Infrared interferometric observations of nearby exozodiacal disks: current status and perspectives

D. Defrère1, O. Absil2, E. di Folco3, J.-C. Augereau4, A. Mérand5, and V. Coudé du Foresto6

Abstract

Directly detecting exozodiacal dust in the inner part of extrasolar planetary systems is nowadays feasible thanks to the advance of high-precision near-infrared interferometry. Investigating this region around nearby stars provides unique information to understand the global architecture of planetary systems and to define the population of stars suitable for future exo-Earth characterization missions. Over the last few years, a survey of nearby main-sequence stars has been ongoing at the CHARA array using the FLUOR beam combiner. The goal of this survey is to directly probe the inner part of circumstellar disks in order to detect the signature of hot dust accounting for about 1% of the near-infrared stellar flux. In this poster, we present the status of this survey and provide the first statistical results about the occurrence of bright exozodiacal disks around nearby main-sequence stars. We also report on the first H-band interferometric observations of the exozodiacal disk around Vega which have been obtained with IOTA/IONIC, and discuss the implications on the disk properties.

Ongoing survey at the CHARA array

Following the pioneering detection of the exozodiacal dust around Vega (see Fig. 1 and Fig. 2), a survey of near-infrared excesses around bright Vega-type stars has been initiated with CHARA/FLUOR. The target stars were selected through the presence of significant mid- to far-infrared emission in excess to the expected stellar photospheric flux and identified by infrared space missions (24 targets). A control sample consisting of stars with no cold dust detected so far was also included in the target list (16 targets).

Vega: confirmation with IOTA/IONIC

Summary and discussion

Infrared stellar interferometry at the CHARA array is currently providing the first statistical results about the occurrence of exozodiacal dust disks around nearby main-sequence stars. Although in some cases the presence of a binary companion could not be ruled out (e.g., ζ Aquilae, and the G-type star τ Ceti), a total sample of 40 stars among which 24 with known cold dust have now been observed. The sample consists in 13 A-type stars (9 with cold dust), 12 F-type stars (7 with cold dust) and 15 G- and K-stars (8 with cold dust). Even though the data are still under analysis, preliminary results indicate some interesting statistical properties (see Fig. 3, Absil et al., in prep):

- Frequency versus spectral type. Early type stars are more likely to present an infrared excess with ~50% (±14%) for A-type stars, ~20% (±15%) for F-type stars and ~10% (±17%) for G- and K-type stars. This trend is supported by Spitzer observations showing that 33% of A stars and 8% of FGK stars present a 70-μm excess (Su et al. 2006, Carpenter et al. 2009).

- Frequency versus presence of cold dust. No significant correlation is presently found in the sample of observations (see Fig. 4). An infrared excess has been detected around ~25% (±11%) of stars with cold dust and ~25% (±13%) with no cold dust.

Prospects

The first results of the survey have been reported by di Folco et al. (2007) and Absil et al. (2008), showing the presence of a resolved near-infrared emission in the first AU around the A-type star ζ Aquilae, and the G-type star τ Ceti. A total sample of 40 stars around which 24 with known cold dust have now been observed. The sample consists in 13 A-type stars (9 with cold dust), 12 F-type stars (7 with cold dust) and 15 G- and K-stars (8 with cold dust). Even though the data are still under analysis, preliminary results indicate some interesting statistical properties (see Fig. 3, Absil et al., in prep):

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