Optical Monitoring of BL Lac Object S5 0716+714 with High Temporal Resolution

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ABSTRACT
Optical monitoring of S5 0716+714 was performed with a 60/90 Schmidt telescope in 2003 November and December and 2004 January for studying the variability of the object on short timescales. Due to the high brightness of the source we could carry out quasi-simultaneous measurements in three bands with a temporal resolution of about 20 minutes by using one single telescope. Intraday and intranight variations were observed with an overall change of \( \sim 0.9 \text{ mag} \) during the whole campaign. Two outbursts were recorded on JD 2453005 and JD 2453009. Minimum timescales of a few hours were derived from the light curves of individual nights but were different from night to night. A bluer-when-brighter chromatism was present when the object was in fast flare, but was absent when it was in a relatively quiescent state. Our results are basically consistent with the shock-in-jet model and demonstrate that the geometrical effects can sometimes play an important role in the variability of blazars.

Subject headings: galaxies: active — galaxies: photometry — BL Lacertae objects: individual (S5 0716+714)

1. INTRODUCTION

Blazars are a subset of active galactic nuclei (AGNs). These radio-loud flat-spectrum objects exhibit the most rapid variations and the largest amplitude variations among all AGNs. The variations are thought to originate from a relativistic jet, which is believed to be oriented at a small angle to our light of sight and which is probably powered and accelerated by a rotating and accreting supermassive black hole. There are basically two types of blazars, the BL Lac objects and the flat-spectrum radio quasars (FSRQ), the former have a featureless optical continuum while the latter show many strong and broad emission lines.

Variability studies of blazars have been essential in understanding the physics of their central regions, which in general cannot be resolved even with existing or planned optical/infrared interferometers. The timescales, the spectral changes, and the correlations and delays between variations in different continuum components provide crucial information on the nature and location of these components and on their interdependencies. These parameters can be well studied with multi-frequency observational campaigns, such as those coordinated for Mrk 421 (e.g., Buckley et al. 1996), 3C 279 (e.g., Wehrle et al. 1998), S5 0716+714 (e.g., Raiteri et al. 2003; Wagner et al. 1996), and PKS 2155-304 (e.g., Urry et al. 1997).

The BL Lac object S5 0716+714 is well known for its intraday variability (IDV) in the
radio and optical bands and has been the target of many monitoring programs, as mentioned above. Nesci, Massaro, & Montagni (2002) found a typical variation rate of 0.02 mag per hour and a maximum rising rate of 0.16 mag per hour for this object. Heidt & Wagner (1996) reported a period of 4 day in the optical band while Qian, Tao, & Fan (2002) derived a 10 day period from their 5.3 yr optical monitoring. The latter authors also discovered a variation range of about 3 mag in the $V$ band and 2.5 mag in both $R$ and $I$ bands during their whole monitoring program. The optical and radio behavior of the object was recently presented by Raiteri et al. (2003) based on 8 years of optical and more than 20 years of radio observations. Four major optical outbursts were observed at the beginning of 1995, in late 1997, at the end of 2000, and in fall 2001. An exceptional brightening of 2.3 mag in 9 days was detected in the $R$ band just before a BeppoSAX pointing on Oct 30th, 2000. The radio flux variations at different frequencies are similar, but the amplitude decreases with increasing wavelength. Its multiwavelength variability was described in detail in Wagner et al. (1996).

The broad band spectral properties of S5 0716+714 suggest that it is intermediate between low-frequency peaked BL Lac (LBL) and high-frequency peaked BL Lac (HBL) (Ulrich, Maraschi, & Urry 1997). The high-energy part of its spectral energy distribution is expected to peak in the MeV energy domain. A 450 ks INTEGRAL observation of S5 0716+714 proposed by the Landessternwarte Heidelberg group (PI: S. Wagner) was performed in the period 2003 November 10–18. A number of ground-based radio and optical telescopes have monitored this source during this period, including our 60/90 Schmidt telescope.

Our monitoring program have covered the period from 2003 November 8 to 18. and from 2003 December 30 to 2004 January 5 with a temporal resolution of about 20 minutes. Unlike most previous investigations, which focused on the long-term variability of this object, we concentrated on its microvariability in short timescales based on our high temporal resolution. The short timescales and spectral behaviors were studied. Here we present the observational results and analysis.

This paper is organized as follows: The observation and reduction procedures on the monitoring data are described in Sect. 2. Sect. 3 presented the results, including the light curves, the analysis on timescales and spectral changes, and some discussion on the sine-like light curves we observed. A summary is given in Sect. 4.
2. OBSERVATION AND DATA REDUCTION

Our optical monitoring program was performed on a 60/90 Schmidt telescope, which is located at the Xinglong Station of the National Astronomical Observatories of China (NAOC). A Ford Aerospace $2048 \times 2048$ CCD camera is mounted at its main focus. The CCD has a pixel size of 15 microns and its field of view is $58' \times 58'$, resulting in a resolution of $1.7''/\text{pixel}$. The telescope is equipped with a 15-color intermediate-band photometric system, covering a wavelength range from 3000 to 10000 Å. The telescope and the photometric system are mainly used to carry out the Beijing-Arizona-Taiwan-Connecticut (BATC) survey and has shown their efficiency in detecting fast variabilities in blazars (e.g., Peng, Wu, & Zhou 2003).

The observations on the telescope are now highly automated. The telescope and filters can be controlled by a single computer command with a parameter file that specifies the telescope pointing, the filter change, the exposure time, etc. Once the observation starts, the remaining work left for the observers are to check the quality of the observed CCD images and to pay some attention to the weather condition. In fact, after the night assistant prepared the hardwares, the monitoring of S5 0716+714 was controlled remotely by a computer at the headquarters of NAOC in Beijing, which is about 140 km away from the telescope.

Our monitoring of S5 0716+714 was divided into two periods, one was from 2003 November 8 to 18 (6 nights, in fact, due to weather condition), the other was from 2003 December 30 to 2004 January 5 (7 successive nights). The first period (hereafter Period 1) covered the duration of the INTEGRAL observation and the second period (hereafter Period 2) was an extension of Period 1. A filter cycle of $e$, $f$, and $k$ (their central wavelengths are 4873, 5248, and 7528 Å, respectively) was used in Period 1 and a typical exposure time of 200–300 s was able to produce an image with a good signal-to-noise ratio. Only the central $512 \times 512$ pixels were read out as the CCD images and the readout time was about 5.6 s. Plus the time on filter change, we achieved a temporal resolution of about 20 min in each band. This enabled us to realize quasi-simultaneous measurements in three BATC bands with a high temporal resolution by using only one telescope. The size of the $512 \times 512$ image is $14.5' \times 14.5'$ and is enough to cover the BL Lac and eight previously published comparison stars (Villata et al. 1998).

During Period 2, we changed the $k$ filter to the more sensitive $i$ filter (its central wavelength is 6711 Å), with which a shorter exposure time can produce images with the same quality as in the $k$ band. The other observational procedures and constraints were the same as in Period 1. The observational log and parameters are presented in Tables 2–7 with columns being observation date and time (UT), exposure time, Julian Date, BATC magnitude and error. The finding chart of S5 0716+714 and the comparison stars is illustrated in
In order to obtain in real time the light curves of the BL Lac object we developed an automatic procedure. The procedure includes the following steps. The CCD images were first flat-fielded, then Bertin’s Source EXtractor (SEX, Bertin & Arnouts 1996) was run on the CCD frames and the instrumental magnitudes and errors of S5 0716+714 and the 8 comparison stars were extracted. The average FWHM of the stellar images is about 4.0′′. A photometric aperture of 5 pixel (8.5′′) diameter was adopted during the extraction. The BATC $e$, $f$, $i$, and $k$ magnitudes of the 8 comparison stars were obtained by observing them and a BATC standard star HD 19445 in a same night and are listed in Table 1. Then, by comparing the instrumental magnitudes of the 8 comparison stars with their BATC magnitudes, the instrumental magnitudes of S5 0716+714 were calibrated into the BATC $e$, $f$, $i$, and $k$ magnitudes and the light curves in 4 BATC bands were obtained.

