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DUST POPULATIONS FROM 30 TO 1 000 AU IN THE DEBRIS DISK OF HD 120326

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Abstract. HD 120326 hosts a young (∼16 Myr) debris disk with various structures at intermediate (30–150 au) and large (150–1000 au) scales. In this poster presented at the conference SF2A 2025, we highlight our multi-wavelength (optical, near-infrared and millimeter), deep analysis on this system published in Astronomy & Astrophysics (Desgrange et al. 2025).

Keywords: methods: observational techniques: high angular resolution - infrared: planetary system

1 Introduction

More than one hundred of debris disks have been spatially resolved in optical, infrared or millimeter wavelengths. The debris disk around the young (16 Myr, Mamajek et al. 2002) F0V-type star HD 120326 located at 113±0.4 pc (Gaia Collaboration et al. 2021) in the Scorpius-Centaurus association stands out by displaying disk structures at different scales (see Fig. 1). Between 30 and 150 au in the near-infrared (NIR), scattered-light SPHERE observations revealed the inner belt in both total and polarized intensity, as well as a second structure detected in total intensity, but not in polarized intensity. At this intermediate scale, ALMA detects unresolved dust emission. At larger scales, from 150 to 1 000 au, HST/STIS resolves an asymmetric extended structure in scattered light, which is not seen in SPHERE or ALMA data. Our goal was to clarify the architecture of the debris disk around HD 120326 based on archival data, some already published (Padgett & Stapelfeldt 2016; Bonnefoy et al. 2017; Olofsson et al. 2022) and new data, and to constrain the dust properties. We reprocessed the data and analyzed them in a consistent manner.

2 Main results and conclusions

Our study on the debris disk around HD 120326 is described in details in Desgrange et al. (2025) and is summarized in the Figure 1, which was our poster presented during the conference SF2A 2025. Based on the HST/STIS optical observations, we investigated what could cause the extended (150–1 000 au) spiral-like feature, showing that a Jupiter-mass exoplanet on eccentric (e = 0.9, periastron = 750 au) could generate an asymmetric structure such as spiral spanning hundreds of au and by the age of the system. Other scenarios could generate an asymmetric structure, such as interactions with the interstellar medium wind, collisional dust avalanches or a giant impact (Fig. 1, bottom-left). As for the SPHERE NIR data, we constrained the morphology of the inner belt (30–60 au) by modeling jointly the SPHERE total and polarized intensity observations using our newly developed and open-access tool `MoDiSc` (Modeling Disks in Scattered-light) available on Github (`https://github.com/cdesgrange/MoDiSc`). `MoDiSc` runs simulations to match the observation(s) with the

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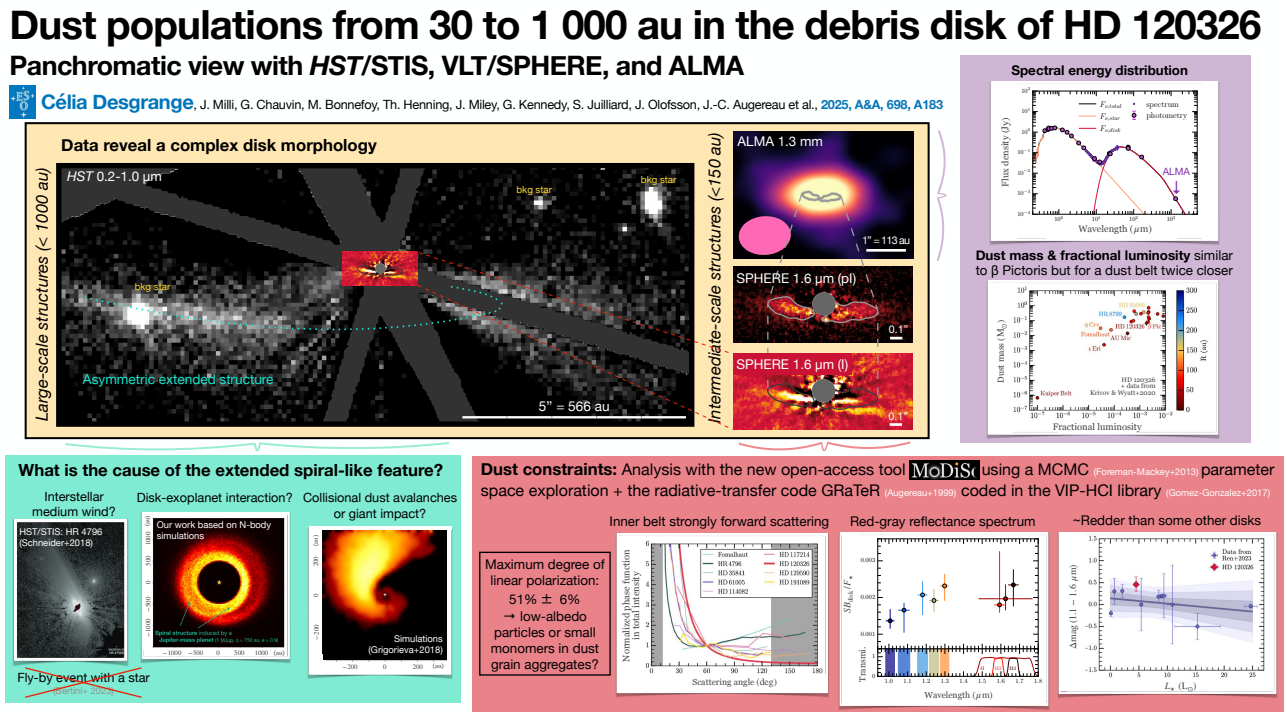

Fig. 1. Poster presented at the SF2A 2025, session S01 "General workshop of the action thematic Exosystems"

best disk model(s) using the radiative-transfer code `GRaTeR` (available in the open-access `VIP-HCI` library) to generate fake disk models and a Markov Chain Monte-Carlo exploration of the parameter space via the `emcee` package (Foreman-Mackey et al. 2013). Based on our best models, we characterized the scattering phase function of the inner belt, its maximum degree of linear polarization ($51 \pm 6\%$) and its reflectance spectrum (Fig. 1, bottom-right). Last but not least, using the ALMA data, we obtained the flux density at 1.3 mm (561 ± 20 μJy), completing the spectral energy distribution (SED) of the system. We modeled the new SED, determined a fractional luminosity of 1.8×10^{-3} and a dust mass of mm-size particles in this system of 0.067 $M_\oplus$, which is very similar to the debris disks around β Pictoris, HD 61005 and HD 146181 (Fig. 1, top-right).

To conclude, further data are needed to deepen the constraints on the morphology of the disk structures and the dust properties, for instance, in the optical with new HST/STIS data with a smaller mask (CBar5), using a color-matched reference star and more angular diversity (three rolling angles), in the IR with JWST and in the millimeter with higher-resolution ALMA data.

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