

CALL FOR NEAR SCIENCE DEMONSTRATION PROPOSALS

Deadlines

**SD Runs: First half of nights 13-16 September 2019
and 11-18 December 2019**

Deadline for SD proposals: 7 August 2019 12:00 CEST

ESO, in collaboration with the Breakthrough Initiatives, has modified the Very Large Telescope mid-IR imager (VISIR) to greatly enhance its ability to search for potentially habitable planets around both components of the binary Alpha Centauri, part of the closest stellar system to the Earth. Apart from this specific goal, a large variety of science cases will benefit from the enhanced sensitivity and PSF contrast.

The **NEAR** (New Earths in the Alpha Centauri Region) concept combines adaptive optics using the deformable secondary mirror at Unit Telescope 4, annular groove phase mask (AGPM) coronagraphy optimized for the most sensitive spectral bandpass in the N-band, and novel fast (up to 10 Hz) chopping techniques using either the DSM or an internal chopper based on a concept for longer wavelengths invented by the microwave pioneer Robert Dicke. The internal chopper alternates between sky and an internal blackbody adjusted in temperature to match the sky brightness.

With AO and fast chopping NEAR increase the **sensitivity** by about a factor 3 with respect to classical VISIR observations in all N-band filters. The sensitivity in broad-band filters like B10.7 or the new NEAR filter (10-12.5 μm) is better than 1 mJy [$10\sigma/\text{hr}$].

The imaging **contrast** is enhanced by AO in combination with an **AGPM coronagraph** or a **Shaped Pupil mask**. With the AGPM, the inner working angle of $\sim 1 \lambda/D$ corresponds to ~ 300 mas in N-band, and the raw PSF contrast is around 10^{-5} at separations larger than $1''$. The Shaped Pupil mask produces a PSF with a high contrast ($\sim 10^{-5}$) regions between $0.8''$ and $1.5''$ and $3''$ to $7''$. The sensitivity with the AGPM coronagraph is 25% times higher than with the shaped pupil mask, and the images are dimmed, so they do not suffer from electronics ghosts produced by bright sources. The shaped pupil mask, instead, does not leak extended emission into a ring-like structure and has a spatially invariant PSF facilitating de-convolution and PSF subtraction techniques. It is therefore an interesting option for the observation of extended emission around stars like circumstellar disks or shells at later evolution stages.

The new capabilities of NEAR will be offered for science demonstration for two runs: in September 2019 4 first halves of nights and 8 nights in December 2019. ESO

encourages the community to submit challenging and/or risky science observations that will push NEAR and the VLT to its limits in order to better understand the performance parameter space and its envelope. We wish to demonstrate the superior capabilities of NEAR for N-band observations requiring high sensitivity and PSF contrast.

Some **constraints** apply for observations with NEAR, which does not serve all VISIR observing modes. They are detailed on the [NEAR Science Demonstration Web page](#).

Proposals will be reviewed by an internal panel and allocated time on the basis of scientific merit and feasibility, as well as in the demonstrated ability of the Principle Investigators to deliver results on a timely basis.

The observations will be conducted in Service Mode by a dedicated team of ESO astronomers during two runs; the first halves of the nights 13-16 September and from 11-18 December 2019. The NEAR SD team will be available to assist the successful PI's in the preparation and optimisation of the OBs on a best effort basis. The collected data will be made available to the whole ESO user community.

All (raw) data and calibrations are public immediately after the observations. There is no proprietary period nor earlier data release to the PIs. See the [VLT Science Verification Policy and Procedures](#) for more details.

Please use the new [ESO Phase 1](#) system for submissions of NEAR Science Demonstration proposals. "103 VISIR-NEAR" should be used for the proposal cycle. The new proposal submission system was announced in a recent Messenger article ([Messenger 175, 63](#)). A detailed description is available on the [P1 Help Page](#).

Applications should be submitted through the new [Phase 1 system](#) not later than 7 August 2019, 12:00 CEST.