecology & Evolution, 2(1), 27-48.