3. RESULTS

3.1. Light Curves

The light curves are displayed in Figs. 2 and 3 for Periods 1 and 2, respectively. The large panels show light curves of the BL Lac and the small ones present those of the differential magnitudes (average set to 0) between the 5th comparison star and the average of all 8. In order to show the variation clearly, we only plot the duration when the BL Lac was observed and exclude the daytime periods when no observations could be made by us.

All light curves show intranight fluctuations superposed on longer timescale variations. In Period 1 (see Fig. 2), the variation is characterized by fast oscillations with small amplitudes. In the first night or on JD 2 452 952, the BL Lac was in a relatively ‘high’ state. Then its brightness dropped in the following days and reached a minimum on JD 2 452 956. In the following two days, the BL Lac got brighter, reaching another ‘high’ state around the beginning of JD 2 452 959. The total magnitude change was about 0.4 mag in Period 1 and the magnitude changes in individual nights were mostly about 0.1 mag except that on JD 2 452 956. The object appeared in a relatively quiescent state.

The observational accuracy in Period 2 is higher than in Period 1 due to the better weather conditions in Period 2. The light curves are characterized by continuous (except on JD 2 453 006) increase in brightness. Two outbursts were observed on JD 2 453 005 and JD 2 453 009 with rapid brightening of more than 0.3 mag within 0.4 days. The most sharp increase in brightness occurred on JD 2 453 005. The $i$ magnitude changed from 13.896 on JD 2453005.328 to 13.716 on JD 2453005.400 (see Table 7), resulting in a rising rate of 0.1
mag per hour. The total magnitude change is about 0.8 mag in Period 2, which is a factor of two larger than that in Period 1, and the object appeared in an active or flaring state.

The most unusual variation in Period 2 was observed on JD 2453006: all three light curves look very close to sine curves (see Fig. 3) with an amplitude of about 0.1 mag and a period of about 0.21 day (5 hr). This kind of variation is of particular interest and will be discussed in Sect. 3.4.

In order to establish whether there is a time lag between the variations in different wavebands, we have calculated the $z$-transformed discrete correlation function (ZDCF, Alexander 1997) for Periods 1 and 2 and for several individual nights. No significant time lag has been identified except that a couple of nights show time lags from a few to less than 20 minutes between different wavebands. A time lag between variations in different wavebands will lead to an oscillating color index with respect to brightness, rather than a bluer-when-brighter trend reported in Sect. 3.3.

In both periods, the light curves in different bands are consistent with one another. The rms’s of the differential magnitudes between the 5th comparison star and the average of all 8 are 0.011, 0.010, 0.012, 0.009, 0.008, and 0.010 mag in the six small panels in Figs. 2 and 3. These results demonstrate the accuracy of our magnitude measurements.

### 3.2. Timescales of Variability

Structure function (Simonetti, Cordes, & Heeschen 1985) can be used to search for the typical timescales and periodicities of the variability. A characteristic timescale in a light curve, defined as the time interval between a maximum and an adjacent minimum or vice versa, is indicated by a maximum of the structure function, whereas a periodicity in the light curve causes a minimum of the structure function (Heidt & Wagner 1996).

For S5 0716+714, structure function analysis was performed on the light curves of each individual night. Short timescales of a few hours were derived but the results are different from night to night. For example, the structure function analysis (see the left panel in Fig. 4) identified a timescale of 0.11 day (2.5 hr) and a period of 0.21 day (5 hr) for JD 2453006, which are consistent with the period clearly visible on the sine-like light curves in that night. Another example is that the same analysis on light curves of JD 2453007 revealed timescales of 0.07 and 0.17 day (1.7 and 4.1 hr) and periods of 0.11 and 0.23 day (2.6 and 5.5 hr) (see the right panel in Fig. 4). All timescales and periods are labeled by dashed lines in Fig. 4. There are also a common timescale of about 20 min appeared in all structure functions. But this timescale is identical to the temporal resolution of our monitoring and can not be
associated with the intrinsic variability.

IDV has been frequently reported at radio and optical wavelengths in BL Lac S5 0716+714, our observations at optical bands re-confirmed such IDV phenomena in this source. Comparing to the much longer optical timescales of 4–10 day derived by other authors (e.g., Heidt & Wagner 1996; Qian, Tao, & Fan 2002), our dense monitoring enabled us to derive much shorter timescales for this object, which may constrain the physical processes that result in the fast microvariability of S5 0716+714 (see discussion in Sect. 4).

3.3. Spectral Behavior

The optical spectral change with brightness has been investigated for S5 0716+714 (e.g., Ghisellini et al. 1997; Raiteri et al. 2003; Villata et al. 2000, 2004) and for other BL Lac objects (e.g., Carini et al. 1992; Romero, Cellone, & Combi 2000; Speziali & Natali 1998; Villata et al. 2002). Most authors have reported a bluer-when-brighter chromatism when the objects are in fast flares and an “achromatic” trend for their long-term variability. However, Raiteri et al. (2003) also noted for S5 0716+714 that, on short timescales, “different behaviours have been found: sometimes a bluer-when-brighter trend is recognizable, while in some other cases the opposite is true; there are also cases where magnitude variations do not imply spectral changes”. They suggested to perform a very dense monitoring with high precision data to distinguish trends in the short-term spectral behaviour of this source.

Our monitoring of S5 0716+714 with high temporal resolution enables us to study its spectral behavior with a high confidence level. Following most authors mentioned above, we use color index to denote the spectral shape. The color index and brightness are taken as $e - k$ and $e + k$ for Period 1 and $e - i$ and $e + i$ for Period 2. The changes of the color index to the brightness in two periods are shown in Fig. 5. The solid lines are best fits to the points and have taken the errors in both coordinates into consideration (Press et al. 1992).

In Period 1 or when the object was in a relatively quiescent state, The distribution in color-brightness diagram is quite dispersed and there was not an overall color change. However, in Period 2 or when the object was in a flaring state, a clear bluer-when-brighter chromatism was found. The linear fit has a slope of 0.077. The Pearson correlation coefficient is 0.636 and the significance level is $5.014 \times 10^{-18}$, suggesting a strong correlation between color index and brightness. This is in agreement with the results obtained by most authors mentioned above. Ghisellini et al. (1997) have deduced from their monitoring that two processes may be operating in this source: the first one would cause the achromatic long-term flux variations, while the second would be responsible for the short-term fast variations.
Our results are somewhat different but still consistent with theirs: during the quiescent or low state, the variation may be dominated by the long-term component and shows no clear spectral change; while in the active or flaring state, the variation is dominated by the short-term component and has a bluer-when-brighter chromatism.

That the spectra of S5 0716+714 change with its brightness have been observed in other wavelengths. For instances, Raiteri et al. (2003) reported a flatter-when-brighter trend in radio waveband and Cappi et al. (1994) discovered a steeper-when-fainter phenomenon in soft X-ray. In fact, the spectrum changing with the flux in multi-wavelengths is a common feature in blazars (e.g., Aller et al. 1985; Urry, Mushotzky, & Holt 1986; Sembay et al. 1993; Kniffen et al. 1993; Mukherjee et al. 1996). This universal spectral behaviour is nontrivial. It suggests a close relationship among the mechanisms that are responsible for the emission and variation in different wavebands. The analysis of spectral changes of blazars can put some strong constraints on the physical processes that are responsible for their variations (see discussion in Sect. 3.4).

