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Wide-field dynamic astronomy in the near-infrared with Palomar Gattini-IR and DREAMS

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ABSTRACT

There have been a dramatic increase in the number of optical and radio transient surveys due to astronomical transients such as gravitational waves and gamma ray bursts, however, there have been a limited number of wide-field infrared surveys due to narrow field-of-view and high cost of infrared cameras, we present two new wide-field near-infrared fully automated surveyors; Palomar Gattini-IR and the Dynamic REd All-sky Monitoring Survey (DREAMS). Palomar Gattini-IR, a 25 square degree J-band imager that begun science operations at Palomar Observatory, USA in October 2018; we report on survey strategy as well as telescope and observatory operations and will also providing initial science results. DREAMS is a 3.75 square degree wide-field imager that is planned for Siding Spring Observatory, Australia; we report on the current optical and mechanical design and plans to

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achieve on-sky results in 2020. DREAMS is on-track to be one of the first astronomical telescopes to use an Indium Gallium Arsenide (InGaAs) detector and we report initial on-sky testing results for the selected detector package. DREAMS is also well placed to take advantage and provide near-infrared follow-up of the LSST.

Keywords: Gattini-IR, DREAMS, transients, all-sky survey, near-infrared, wide-field, Siding Spring Observatory, Palomar Observatory

1. INTRODUCTION

There are a large number of optical and radio all-sky monitoring surveys which detect and monitor astronomical events, and aim for localisation of gravitational wave events. However, all-sky surveys in the infrared have been limited by a number of factors including the bright sky background and the narrow field-of-view of infrared cameras. The proliferation of small aperture wide-field optical telescopes has not been repeated in the infrared due to these factors and others including cost, atmospheric transmission, and operating requirements.

We present a series of currently operating and proposed near-infrared all-sky monitoring telescopes; these are Palomar Gattini-IR,¹ currently operating at Palomar Observatory, USA; and the Dynamic REd All-sky Monitoring Survey (DREAMS),² planned for Siding Spring Observatory, Australia; the specifications for each telescope are summarised in Table 1.

Table 1: Telescope Specifications

	Palomar Gattini-IR	DREAMS
Telescope Aperture (mm)	300	500
Final F/ratio	1.44	2.0
Field of view (sq. degrees)	25	3.75
Filter	J	(Y), J, H
Detector type	Teledyne Hawaii 2RG	6x Princeton SCICAM InGaAs
Pixels per array	2048x2048	1280x1024
Pixel Size (μm)	18	12
Plate scale (arcsec)	8.59	2.48
Survey depth (M_{AB})	15.7	17.8

Palomar Gattini-IR has begun science observations and will survey the entire observable sky to a depth of $16.4 M_{\text{AB}}$, the survey is currently planned to run for two years. Palomar Gattini-IR is observing dynamic near-infrared transients and providing follow-up and localisation of astronomical transient detections. The Dynamic REd All-sky Monitoring Survey will be provide a near-infrared wide-field astronomical capability using InGaAs detectors and is well placed to capitalise on Australia’s location to provide a new infrared telescope in the southern hemisphere.

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REFERENCES

- [1] Moore, A. M. and Kasliwal, M. M., “Unveiling the dynamic infrared sky,” *Nature Astronomy* **3**, 109 (2019).
- [2] Soon, J. et al., “Opening the dynamic infrared sky,” *Proc.SPIE* **10700** (2018).