

## IRDIS Unpolarized Standard Star Observations May 2016 v2

### Goal

The goal of the observations is to empirically establish the diattenuation of M3 and M4 (part of the Mueller matrices describing the telescope (M3) and M4) when observing with IRDIS/DPI.

### Proposed observations

- Same setup as the last observations of March 9, 2016
- Target: HD98161 (11 17 12.01 -38 00 51.7); additionally HD176425 (19 02 08.66 -41 54 36.3) (see Figure 2)
- BB\_Y, BB\_J, BB\_H and BB\_Ks filters
- NIR half wave plate
- P0\_90 polarizer/analyzer set
- Derotator fixed in vertical position ( $\theta_{\text{der}} = 0^\circ$ ) during all observations
- Adaptive optics turned off (open-loop)
- No neutral-density filters
- No coronagraph
- Detector integration time: sufficiently high photon count without entering the non-linear regime of the detector (for Y-band same as last time: 2.0 seconds)
- Number of detector integration times: 10 per HWP position, so 40 for a full HWP-cycle (Qplus, Qminus, Uplus, Uminus)
- For every filter, 3 blocks (at 3 very different altitude angles, and therefore automatically at different parallactic angles) of 2 full HWP-cycles. So in total 6 HWP cycles per filter, yielding 12 data points (6 Stokes q and 6 Stokes u) per filter (see Figure 1).
- For each block (altitude angle), perform 8 consecutive HWP-cycles in 4 filters in the order Y, J, H, Ks, Y, J, H, Ks (this order is to ensure that a filter is not measured at the same exact altitude angle twice, but has a slightly different value, resulting in a better fit).
- For each block (altitude angle), take a sky frame for every filter (4 sky frames per altitude angle) to allow for the removal of background polarization.
- When observing 1 star, perform the 8 HWP cycles at 3 very different altitude angles.
- When observing 2 stars, perform the 8 HWP cycles at 4 very different altitude angles (in this case the incident polarization of 2 stars needs to be fitted).

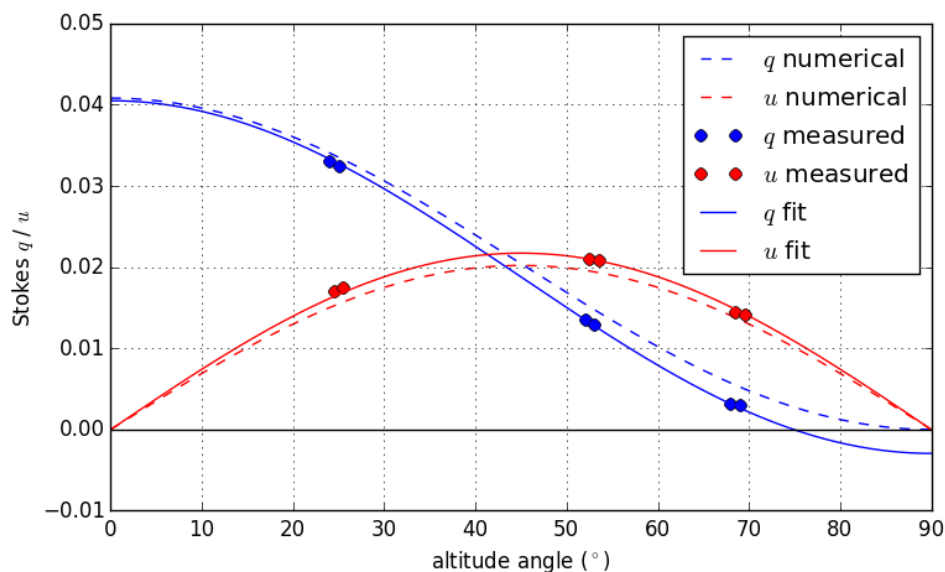


Figure 1: The best fit of the data is obtained when performing 2 HWP cycles per filter (yielding 2 q data point and 2 u data points) at 3 very different altitude angles. Data shown is simulated.

## Important notes

- Measurements need to be performed at 3 very different altitude and parallactic angle combinations to distinguish between the effect of the diattenuations of M3 and M4, and between the diattenuations and the Stokes q and u of the source.
- When observing before and after meridian crossing, it is important not to measure at an altitude angle for which a measurement has already been taken, as this would yield no new information for fitting the parameters to the model.
- Avoid twilight and clouds during the observations.
- HD98161 and HD176425 have approximately the same magnitude, but their meridian crossings at a different time during the night, allowing more flexibility in the measurements.
- Attached is a .txt-file that shows the headers that should result after performing the measurements on 1 star (to clarify the measurements). Note that in reality the altitude angle would slowly change for every HWP position during a HWP-cycle and that the sky frames are not included in the list.