3.4. The Sine Light Curves

The perfect sine light curves observed on JD 2453006 is of particular interest because very few of this kind of light curve has been reported before. They mimic a periodic variation but there is only one complete period (it’s a great pity that our weather got bad just at the end of this period). Webb (1990) has detected a sinusoidal component in the variations of 3C 120, but the period was much longer (~ 13 yr). For S5 0716+714, quasi-periodic oscillations have been detected by Quirrenbach et al. (1991). Their light curves, however, are very different: they are sawtooth-like with sharp turnoffs while our light curves are sine-like with smooth turns. Then we come to the question: what mechanism can produce such sine light curves?

Some mechanisms have been proposed to explain the IDV phenomena of blazars. They can be largely classified into two types, the extrinsic and the intrinsic, as reviewed by Wagner & Witzel (1995). The extrinsic mechanisms include the inter-stellar scintillation (ISS) and gravitational microlensing. The ISS is highly frequency-dependent and only operates at low radio frequencies. The IDV in the mm regime and the fast variability in the optical regime, as observed by us, cannot be caused by the ISS mechanism. Meanwhile, the microlensing is an achromatic process and will result in symmetric light curves. However, color or spectral changes have been frequently observed from radio to X-ray wavebands for the variability of S5 0716+714, as mentioned in last section. We have also detected a clear bluer-when-brighter chromatism. In addition, the light curves at all wavelengths, including our optical
ones, are generally asymmetric. Therefore, the fast variation of S5 0716+714 is unlikely due to microlensing. In fact, the close correlation between the optical and radio bands observed in S5 0716+714 (e.g., Quirrenbach et al. 1991; Wagner et al. 1996) provides a strong evidence against the extrinsic origin of its variability.

The intrinsic interpretations include mainly the accretion disk instabilities and shock-in-jet model. The accretion disk model is able to explain some of the phenomena seen in the optical to X-ray range but cannot explain radio IDV (e.g., Wagner & Witzel 1995). The most frequently cited model is the shock-in-jet model which has been widely used to explain the variability of blazars and quasars (e.g., Guetta et al. 2004; Jia et al. 1998; Qian et al. 1991; Romero, Cellone, & Combi 2000; Wagner & Witzel 1995, and references therein). The main idea of the model is that shocks propagate down the relativistic jet whose plasma is hydromagnetically turbulent. At sites where the shocks encounter particles or magnetic field overdensities, the optical synchrotron emission is enhanced. The amplitude and timescale of the resulting variation depend on the power spectrum of the turbulence and the shock thickness. This kind of shock-in-jet model will naturally lead to the prediction of a bluer-when-brighter phenomenon (Marscher 1998), as observed in our case.

The shock-in-jet model still suffers from a number of problems in explaining IDV, such as the close correlation between the radio and optical variations. Therefore, the geometrical effects are sometimes invoked to account for some observational facts that can not be interpreted satisfactorily by the shock-in-jet model. Geometrical modulation in the context of shock-in-jet models are detailed by Camenzind & Krockenberger (1992). They argued that knots of enhanced particle density are injected at a finite jet radius. In knots moving relativistically on helical trajectories, the direction of forward beaming varies with time. For an observer close to the jet axis, the sweeping of the beam will introduce flares due to the lighthouse effect. This will lead to quasi-periodic variations of a few oscillations and the variations are basically achromatic.

It is tempting to examine the color change on only JD 2 453 006 since perfect sine-like light curves were observed in that night. Fig. 6 illustrates the color index vs brightness relation. The linear fit gives a slope of 0.256 which is very different from the overall slope of Period 2. The correlation coefficient is 0.361 and the significance level is 0.170, which means a poor fit or no clear correlation between the color index and brightness. That is to say, the brightness changed nearly achromatically on JD 2 453 006. The only two known processes that can cause achromatic variability are the microlensing and light house effect. Although the microlensing has been ruled out as the dominant mechanism of the variability of S5 0716+714, it may still have some contribution. The symmetry in the sine light curves may indicate a microlensing event, but the concave shape of the second halves
of the light curves cannot be explained in terms of microlensing. In addition, this very short timescale would require a transverse speed of $v_{\text{trans}} \sim c$ when microlensing. Therefore, the most probable mechanism responsible for the sine light curves is the light house effect. It may produce a periodic variation according to Camenzind & Krockenberger (1992) and the variation is achromatic. In other words, the variation observed on JD 2453006 is likely due to geometrical effects.

It is unclear whether all fast IDV, especially the quasi-periodic ones, such as those observed by Quirrenbach et al. (1991), can also be explained in terms of geometrical effects within the context of shock-in-jet model. If the answer is yes, the actual timescales of the intrinsic flux changes will be longer by a few factors and the deduced extremely high brightness temperature will be reduced by one or more orders of magnitude. This will help to resolve the large difference between the high brightness temperature ($\sim 10^{17}$ K) and the Compton limit ($< 10^{12}$ K), though not fully resolved.

4. SUMMARY

During the periods of 2003 November 8–18 and from 2003 December 30 to 2004 January 5, we have carried out optical monitoring of the BL Lac object S5 0716+714 with a high temporal resolution. Intraday and intranight variations were observed with an overall magnitude change of about 0.9 mag during the whole campaign. Two outbursts were recorded on JD 2453005 and JD 2453009. Short timescales of a few hours were derived from the light curves of each individual night but are different from night to night. A bluer-when-brighter chromatism was present when the object was in an active or flaring state but was absent when it was in a relatively low or quiescent state.

Our observations have suggested that the fast microvariability in S5 0716+714 is basically consistent with the shock-in-jet model. The analysis has also indicated that the geometrical effects can sometimes play an important role in the variability of blazars. Up to now, all theoretical models that have been proposed to explain the variability of blazars have their own individual difficulties (see, e.g., Wagner & Witzel 1995, for a discussion). In order to better understand the variability of blazars and to strictly constrain the theoretical models, simultaneous multifrequency campaigns with high temporal resolutions should be the direction of future efforts.

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Fig. 1.— Finding chart of S5 0716+714 and the 8 comparison stars taken with the 60/90 Schmidt telescope and filter $i$ on JD 2453008. The size is $14.5' \times 14.5'$ (or $512 \times 512$ in pixels). The 8 comparison stars are the same as in Villata et al. (1998).
Fig. 2.— Light curves of S5 0716+714 in the BATC $e$, $f$, and $k$ bands in Periods 1. Large panels are those of the BL Lac object and small ones are of the differential magnitudes between the 5th comparison star and the average of all 8.
Fig. 3.— Light curves of S5 0716+714 in the BATC $e$, $f$, and $i$ bands in Period 2. Large panels are those of the BL Lac object and small ones are of the differential magnitudes between the 5th comparison star and the average of all 8.
Fig. 4.— Structure function of the S5 0716+714 on JD 2453006 (the left panel) and JD 2453007 (the right panel). The dashed lines indicate timescales at maxima and periods at minima of structure functions.
Fig. 5.— Color index vs brightness in two periods. The lines are best fits to the points. The bluer-when-brighter chromatism is clear in Period 2 (right panel) but absent in Period 1 (left panel). The two panels are set to have the same scales on both coordinates for a comparison.
Fig. 6.— Color index vs brightness on JD 2453006. The solid line only indicates a very weak correlation between the color index and brightness.
Table 1. BATC Magnitudes of 8 Comparison Stars.

| Star | $e$   | $f$  | $i$   | $k$   |
|------|-------|------|-------|-------|
| 1    | 11.207| 11.174| 11.075| 11.007|
| 2    | 11.656| 11.615| 11.508| 11.490|
| 3    | 12.663| 12.564| 12.428| 12.361|
| 4    | 13.366| 13.296| 13.245| 13.211|
| 5    | 13.760| 13.661| 13.511| 13.449|
| 6    | 13.839| 13.747| 13.590| 13.564|
| 7    | 14.049| 13.962| 13.628| 13.645|
| 8    | 14.335| 14.284| 14.113| 14.106|
Table 2. Observational log and results in the BATC $e$ band in Period 1.

