Abstract

Sonneberg Observatory’s all-sky patrol (see SOPHIA poster) with photographic plates is continued by digital monitoring using different types of instruments. The cascade starts with all-sky cameras using fish-eye lenses. We have set up two cameras, one from the consumer market, the other as in-house development. An almost continuous monitoring from dawn to dawn is achieved by 20-seconds exposures with just 2.5 seconds read-out time, reaching stars of 6° and 7° in the zenith. The survey runs since four years with the main goal of bright star monitoring, detection of bright meteors and fireballs, besides statistics of unusual atmospheric phenomena.

Introduction

Sonneberg Observatory run the Sky Patrol and Field Patrol from 1923 to 2010 by photographic means. With the development of solid-state detectors and computers during the last decades of the twentieth century it soon became obvious that chemical photography will finally be stopped and be replaced by CCD and CMOS cameras. For this reason we had work out a project called ASPA (All-Sky Patrol Astrophysics) in the mid 1990ies to set up a digital sky patrol at six sites around the world. Unfortunately, this project could not be realised. 

Mainly as a matter of low budget but decisive to start any kind of digital sky patrol we set up a two-stage sky monitoring with digital cameras. One of them should be a permanent all-sky monitoring with a fish-eye lens, and the other should be a kind of field patrol using existing optical instruments.

All-Sky Monitoring

The first all-sky camera (Starlight Xpress Oculus, see figure 1, left) was mounted in March 2015 and is running since without minor technical interruptions only. Impressed by the results we (T.B.) developed an in-house fish-eye camera which runs since mid 2017 (figure 1, right).

The cameras are operated in the following way. From dawn to dawn (Sun elevation below –10°) the camera takes images of 20 seconds exposure time. This exposure time is adjusted in the way that stars at the celestial equator still appear as points. The read-out time of one image is in the order of 2.5 seconds. Thus, there are roughly 160 images taken per hour, summing up to about 600 images near summer and winter solstices, depending on declination and weather conditions.

Owing to the limiting magnitude a few thousands of bright stars are monitored though the year with approximately 25,000 to 100,000 data points, depending on declination and weather conditions.

An automatic analysis of the images is currently missing. As a test case (in other context), K.S. has estimated δ Cephei, the famous prototype of pulsating stars, with Argelander’s method. Figure 5 shows the folded light-curve of this star.

Deeper monitoring of selected fields

By combination of a Tessar 80/360 mm objective and a Canon EOS 5D Mark I the selection of the fields comes from prominent variable stars such as R Coronae Borealis or FG Sagittae. As the field of view is 3.8° × 7.7°, also other variables are recorded. As an example, figure 7 shows the light curves of R Cee, SX Her, and VV Cep over the last three to four years, reduced with MinWin by E.S.

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