Searching for Hα emitting sources around MWC758

SPHERE/ZIMPOL high contrast imaging

N. Huélamo (CAB, CSIC-INTA, Spain), **G. Chauvin, M. Benisty** (U. Chile/IPAG), **H.M. Schmidt, S. Quanz** (ETH Zurich), **E. Whelan** (Maynooth University, Ireland**), J. Lillo-Box** (ESO, Chile), **D. Barrado, B. Montesinos** (CAB, Spain), **J.M. Alcalá** (INAF, Italy), **I. de Gregorio-Monsalvo** (ALMA, Chile), **H. Bouy** (U. Bordeaux, France) and **B. Merín** (ESAC, Spain)

Introduction: MWC758 is a young star surrounded by a transitional disk. The disk shows spiral arms that could be caused by the presence of planets. Very recently, a possible protoplanet candidate has been detected around MWC758 through high resolution L'-band observations (Reggiani et al. 2017). The candidate is located at a separation of 111 mas from the central star, at an average position angle of 165.5 degrees (see Fig. 1, left). The comparison of the L'-band data with circumplanetary disks accretion models (Zhu 2015), predicts a protoplanet with a mass between 0.5-5 M_{Jup} and an accretion rate of 10^{-7}-10^{-9} $M_{\odot}$/yr.

Our project: We have performed simultaneous adaptive optics observations in the Hα line (B_Ha filter) and the adjacent continuum (ContHa filter) using SPHERE/ZIMPOL at the VLT. We aim at detecting accreting protoplanet candidates within the disk of MWC758, through spectral angular differential imaging (ASDI) observations in the optical regime. In particular, we will explore the emission at the position of the detected planet candidate.

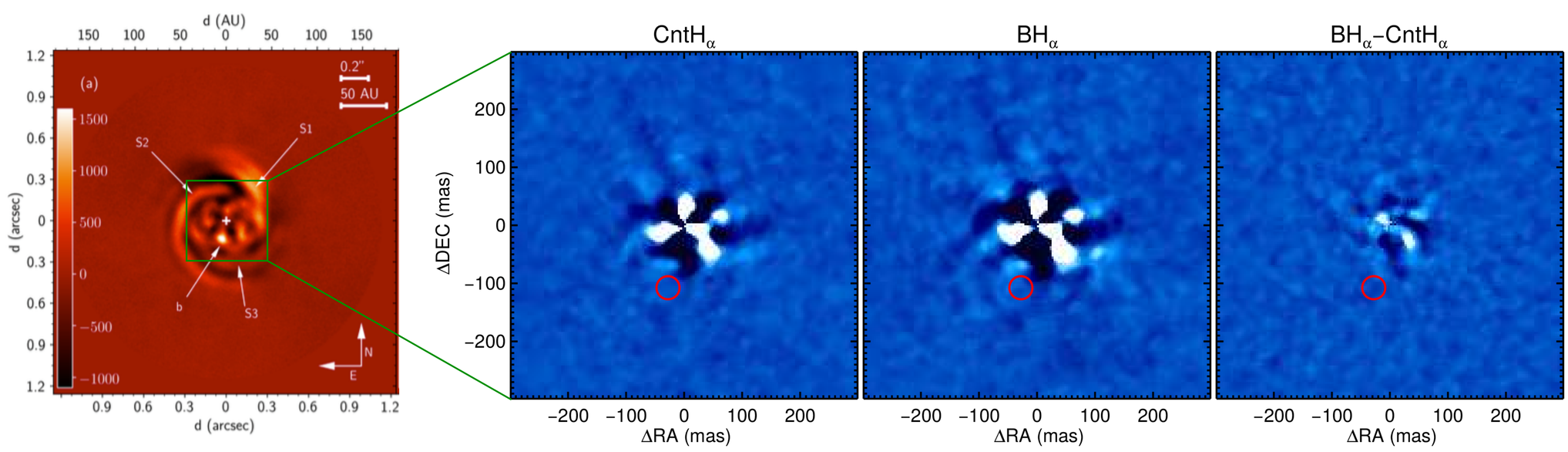

Figure 1 – Left: L'-band image from Reggiani et al. 2017. The spiral arms in the disk (S1, S2 and S3) together with the protoplanet candidate (b) are marked. **Right:** SPHERE/ZIMPOL images of MWC758 in two individual filters (B_Ha, ContHa) and the differential (B_Ha-ContHa) image. The red circle shows the position of the L' source detected by Reggiani et al. 2017.