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD | $e$ (mag) | $e_{err}$ (mag) |
|------------------------|----------------------|---------------|----|-----------|-----------------|
| 2003 11 08             | 16:04:57             | 100           | 2452952.171 | 14.285     | 0.026           |
| 2003 11 08             | 17:43:46             | 300           | 2452952.241 | 14.327     | 0.014           |
| 2003 11 08             | 18:19:14             | 300           | 2452952.265 | 14.312     | 0.013           |
| 2003 11 12             | 16:36:29             | 300           | 2452956.194 | 14.522     | 0.014           |
| 2003 11 12             | 16:55:35             | 300           | 2452956.207 | 14.540     | 0.014           |
| 2003 11 12             | 17:14:19             | 300           | 2452956.220 | 14.561     | 0.015           |
| 2003 11 12             | 17:33:15             | 300           | 2452956.233 | 14.573     | 0.015           |
| 2003 11 12             | 17:52:09             | 300           | 2452956.246 | 14.560     | 0.014           |
| 2003 11 12             | 18:10:59             | 300           | 2452956.259 | 14.552     | 0.015           |
| 2003 11 12             | 18:29:50             | 300           | 2452956.273 | 14.563     | 0.016           |
| 2003 11 12             | 18:48:47             | 300           | 2452956.286 | 14.570     | 0.017           |
| 2003 11 12             | 19:07:32             | 300           | 2452956.299 | 14.534     | 0.016           |
| 2003 11 12             | 19:26:31             | 300           | 2452956.312 | 14.542     | 0.018           |
| 2003 11 12             | 19:45:18             | 300           | 2452956.325 | 14.576     | 0.019           |
| 2003 11 12             | 20:04:36             | 300           | 2452956.338 | 14.606     | 0.020           |
| 2003 11 12             | 20:23:30             | 300           | 2452956.351 | 14.616     | 0.021           |
| 2003 11 12             | 20:42:24             | 300           | 2452956.364 | 14.616     | 0.020           |
| 2003 11 12             | 21:01:19             | 300           | 2452956.378 | 14.645     | 0.019           |
| 2003 11 12             | 21:20:02             | 300           | 2452956.391 | 14.649     | 0.021           |
| 2003 11 12             | 21:38:58             | 300           | 2452956.404 | 14.666     | 0.023           |
| 2003 11 12             | 21:58:10             | 300           | 2452956.417 | 14.670     | 0.037           |
| 2003 11 14             | 16:14:20             | 300           | 2452958.178 | 14.604     | 0.018           |
| 2003 11 14             | 16:33:04             | 300           | 2452958.191 | 14.585     | 0.018           |
| 2003 11 14             | 16:51:59             | 300           | 2452958.205 | 14.591     | 0.018           |
| 2003 11 14             | 17:10:48             | 300           | 2452958.218 | 14.575     | 0.014           |
| 2003 11 14             | 17:29:48             | 300           | 2452958.231 | 14.627     | 0.013           |
| 2003 11 14             | 17:48:29             | 300           | 2452958.244 | 14.605     | 0.012           |
| 2003 11 14             | 18:07:29             | 300           | 2452958.257 | 14.628     | 0.014           |
| 2003 11 14             | 18:26:39             | 300           | 2452958.270 | 14.581     | 0.018           |
| 2003 11 14             | 18:45:54             | 300           | 2452958.284 | 14.577     | 0.012           |
| 2003 11 14             | 19:04:43             | 300           | 2452958.297 | 14.579     | 0.011           |
| 2003 11 14             | 19:23:29             | 300           | 2452958.310 | 14.584     | 0.011           |
| 2003 11 14             | 19:42:20             | 300           | 2452958.323 | 14.549     | 0.011           |
| 2003 11 14             | 20:01:27             | 300           | 2452958.336 | 14.556     | 0.011           |
| 2003 11 14             | 20:20:35             | 300           | 2452958.349 | 14.518     | 0.011           |
| 2003 11 14             | 20:39:35             | 300           | 2452958.363 | 14.536     | 0.011           |
| 2003 11 14             | 20:58:20             | 300           | 2452958.376 | 14.521     | 0.011           |
| 2003 11 14             | 21:17:37             | 300           | 2452958.389 | 14.522     | 0.011           |
| 2003 11 14             | 21:36:34             | 300           | 2452958.402 | 14.521     | 0.011           |
| 2003 11 14             | 21:55:39             | 300           | 2452958.415 | 14.481     | 0.016           |
| 2003 11 15             | 15:17:15             | 300           | 2452959.139 | 14.368     | 0.011           |
| 2003 11 15             | 15:39:57             | 300           | 2452959.154 | 14.385     | 0.010           |
| 2003 11 15             | 16:09:28             | 300           | 2452959.175 | 14.393     | 0.010           |
| 2003 11 15             | 16:28:10             | 300           | 2452959.188 | 14.439     | 0.011           |
Table 2—Continued

| Obs. Date  | Obs. Time | Exp. Time | JD        | $e$   | $e_{err}$ |
|------------|-----------|-----------|-----------|-------|-----------|
| (yyyy mm dd) | (hh:mm:ss) | (s)       |           | (mag) | (mag)     |
| 2003 11 15 | 16:46:52  | 300       | 2452959.201 | 14.437 | 0.011     |
| 2003 11 15 | 17:05:52  | 300       | 2452959.214 | 14.423 | 0.011     |
| 2003 11 15 | 17:24:35  | 300       | 2452959.227 | 14.435 | 0.011     |
| 2003 11 15 | 17:43:40  | 300       | 2452959.240 | 14.453 | 0.013     |
| 2003 11 15 | 18:02:34  | 300       | 2452959.254 | 14.414 | 0.011     |
| 2003 11 15 | 18:21:30  | 300       | 2452959.267 | 14.441 | 0.012     |
| 2003 11 15 | 18:40:35  | 300       | 2452959.280 | 14.426 | 0.010     |
| 2003 11 15 | 18:59:20  | 300       | 2452959.293 | 14.442 | 0.010     |
| 2003 11 15 | 19:18:12  | 300       | 2452959.306 | 14.423 | 0.011     |
| 2003 11 15 | 19:36:58  | 300       | 2452959.319 | 14.421 | 0.010     |
| 2003 11 15 | 19:56:04  | 300       | 2452959.332 | 14.425 | 0.010     |
| 2003 11 15 | 20:15:17  | 300       | 2452959.346 | 14.416 | 0.009     |
| 2003 11 15 | 20:34:12  | 300       | 2452959.359 | 14.390 | 0.010     |
| 2003 11 15 | 20:53:04  | 300       | 2452959.372 | 14.393 | 0.010     |
| 2003 11 15 | 21:12:13  | 300       | 2452959.385 | 14.404 | 0.009     |
| 2003 11 15 | 21:31:09  | 300       | 2452959.398 | 14.393 | 0.010     |
| 2003 11 15 | 21:50:01  | 300       | 2452959.412 | 14.393 | 0.011     |
| 2003 11 16 | 15:20:41  | 300       | 2452960.141 | 14.313 | 0.008     |
| 2003 11 16 | 15:39:53  | 300       | 2452960.154 | 14.336 | 0.008     |
| 2003 11 16 | 15:58:38  | 300       | 2452960.168 | 14.334 | 0.008     |
| 2003 11 16 | 16:18:00  | 300       | 2452960.181 | 14.357 | 0.009     |
| 2003 11 16 | 16:36:50  | 300       | 2452960.194 | 14.383 | 0.009     |
| 2003 11 16 | 16:55:34  | 300       | 2452960.207 | 14.365 | 0.009     |
| 2003 11 16 | 17:14:35  | 300       | 2452960.220 | 14.363 | 0.009     |
| 2003 11 16 | 17:33:32  | 300       | 2452960.233 | 14.371 | 0.013     |
| 2003 11 16 | 17:46:00  | 300       | 2452960.242 | 14.359 | 0.015     |
| 2003 11 16 | 18:04:47  | 300       | 2452960.255 | 14.367 | 0.014     |
| 2003 11 16 | 18:23:48  | 300       | 2452960.268 | 14.342 | 0.022     |
| 2003 11 16 | 18:42:33  | 300       | 2452960.281 | 14.392 | 0.024     |
| 2003 11 16 | 19:01:31  | 300       | 2452960.294 | 14.368 | 0.010     |
| 2003 11 16 | 19:14:01  | 300       | 2452960.303 | 14.362 | 0.009     |
| 2003 11 16 | 19:32:45  | 300       | 2452960.316 | 14.342 | 0.009     |
| 2003 11 16 | 19:51:44  | 300       | 2452960.329 | 14.375 | 0.009     |
| 2003 11 16 | 20:11:02  | 300       | 2452960.343 | 14.353 | 0.009     |
| 2003 11 16 | 20:30:16  | 300       | 2452960.356 | 14.408 | 0.009     |
| 2003 11 16 | 20:43:00  | 300       | 2452960.365 | 14.384 | 0.012     |
| 2003 11 16 | 21:02:02  | 300       | 2452960.378 | 14.366 | 0.025     |
| 2003 11 18 | 15:20:20  | 300       | 2452962.141 | 14.425 | 0.022     |
| 2003 11 18 | 15:39:24  | 360       | 2452962.154 | 14.423 | 0.021     |
| 2003 11 18 | 16:01:25  | 300       | 2452962.169 | 14.419 | 0.048     |

