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RECENT SITE TESTING CAMPAIGN AT THE OBSERVATORIO ASTRONÓMICO NACIONAL IN SAN PEDRO MÁRTIR

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RESUMEN

Hemos llevado a cabo un nuevo programa para medir el seeing en el Observatorio Astronómico Nacional en San Pedro Mártir. Los resultados obtenidos durante un período de dos años, arrojan una calidad de imagen con mediana de 0.57 segundos de arco y un primer cuartil de 0.46 segundos de arco. Mostramos también que el seeing puede ser muy estable durante toda la noche bajo condiciones excelentes. Las mejores medidas arrojan una mediana de 0.37 segundos de arco, obtenidas de observaciones continuas durante casi nueve horas. Nuestros resultados son comparados con un estudio previo del sitio, encontrándose resultados muy similares.

ABSTRACT

We have conducted a new program to measure the seeing at the site of the Observatorio Astronómico Nacional in San Pedro Mártir. The results obtained during a two year period yield a median seeing of 0.57 arcsec and a first quartile of 0.46 arcsec. We show that the seeing can be very stable for the whole night under excellent conditions. The best measurements yield a median of 0.37 arcsec during nearly nine hours of continuous observations. Our results, when compared with a previous study of the site, yield very similar results.

Key Words: **SITE TESTING**

1. INTRODUCTION

In this contribution we present the results of a new campaign to evaluate the site at the Observatorio Astronómico Nacional in San Pedro Mártir. Our previous campaign (Echevarría et al. 1998) was mostly devoted to measuring the seeing by means of the *Carnegie Monitor* and the University of Arizona *Site Testing Telescope*, both apparatus working with different instrumental techniques. Although this time we have accumulated considerable less data, the results of both campaigns may shed light on the consequences of diverse instrumental characteristics upon seeing evaluation.

2. INSTRUMENTATION AND OBSERVATIONS

We used a two-aperture Differential Image Motion Monitor (DIMM) from LHESA Electronique, very similar to the one described by Vernin & Muñoz-Tuñon (1995). The instrument we used consists of a 20 cm Schmidth-Cassegrain telescope (CELESTRON) on an equatorial mount with automatic guiding capabilities, a diaphragm with two 60 mm diameter apertures with their centers separated by 140 mm, an optical wedge in one of these apertures, an intensified CCD camera (LHESA's LH750EIA) and a PC compatible computer equipped with a frame grabber.

The instrument is located in the same site where we have previously used the Carnegie Monitor (Echevarría et al. 1998). The DIMM telescope and part of the electronics are installed at the top of a concrete pedestal that places the diaphragm of the telescope 8.3 m above the ground. The computer and the rest of the electronics are inside a small hut, well detached from the pedestal.

Each data point comes from the processing of a sequence of 200, 6 ms exposure time, frames. Including the associated processing time, we thus obtain a pair of airmass corrected seeing measurement every 14 seconds.

A total of 90 observation nights were carried out from August 18, 2000 through October 14, 2002. In addition, with their kind permission, we have included 7 extra nights observed by Conan et al. (2002) in order to improve our seasonal coverage in Autumn. Each data point was calculated as the average of the simultaneous longitudinal and transversal seeing measurements. When these values differ by more than 12% – the spected relative error for the DIMM (Muñoz-Tuñon et al. 1997)– the data point was discarded.

3. THE SEEING DISTRIBUTION

The median seeing values for each of the 97 individual nights, folded with the orbital period of the

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earth, are shown in Figure 1.

The sample is not evenly distributed: there is a noticeable gap in May and a clustering in August, but we do not expect any large deviations from the overall results during the poorly sample months. It can be seen that there are only six nights in the whole survey with seeing median above one arcsec: four in March, one in June an additional one in September.

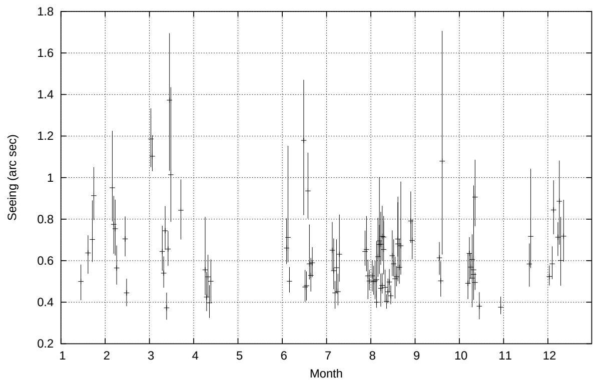

Fig. 1. Nightly seeing measurements. The bars represent the first and third quartiles.

The seeing distribution for the overall observations, comprising 82974 measurements during the ninety seven nights, is shown in Figure 2. The distribution of the data is of the log-normal type, as expected for a positive random variable (Muñoz-Tuñon et al. 1997). The median is 0.57 arcsec and the first quartile is 0.46 arcsec.

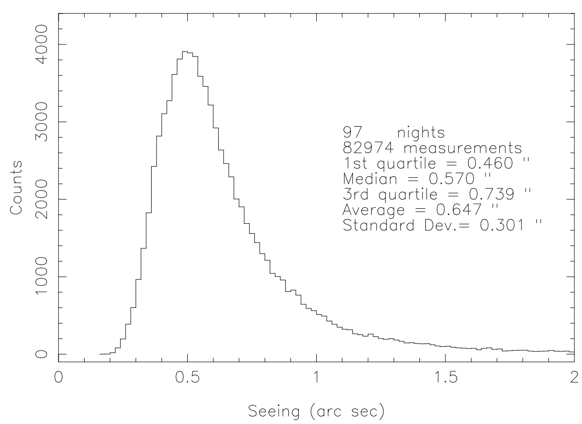

Fig. 2. Seeing Distribution

4. NIGHTLY SEEING STABILITY

In order to illustrate the seeing stability, during any given night, we have plotted the data points as a function of time for three nights with excellent, good and bad seeing, each one together with their corresponding histogram. These are shown in Figure 3. The upper pair of graphs correspond to observations made during the night of March 13, 2002 which lasted 8.8 hr. The median value yields 0.37 arcsec, with measurements as low as 0.2 arcseconds. The middle graphs correspond to the night of June 21, 2002 with 7.8 hr of data. Here the median seeing is 0.59 arcseconds.