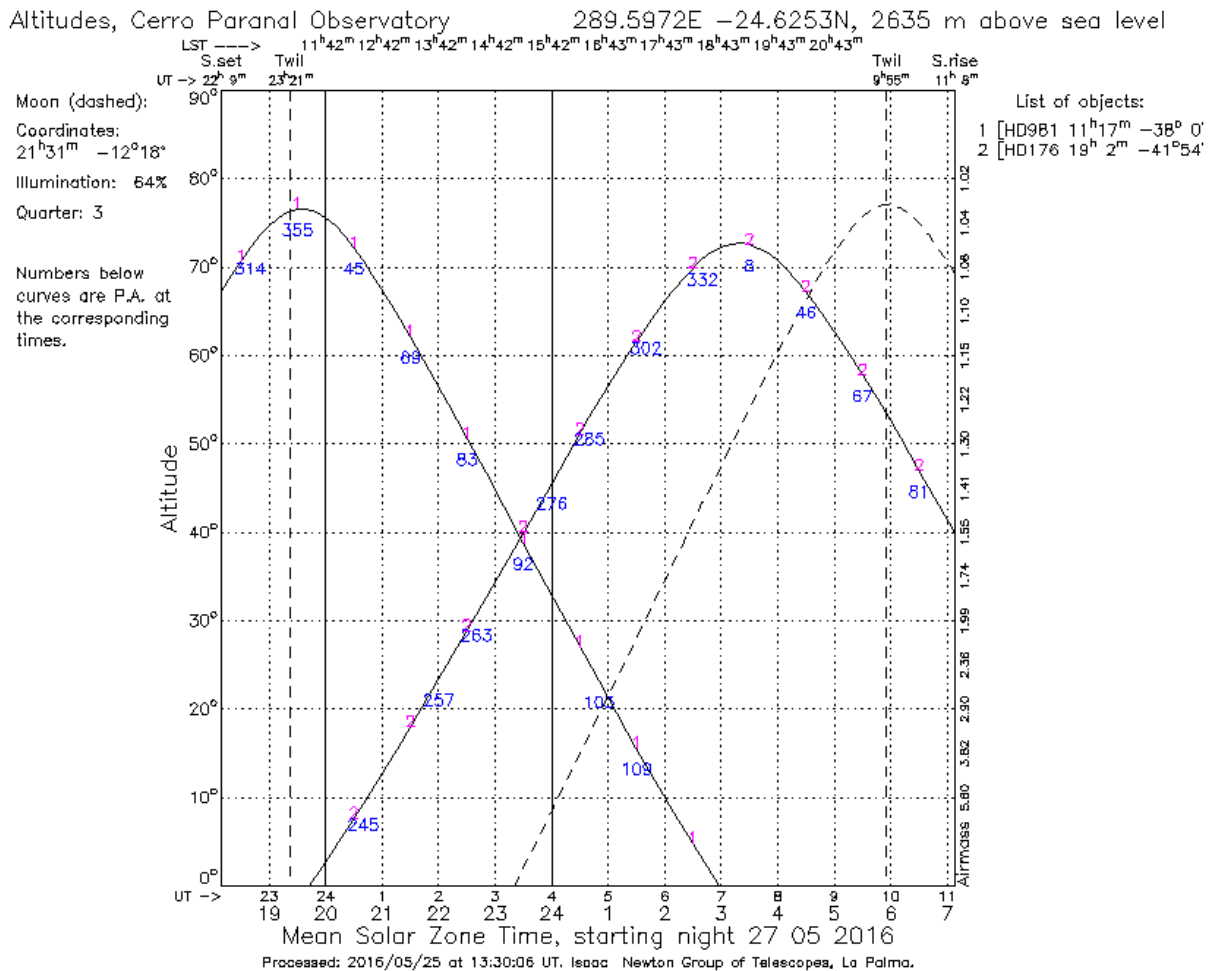


Figure 2: Altitude angles of HD98161 and HD176425 during the night of May 27 to 28, 2016.