aThe obs. date and time are of universal time. They are the same for Tables 3-7.
Table 3. Observational log and results in the BATC $f$ band in Period 1.

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD | $f$ (mag) | $f_{err}$ (mag) |
|------------------------|----------------------|---------------|----|-----------|-----------------|
| 2003 11 08             | 16:16:03             | 100           | 2452952.178 | 14.221     | 0.022           |
| 2003 11 08             | 17:51:25             | 300           | 2452952.246 | 14.247     | 0.012           |
| 2003 11 08             | 18:26:52             | 300           | 2452952.270 | 14.272     | 0.012           |
| 2003 11 08             | 19:01:50             | 300           | 2452952.295 | 14.234     | 0.011           |
| 2003 11 08             | 19:29:07             | 300           | 2452952.314 | 14.256     | 0.011           |
| 2003 11 08             | 19:56:22             | 300           | 2452952.333 | 14.235     | 0.012           |
| 2003 11 08             | 20:28:06             | 300           | 2452952.355 | 14.209     | 0.013           |
| 2003 11 08             | 20:55:32             | 300           | 2452952.374 | 14.189     | 0.019           |
| 2003 11 08             | 21:22:45             | 300           | 2452952.393 | 14.199     | 0.019           |
| 2003 11 12             | 16:43:00             | 300           | 2452956.198 | 14.482     | 0.013           |
| 2003 11 12             | 17:01:49             | 300           | 2452956.211 | 14.493     | 0.013           |
| 2003 11 12             | 17:20:32             | 300           | 2452956.224 | 14.481     | 0.013           |
| 2003 11 12             | 17:39:39             | 300           | 2452956.238 | 14.494     | 0.013           |
| 2003 11 12             | 17:58:25             | 300           | 2452956.251 | 14.475     | 0.012           |
| 2003 11 12             | 18:17:22             | 300           | 2452956.264 | 14.474     | 0.014           |
| 2003 11 12             | 18:36:17             | 300           | 2452956.277 | 14.514     | 0.015           |
| 2003 11 12             | 18:55:01             | 300           | 2452956.290 | 14.474     | 0.014           |
| 2003 11 12             | 19:13:47             | 300           | 2452956.303 | 14.476     | 0.015           |
| 2003 11 12             | 19:32:46             | 300           | 2452956.316 | 14.482     | 0.016           |
| 2003 11 12             | 19:51:35             | 300           | 2452956.329 | 14.494     | 0.016           |
| 2003 11 12             | 20:10:47             | 300           | 2452956.343 | 14.526     | 0.017           |
| 2003 11 12             | 20:29:56             | 300           | 2452956.356 | 14.570     | 0.017           |
| 2003 11 12             | 20:48:50             | 300           | 2452956.369 | 14.517     | 0.024           |
| 2003 11 12             | 21:07:33             | 300           | 2452956.382 | 14.574     | 0.017           |
| 2003 11 12             | 21:26:17             | 300           | 2452956.395 | 14.602     | 0.019           |
| 2003 11 12             | 21:45:15             | 300           | 2452956.408 | 14.603     | 0.021           |
| 2003 11 14             | 16:01:49             | 300           | 2452958.170 | 14.532     | 0.014           |
| 2003 11 14             | 16:20:33             | 300           | 2452958.183 | 14.555     | 0.017           |
| 2003 11 14             | 16:39:19             | 300           | 2452958.196 | 14.559     | 0.014           |
| 2003 11 14             | 16:58:17             | 300           | 2452958.209 | 14.546     | 0.014           |
| 2003 11 14             | 17:17:03             | 300           | 2452958.222 | 14.534     | 0.012           |
| 2003 11 14             | 17:36:01             | 300           | 2452958.235 | 14.525     | 0.014           |
| 2003 11 14             | 17:54:44             | 300           | 2452958.248 | 14.551     | 0.011           |
| 2003 11 14             | 18:13:44             | 300           | 2452958.261 | 14.530     | 0.012           |
| 2003 11 14             | 18:33:09             | 300           | 2452958.275 | 14.550     | 0.014           |
| 2003 11 14             | 18:52:11             | 300           | 2452958.288 | 14.520     | 0.011           |
| 2003 11 14             | 19:10:58             | 300           | 2452958.301 | 14.508     | 0.010           |
| 2003 11 14             | 19:29:53             | 300           | 2452958.314 | 14.539     | 0.010           |
| 2003 11 14             | 19:48:41             | 300           | 2452958.327 | 14.495     | 0.010           |
| 2003 11 14             | 20:08:04             | 300           | 2452958.341 | 14.480     | 0.011           |
| 2003 11 14             | 20:26:49             | 300           | 2452958.354 | 14.468     | 0.010           |
| 2003 11 14             | 20:45:50             | 300           | 2452958.367 | 14.442     | 0.010           |
| 2003 11 14             | 21:04:46             | 300           | 2452958.380 | 14.452     | 0.010           |
| 2003 11 14             | 21:23:51             | 300           | 2452958.393 | 14.460     | 0.009           |
