

## ASGARD: THE REALM OF HIGH ANGULAR RESOLUTION

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**Abstract.** Asgard promises significant advances in diverse astrophysical fields such as the formation of the binaries and multiple systems, the formation and evolution of exoplanets and the characterization of their atmospheres, the observation of mass accretion around YSOs and AGNs, the study of protoplanetary or exozodiacal disks. To do so, Asgard embeds four natively collaborating instruments: HEIMDALLR, Baldr, BIFROST and NOTT.

Keywords: integrated-optics, wavefront control, infrared, high contrast imaging, high angular resolution, optical fibers, long baseline interferometry, exoplanets, AGN, protoplanetary disk, spectroscopy

### 1 Introduction

The emphatic triumph of the Very Large Telescope Interferometer (VLTI) of the European Southern Observatory (ESO) and its second-generation instruments (namely General Relativity Analysis via Vlt InTerferometrY – GRAVITY– (Eisenhauer et al. 2011) and Multi AperTure mid-Infrared SpectroScopic Experiment –MATISSE– (Lopez et al. 2022)) in delivering unique science has set European astronomy apart. The Asgard instrument suite will extend the scientific capabilities of the VLTI following its priorities for the next decade (M erand 2018). Asgard was approved during the first semester of 2023 for integration and commissioning from 2024 to mid-2026.

### 2 Instrument overview

The Asgard suite (Martinod et al. 2023) mainly consists of four instruments which are:

- HEIMDALLR (High-Efficiency Multiaxial Do-it ALL Recombiner): a remapped interferometer + wavefront sensor operating in K band (Ireland et al. 2018);
- Baldr: an active injection controller (Zernike wavefront sensor) operating in H band;
- BIFROST (Beam-combination Instrument for studying the Formation and fundamental paRameters of Stars and planeTary systems): a stellar interferometer with high resolution spectroscopy operating in Y, J and H bands with spectral resolutions of R=50, 1000, 5000, 25000 (Kraus et al. 2022);
- NOTT (Nulling Observations of dusT and planeTs): a photonic nuller operating in the L band (Defr ere et al. 2022).

HEIMDALLR and Baldr are mostly dedicated to correcting atmospheric aberrations and atmospheric pistons; BIFROST and NOTT are mostly science-driven. Asgard will operate from Y to L bands (1 to 4 microns). The current design of Asgard is shown in Figure 1.

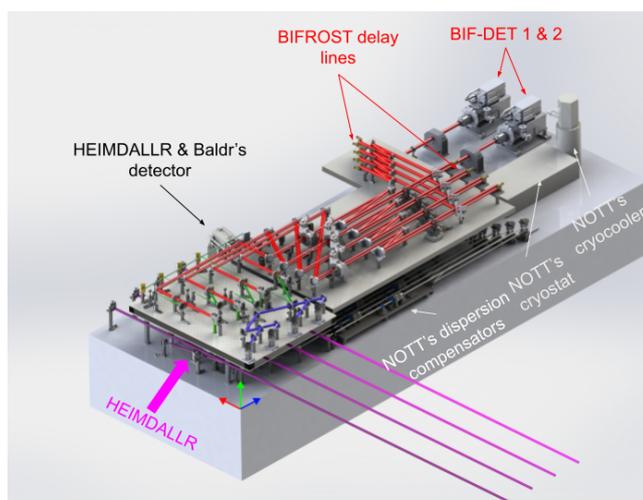
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**Fig. 1.** Preliminary version of the optomechanical design of Asgard.

### 3 Science cases

Asgard science cases are diverse (Martinod et al. 2023; Kraus et al. 2022; Defrère et al. 2022), such as the formation process of binary systems, mass accretion and ejection, formation and evolution of exoplanetary systems and exoplanet atmospheres, protoplanetary and circumplanetary disks, exozodiacal dust.

### 4 Conclusions

Asgard is a new instrument suite proposed to ESO as a visitor instrument to open new unique scientific capabilities at the VLTI (YJH high-spectral resolution and L-band high-contrast nulling interferometry at milli-arcsecond angular separation). It consists of 4 different modules: BIFROST, Baldr, HEIMDALLR, and NOTT. The suite is currently in the design and preparation phases.

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