NACO observations of protoplanetary disks

1. Introduction

In recent years, debris disks have been evidenced around main sequence (MS) and old pre-main sequence (PMS) stars. Their dust is probably of second generation, produced by collisions and/or evaporation among larger, km sized bodies. Such systems trace then planetary systems evolution stages where planetesimals and may be also planets are already present. They help constraining such types of evolution of planetary systems, in terms of km and/or planets bodies distribution and dynamics.

These disks are typically a few 100 AUs in size even though extended nebulosities may be observed at larger distances in some cases. They are nevertheless orders of magnitudes fainter than the central star, so their observation at JHK requires high dynamical range imaging.

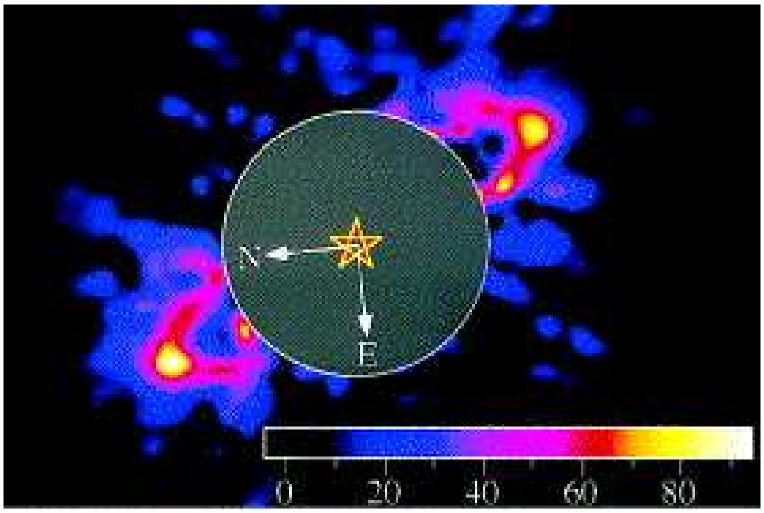

Figure 1: NICMOS H-band coronagraphic image of the protoplanetary disk around HR 4796 (Schneider et al. 1999, ApJ 513, L127). The central star (marked with a symbol) is occulted behind the mask. As it can be seen, the star is surrounded by a disk with a ring-structure, located at $\sim$70 AU from the central object.

2. NACO observations: Scientific goals

HST NICMOS coronographic observations of HR 4796 (see Figure 1)and HD 163296 have revealed the presence of circumstellar disks around these two objects (Schneider et al. 1999, ApJ 513, L127, Augereau et al. 1999, A&A 348, 557, Grady et al. 2001,

Table 1: Stellar data of HR 4796 and HD 163296

Name	RA (2000)	DEC (2000)	Sp. Type	V-mag
HR 4796	12 36 01.03	-39 52 10.2	AO	5.8
HD 163296	17 56 21.28	-21 57 21.9	A1	6.9

AJ122, 3396). We propose for NACO coronography and polarimetry observations of the two stars:

The NACO coronography observations will allow to image the circumstellar disks with a better spatial resolution than that provided by HST. Hence, structures within the disks that can be related with planetary formation (like gaps or warps), can be studied in more detail.

The polarimetric observations with the Wollaston prism will allow to separate the polarized light from the debris disks from the unpolarized light from the star. In this way, we can study the disk structure avoiding the light from the central object. The main advantage of this technique is that it allows to observe very close to the central star, so we can study in detail the structure of the inner parts of the disks. Hence, these observations are complementary to the coronographic ones. With this project we will be able to test the performance of the Wollaston prism with NACO.

3. NACO observations: Technical details

The stellar data for the two objects are provided in Table 1. As seen, both stars are bright enough to be used as reference stars with the visible WFS.

1. **Coronography:** We propose for observatiosn in H and/or K-band. Comparison stars, together with sky frames and PSF stars outside the mask, must be also observed. We will need 2 hours of observations per object and per filter.

2. **Polarimetry:** Observations will be obtained with NACO using the visible WFS, the C25S camera, the Wollaston prism and the H and Ks filters. Sets of short (DIT =0.4s, NDIT=20) and long (DIT = 30s, NDIT=5) will be obtained in a 3 point dither pattern for each rotator angle. This adds up to 45min per object and filter. Taking into account the overheads estimated by the NACO team, we will require 1.5hours in total per object in both H and Ks bands.

We require excellent seeing conditions (seeing ≤ 0.8) to carry out the project.