| 2003 11 14             | 21:43:00             | 300           | 2452958.407 | 14.447     | 0.009           |
Table 3—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD     | f (mag) | f$_{err}$ (mag) |
|------------------------|----------------------|---------------|--------|---------|----------------|
| 2003 11 14             | 22:01:56             | 300           | 2452958.420 | 14.432  | 0.024          |
| 2003 11 15             | 15:25:35             | 300           | 2452959.145 | 14.317  | 0.010          |
| 2003 11 15             | 15:47:07             | 300           | 2452959.160 | 14.332  | 0.009          |
| 2003 11 15             | 15:52:51             | 300           | 2452959.163 | 14.318  | 0.009          |
| 2003 11 15             | 16:15:41             | 300           | 2452959.179 | 14.347  | 0.009          |
| 2003 11 15             | 16:34:23             | 300           | 2452959.192 | 14.351  | 0.009          |
| 2003 11 15             | 16:53:09             | 300           | 2452959.205 | 14.384  | 0.009          |
| 2003 11 15             | 17:12:05             | 300           | 2452959.219 | 14.366  | 0.009          |
| 2003 11 15             | 17:31:00             | 300           | 2452959.232 | 14.378  | 0.009          |
| 2003 11 15             | 17:50:05             | 300           | 2452959.245 | 14.384  | 0.010          |
| 2003 11 15             | 18:08:50             | 300           | 2452959.258 | 14.357  | 0.009          |
| 2003 11 15             | 18:27:45             | 300           | 2452959.271 | 14.368  | 0.010          |
| 2003 11 15             | 18:46:49             | 300           | 2452959.284 | 14.357  | 0.009          |
| 2003 11 15             | 19:05:34             | 300           | 2452959.297 | 14.363  | 0.009          |
| 2003 11 15             | 19:24:27             | 300           | 2452959.310 | 14.347  | 0.010          |
| 2003 11 15             | 19:43:10             | 300           | 2452959.323 | 14.348  | 0.009          |
| 2003 11 15             | 20:02:26             | 300           | 2452959.337 | 14.347  | 0.009          |
| 2003 11 15             | 20:21:31             | 300           | 2452959.350 | 14.341  | 0.008          |
| 2003 11 15             | 20:40:28             | 300           | 2452959.363 | 14.313  | 0.009          |
| 2003 11 15             | 20:59:30             | 300           | 2452959.376 | 14.328  | 0.009          |
| 2003 11 15             | 21:18:26             | 300           | 2452959.389 | 14.334  | 0.009          |
| 2003 11 15             | 21:37:23             | 300           | 2452959.403 | 14.323  | 0.009          |
| 2003 11 15             | 21:56:14             | 300           | 2452959.416 | 14.338  | 0.013          |
| 2003 11 16             | 15:05:24             | 300           | 2452960.131 | 14.236  | 0.007          |
| 2003 11 16             | 15:26:57             | 300           | 2452960.146 | 14.253  | 0.007          |
| 2003 11 16             | 15:46:08             | 300           | 2452960.159 | 14.254  | 0.007          |
| 2003 11 16             | 16:05:08             | 300           | 2452960.172 | 14.254  | 0.007          |
| 2003 11 16             | 16:24:16             | 300           | 2452960.185 | 14.295  | 0.008          |
| 2003 11 16             | 16:43:05             | 300           | 2452960.198 | 14.313  | 0.008          |
| 2003 11 16             | 17:01:50             | 300           | 2452960.211 | 14.329  | 0.009          |
| 2003 11 16             | 17:20:50             | 300           | 2452960.225 | 14.318  | 0.008          |
| 2003 11 16             | 17:39:47             | 300           | 2452960.238 | 14.315  | 0.013          |
| 2003 11 16             | 17:52:19             | 300           | 2452960.246 | 14.305  | 0.013          |
| 2003 11 16             | 18:11:03             | 300           | 2452960.259 | 14.297  | 0.015          |
| 2003 11 16             | 18:30:03             | 300           | 2452960.273 | 14.283  | 0.022          |
| 2003 11 16             | 18:48:49             | 300           | 2452960.286 | 14.302  | 0.017          |
| 2003 11 16             | 19:07:47             | 300           | 2452960.299 | 14.280  | 0.008          |
| 2003 11 16             | 19:20:16             | 300           | 2452960.308 | 14.283  | 0.008          |
| 2003 11 16             | 19:39:15             | 300           | 2452960.321 | 14.303  | 0.008          |
| 2003 11 16             | 19:58:14             | 300           | 2452960.334 | 14.316  | 0.008          |
| 2003 11 16             | 20:17:19             | 300           | 2452960.347 | 14.295  | 0.008          |
| 2003 11 16             | 20:36:44             | 300           | 2452960.361 | 14.288  | 0.009          |
| 2003 11 16             | 20:49:16             | 300           | 2452960.369 | 14.294  | 0.010          |
| 2003 11 16             | 21:08:17             | 300           | 2452960.382 | 14.338  | 0.017          |
| 2003 11 18             | 15:26:36             | 300           | 2452962.145 | 14.351  | 0.016          |
Table 3—Continued