At the bottom of the figure we show an example of bad seeing observed four nights later than the previous example. This run lasted 7 hr and has a median value of 1.18 arcsec. In this last example the seeing started with a mean value of ∼0.6 arcsec and steadily increased throughout the night, reaching values greater than 2 arcsec.

These examples are not unique. In particular, other excellent seeing nights were measured, as shown in Table 1, where we can cross-select nights with a large number of data points and excellent median, mean and sigma values. These results are comparable or slightly better than previous ones obtained for single nights, as is the case in the example shown for the night of May 22, 1993 by Echevarría et al. (1998), where simultaneous STT and Carnegie observations yield a median of 0.43 arcsec for an 8 hour run during a very stable night.

5. CONCLUSIONS

From this two-year DIMM program to measure atmospheric turbulence at the site of the Observatorio Astronómico Nacional in San Pedro Mártir we conclude that: a) the seeing has a median of 0.57 arcsec and a first quartile of 0.46 arcsec; and b) it is not uncommon for the seeing to remain very stable for whole nights; under excellent conditions, the best results yield a median with 0.37 arcsec during nearly nine hours of continuous observations.

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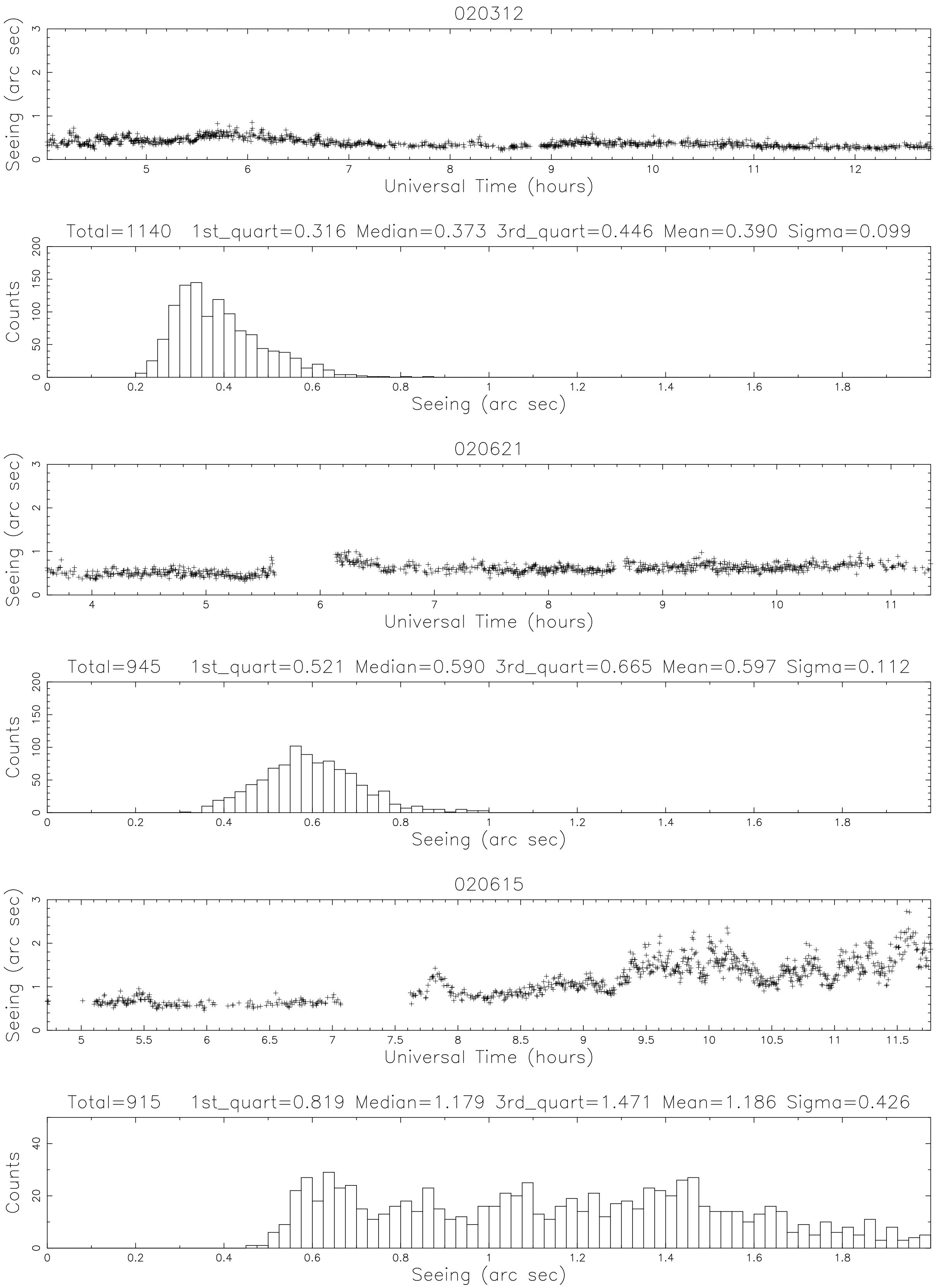

Fig. 3. Examples of good, average and bad observing nights.