Our results: The data analysis does not reveal any Hα signal around the target (see Fig. 1, right). The derived contrast curve in the B_Ha filter allows us to derive a 5σ upper limit of 7.6 mag at 111 mas, the separation of the detected planet candidate (see Figure 2). After calibrating the counts from the primary star, we estimate that the contrast translates into a Hα line luminosity of $L_{H\alpha} < 4.9 \times 10^{-5}$ $L_{\odot}$ at 111 mas.

Assuming that $L_{H\alpha}$ scales with L_{acc} as in Classical T Tauri stars (Rigliaco et al. 2012), we estimate an accretion luminosity of $L_{acc} < 3.7 \times 10^{-4}$ $L_{\odot}$. For the predicted mass range of the accreting protoplanet candidate, 0.5-5M_{Jup}, this implies accretion rates smaller than $\dot{M} < 3.4 \times (10^{-8}$-$10^{-9})$ $M_{\odot}$/yr, for an average planet radius of 1.1 R_{Jup}. Our estimates are consistent with the results obtained from circumplanetary disk accretion models with $R_{in} = 1$ R_{Jup}.

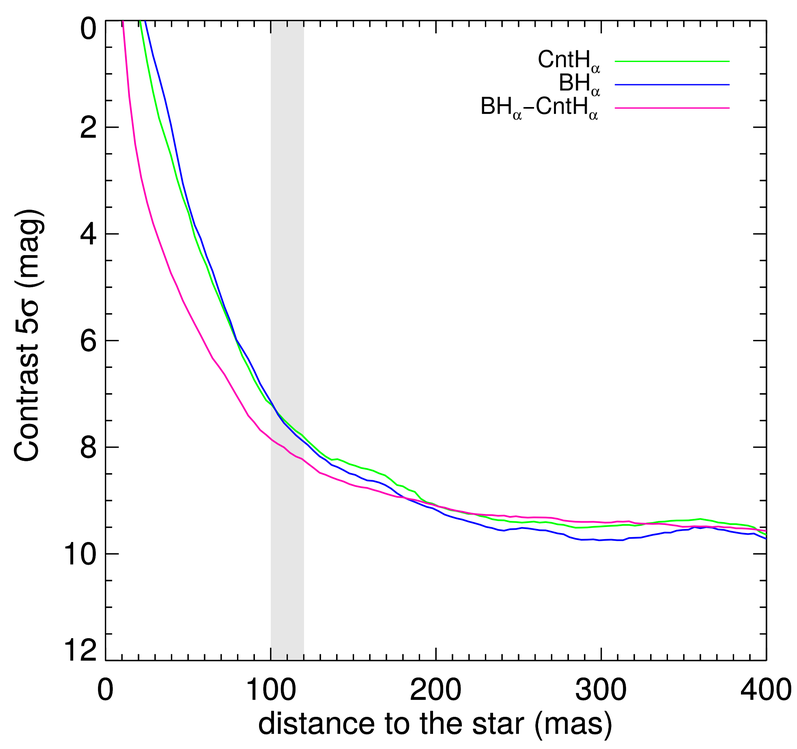

Fig.2: SPHERE/ZIMPOL 5σ contrast curves obtained in CntHa, B_Ha in ADI using PCA, and in B_Ha-CntHa in ASDI using PCA. The grey area shows the separation of the companion candidate detected in L' by Reggiani et al. (2017).

The non-detection of any Hα emitting source in the SPHERE/ZIMPOL images does not allow us to unveil the nature of the L'-band detected source.