| Obs. Date   | Obs. Time  | Exp. Time | JD           |  $f$  |  $f_{err}$ |
|-------------|------------|-----------|--------------|-------|------------|
| (yyyy mm dd)| (hh:mm:ss) | (s)       | (s)          | (mag) | (mag)      |
| 2003 11 18  | 15:48:54   | 300       | 2452962.161  | 14.350| 0.016      |
| 2003 11 18  | 16:07:39   | 300       | 2452962.174  | 14.371| 0.030      |
Table 4. Observational log and results in the BATC $k$ band in Period 1.

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD | $k$ (mag) | $k_{err}$ (mag) |
|------------------------|----------------------|---------------|----|----------|-----------------|
| 2003 11 08             | 16:33:17             | 100           | 2452952.190 | 13.869 | 0.021 |
| 2003 11 08             | 18:11:18             | 300           | 2452952.260 | 13.882 | 0.010 |
| 2003 11 08             | 18:46:28             | 300           | 2452952.284 | 13.879 | 0.010 |
| 2003 11 08             | 19:21:27             | 300           | 2452952.308 | 13.867 | 0.010 |
| 2003 11 08             | 19:48:44             | 300           | 2452952.327 | 13.869 | 0.010 |
| 2003 11 08             | 20:20:24             | 300           | 2452952.349 | 13.862 | 0.015 |
| 2003 11 08             | 20:47:55             | 300           | 2452952.368 | 13.813 | 0.025 |
| 2003 11 08             | 21:15:07             | 300           | 2452952.387 | 13.849 | 0.025 |
| 2003 11 08             | 21:42:28             | 300           | 2452952.406 | 13.884 | 0.042 |
| 2003 11 12             | 16:49:24             | 300           | 2452956.203 | 14.035 | 0.012 |
| 2003 11 12             | 17:08:07             | 300           | 2452956.216 | 14.031 | 0.012 |
| 2003 11 12             | 17:26:45             | 300           | 2452956.229 | 14.051 | 0.012 |
| 2003 11 12             | 17:45:55             | 300           | 2452956.242 | 14.029 | 0.011 |
| 2003 11 12             | 18:04:41             | 300           | 2452956.255 | 14.052 | 0.011 |
| 2003 11 12             | 18:23:35             | 300           | 2452956.268 | 14.057 | 0.012 |
| 2003 11 12             | 18:42:29             | 300           | 2452956.281 | 14.068 | 0.013 |
| 2003 11 12             | 19:01:19             | 300           | 2452956.294 | 14.013 | 0.012 |
| 2003 11 12             | 19:20:14             | 300           | 2452956.308 | 14.024 | 0.013 |
| 2003 11 12             | 19:39:04             | 300           | 2452956.320 | 14.045 | 0.013 |
| 2003 11 12             | 19:57:58             | 300           | 2452956.334 | 14.083 | 0.014 |
| 2003 11 12             | 20:17:15             | 300           | 2452956.347 | 14.087 | 0.015 |
| 2003 11 12             | 20:36:10             | 300           | 2452956.360 | 14.128 | 0.015 |
| 2003 11 12             | 20:55:05             | 300           | 2452956.373 | 14.136 | 0.017 |
| 2003 11 12             | 21:13:46             | 300           | 2452956.386 | 14.184 | 0.016 |
| 2003 11 12             | 21:32:44             | 300           | 2452956.400 | 14.207 | 0.017 |
| 2003 11 12             | 21:51:40             | 300           | 2452956.413 | 14.199 | 0.020 |
| 2003 11 14             | 16:08:07             | 300           | 2452958.174 | 14.161 | 0.014 |
| 2003 11 14             | 16:26:47             | 300           | 2452958.187 | 14.152 | 0.014 |
| 2003 11 14             | 16:45:46             | 300           | 2452958.200 | 14.149 | 0.014 |
| 2003 11 14             | 17:04:32             | 300           | 2452958.213 | 14.150 | 0.013 |
| 2003 11 14             | 17:23:34             | 300           | 2452958.226 | 14.152 | 0.011 |
| 2003 11 14             | 17:42:14             | 300           | 2452958.239 | 14.207 | 0.012 |
| 2003 11 14             | 18:01:14             | 300           | 2452958.253 | 14.166 | 0.011 |
| 2003 11 14             | 18:20:12             | 300           | 2452958.266 | 14.162 | 0.012 |
| 2003 11 14             | 18:39:25             | 300           | 2452958.279 | 14.159 | 0.012 |
| 2003 11 14             | 18:58:25             | 300           | 2452958.292 | 14.162 | 0.011 |
| 2003 11 14             | 19:17:15             | 300           | 2452958.305 | 14.123 | 0.011 |
| 2003 11 14             | 19:36:05             | 300           | 2452958.319 | 14.118 | 0.009 |
| 2003 11 14             | 19:55:12             | 300           | 2452958.332 | 14.133 | 0.010 |
| 2003 11 14             | 20:14:18             | 300           | 2452958.345 | 14.114 | 0.011 |
| 2003 11 14             | 20:33:08             | 300           | 2452958.358 | 14.093 | 0.010 |
| 2003 11 14             | 20:52:04             | 300           | 2452958.371 | 14.088 | 0.010 |
| 2003 11 14             | 21:11:11             | 300           | 2452958.384 | 14.117 | 0.010 |
| 2003 11 14             | 21:30:06             | 300           | 2452958.398 | 14.108 | 0.010 |
| 2003 11 14             | 21:49:14             | 300           | 2452958.411 | 14.079 | 0.010 |
Table 4—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD (mag) | k (mag) | k$_{ext}$ (mag) |
|------------------------|----------------------|---------------|----------|---------|----------------|
| 2003 11 15             | 15:33:15             | 300           | 2452959.150 | 13.928  | 0.009          |
| 2003 11 15             | 16:03:03             | 300           | 2452959.170 | 13.941  | 0.009          |
| 2003 11 15             | 16:21:53             | 300           | 2452959.184 | 13.955  | 0.009          |
| 2003 11 15             | 16:40:40             | 300           | 2452959.197 | 13.973  | 0.009          |
| 2003 11 15             | 16:59:23             | 300           | 2452959.210 | 13.997  | 0.009          |
| 2003 11 15             | 17:18:20             | 300           | 2452959.223 | 13.974  | 0.010          |
| 2003 11 15             | 17:37:22             | 300           | 2452959.236 | 13.995  | 0.010          |
| 2003 11 15             | 17:56:21             | 300           | 2452959.249 | 13.999  | 0.010          |
| 2003 11 15             | 18:15:03             | 300           | 2452959.262 | 13.995  | 0.009          |
| 2003 11 15             | 18:34:12             | 300           | 2452959.275 | 14.000  | 0.009          |
| 2003 11 15             | 18:53:04             | 300           | 2452959.289 | 13.982  | 0.009          |
| 2003 11 15             | 19:12:02             | 300           | 2452959.302 | 13.988  | 0.009          |
| 2003 11 15             | 19:30:42             | 300           | 2452959.315 | 13.990  | 0.010          |
| 2003 11 15             | 19:49:37             | 300           | 2452959.328 | 13.999  | 0.010          |
| 2003 11 15             | 20:08:58             | 300           | 2452959.341 | 13.987  | 0.009          |
| 2003 11 15             | 20:27:59             | 300           | 2452959.354 | 13.968  | 0.009          |
| 2003 11 15             | 20:46:42             | 300           | 2452959.368 | 13.962  | 0.009          |
| 2003 11 15             | 21:05:59             | 300           | 2452959.381 | 13.973  | 0.009          |
| 2003 11 15             | 21:24:51             | 300           | 2452959.394 | 13.987  | 0.009          |
| 2003 11 15             | 21:43:46             | 300           | 2452959.407 | 13.956  | 0.009          |
| 2003 11 15             | 22:02:28             | 300           | 2452959.420 | 13.953  | 0.022          |
| 2003 11 16             | 15:53:25             | 300           | 2452960.150 | 13.889  | 0.008          |
| 2003 11 16             | 15:52:23             | 300           | 2452960.163 | 13.894  | 0.007          |
| 2003 11 16             | 16:11:34             | 300           | 2452960.176 | 13.931  | 0.009          |
| 2003 11 16             | 16:30:32             | 300           | 2452960.190 | 13.934  | 0.008          |
| 2003 11 16             | 16:49:18             | 300           | 2452960.203 | 13.932  | 0.008          |
| 2003 11 16             | 17:08:05             | 300           | 2452960.216 | 13.927  | 0.009          |
| 2003 11 16             | 17:27:04             | 300           | 2452960.229 | 13.943  | 0.010          |
| 2003 11 16             | 17:58:33             | 300           | 2452960.251 | 13.920  | 0.012          |
| 2003 11 16             | 18:17:33             | 300           | 2452960.264 | 13.912  | 0.024          |
| 2003 11 16             | 18:36:18             | 300           | 2452960.277 | 13.864  | 0.027          |
| 2003 11 16             | 18:55:07             | 300           | 2452960.290 | 13.882  | 0.015          |
| 2003 11 16             | 19:26:31             | 300           | 2452960.312 | 13.908  | 0.008          |
| 2003 11 16             | 19:45:30             | 300           | 2452960.325 | 13.927  | 0.008          |
| 2003 11 16             | 20:04:36             | 300           | 2452960.338 | 13.923  | 0.008          |
| 2003 11 16             | 20:23:46             | 300           | 2452960.352 | 13.904  | 0.009          |
| 2003 11 16             | 20:55:33             | 300           | 2452960.374 | 13.958  | 0.013          |
| 2003 11 18             | 15:13:55             | 300           | 2452962.136 | 13.969  | 0.014          |
| 2003 11 18             | 15:32:58             | 300           | 2452962.150 | 13.967  | 0.014          |
Table 5. Observational log and results in the BATC $e$ band in Period 2.

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD | $e$ (mag) | $e_{\text{err}}$ (mag) |
|------------------------|----------------------|--------------|----|-----------|------------------------|
| 2003 12 30             | 12:31:07             | 300          | 2453004.023 | 14.535 | 0.015  |
| 2003 12 30             | 12:42:56             | 300          | 2453004.032 | 14.505 | 0.014  |
| 2003 12 30             | 13:16:10             | 300          | 2453004.055 | 14.514 | 0.013  |
| 2003 12 30             | 13:32:42             | 300          | 2453004.066 | 14.534 | 0.014  |
| 2003 12 30             | 13:53:08             | 300          | 2453004.080 | 14.519 | 0.014  |
| 2003 12 30             | 14:12:09             | 300          | 2453004.094 | 14.545 | 0.013  |
| 2003 12 30             | 14:28:39             | 300          | 2453004.105 | 14.505 | 0.013  |
| 2003 12 30             | 14:49:45             | 300          | 2453004.120 | 14.524 | 0.012  |
| 2003 12 30             | 15:06:09             | 300          | 2453004.131 | 14.515 | 0.013  |
| 2003 12 30             | 15:22:46             | 300          | 2453004.142 | 14.492 | 0.013  |
| 2003 12 30             | 15:39:17             | 300          | 2453004.154 | 14.516 | 0.016  |
| 2003 12 30             | 15:56:00             | 300          | 2453004.166 | 14.444 | 0.012  |
| 2003 12 30             | 16:12:17             | 300          | 2453004.177 | 14.427 | 0.012  |
| 2003 12 30             | 16:28:42             | 300          | 2453004.188 | 14.436 | 0.012  |
| 2003 12 30             | 16:45:08             | 300          | 2453004.200 | 14.417 | 0.012  |
| 2003 12 30             | 17:01:36             | 300          | 2453004.211 | 14.414 | 0.011  |
| 2003 12 30             | 17:18:16             | 300          | 2453004.223 | 14.405 | 0.011  |
| 2003 12 30             | 17:34:50             | 300          | 2453004.234 | 14.401 | 0.010  |
| 2003 12 30             | 17:51:22             | 300          | 2453004.246 | 14.434 | 0.010  |
| 2003 12 30             | 18:11:39             | 300          | 2453004.260 | 14.396 | 0.009  |
| 2003 12 30             | 18:28:22             | 300          | 2453004.271 | 14.406 | 0.009  |
| 2003 12 30             | 18:44:52             | 300          | 2453004.283 | 14.400 | 0.010  |
| 2003 12 30             | 19:01:11             | 300          | 2453004.294 | 14.394 | 0.009  |
| 2003 12 30             | 19:17:39             | 300          | 2453004.306 | 14.437 | 0.010  |
| 2003 12 30             | 19:34:08             | 300          | 2453004.317 | 14.415 | 0.010  |
| 2003 12 30             | 19:50:37             | 300          | 2453004.329 | 14.416 | 0.010  |
| 2003 12 30             | 20:07:34             | 300          | 2453004.340 | 14.410 | 0.010  |
| 2003 12 30             | 20:26:57             | 300          | 2453004.354 | 14.400 | 0.009  |
| 2003 12 30             | 20:43:33             | 300          | 2453004.365 | 14.374 | 0.009  |
| 2003 12 30             | 20:59:53             | 300          | 2453004.377 | 14.363 | 0.010  |
| 2003 12 30             | 21:16:36             | 300          | 2453004.388 | 14.373 | 0.010  |
| 2003 12 30             | 21:33:15             | 300          | 2453004.400 | 14.415 | 0.012  |
| 2003 12 30             | 21:49:50             | 300          | 2453004.411 | 14.418 | 0.010  |
| 2003 12 30             | 22:06:23             | 300          | 2453004.423 | 14.412 | 0.011  |
| 2003 12 31             | 13:16:36             | 300          | 2453005.055 | 14.288 | 0.011  |
| 2003 12 31             | 13:33:01             | 300          | 2453005.066 | 14.315 | 0.011  |
| 2003 12 31             | 13:49:36             | 300          | 2453005.078 | 14.305 | 0.011  |
| 2003 12 31             | 14:05:59             | 300          | 2453005.089 | 14.321 | 0.011  |
| 2003 12 31             | 14:22:26             | 300          | 2453005.101 | 14.323 | 0.012  |
| 2003 12 31             | 14:38:55             | 300          | 2453005.112 | 14.331 | 0.012  |
| 2003 12 31             | 14:56:20             | 300          | 2453005.124 | 14.369 | 0.012  |
| 2003 12 31             | 15:12:50             | 300          | 2453005.136 | 14.375 | 0.014  |
| 2003 12 31             | 15:29:04             | 300          | 2453005.147 | 14.382 | 0.012  |
| 2003 12 31             | 15:45:18             | 300          | 2453005.158 | 14.372 | 0.012  |
Table 5—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD 2453005 | e   (mag) | \(e_{err}\) (mag) |
|------------------------|----------------------|---------------|-------------|----------|-------------------|
| 2003 12 31             | 16:01:42             | 300           | 2453005.170| 14.348   | 0.012             |
| 2003 12 31             | 16:18:27             | 300           | 2453005.181| 14.354   | 0.012             |
| 2003 12 31             | 16:36:37             | 300           | 2453005.194| 14.310   | 0.011             |
| 2003 12 31             | 17:09:18             | 300           | 2453005.216| 14.352   | 0.011             |
| 2003 12 31             | 17:42:14             | 300           | 2453005.239| 14.316   | 0.012             |
| 2003 12 31             | 17:59:11             | 300           | 2453005.251| 14.313   | 0.012             |
| 2003 12 31             | 18:42:17             | 300           | 2453005.281| 14.278   | 0.011             |
| 2003 12 31             | 18:59:28             | 300           | 2453005.293| 14.281   | 0.012             |
| 2003 12 31             | 19:19:37             | 300           | 2453005.307| 14.274   | 0.011             |
| 2003 12 31             | 19:36:02             | 300           | 2453005.318| 14.261   | 0.010             |
| 2003 12 31             | 19:54:17             | 300           | 2453005.331| 14.231   | 0.009             |
| 2003 12 31             | 20:10:59             | 300           | 2453005.343| 14.201   | 0.009             |
| 2003 12 31             | 20:27:25             | 300           | 2453005.354| 14.180   | 0.009             |
| 2003 12 31             | 20:43:51             | 300           | 2453005.366| 14.187   | 0.009             |
| 2003 12 31             | 21:00:31             | 300           | 2453005.377| 14.111   | 0.009             |
| 2003 12 31             | 21:22:06             | 300           | 2453005.392| 14.108   | 0.008             |
| 2003 12 31             | 21:38:20             | 300           | 2453005.403| 14.071   | 0.008             |
| 2003 12 31             | 21:57:07             | 300           | 2453005.416| 14.036   | 0.008             |
| 2004 01 01             | 12:36:21             | 300           | 2453006.027| 14.325   | 0.009             |
| 2004 01 01             | 12:52:49             | 300           | 2453006.038| 14.303   | 0.009             |
| 2004 01 01             | 13:09:33             | 300           | 2453006.050| 14.294   | 0.009             |
| 2004 01 01             | 13:26:34             | 300           | 2453006.062| 14.266   | 0.009             |
| 2004 01 01             | 13:54:33             | 300           | 2453006.081| 14.272   | 0.009             |
| 2004 01 01             | 14:11:39             | 300           | 2453006.093| 14.284   | 0.009             |
| 2004 01 01             | 14:29:25             | 300           | 2453006.105| 14.268   | 0.008             |
| 2004 01 01             | 14:46:18             | 300           | 2453006.117| 14.277   | 0.008             |
| 2004 01 01             | 15:13:28             | 300           | 2453006.136| 14.290   | 0.008             |
| 2004 01 01             | 15:29:49             | 300           | 2453006.147| 14.312   | 0.009             |
| 2004 01 01             | 15:46:07             | 300           | 2453006.159| 14.340   | 0.009             |
| 2004 01 01             | 16:41:51             | 300           | 2453006.198| 14.360   | 0.009             |
| 2004 01 01             | 17:00:23             | 300           | 2453006.210| 14.347   | 0.009             |
| 2004 01 01             | 17:37:42             | 300           | 2453006.236| 14.324   | 0.009             |
| 2004 01 01             | 17:54:43             | 300           | 2453006.248| 14.288   | 0.008             |
| 2004 01 01             | 18:11:14             | 300           | 2453006.259| 14.271   | 0.008             |
| 2004 01 01             | 18:30:07             | 300           | 2453006.273| 14.289   | 0.008             |
| 2004 01 02             | 12:25:02             | 300           | 2453007.019| 13.987   | 0.008             |
| 2004 01 02             | 12:42:41             | 300           | 2453007.031| 14.017   | 0.008             |
| 2004 01 02             | 12:59:16             | 300           | 2453007.043| 14.014   | 0.009             |
| 2004 01 02             | 13:15:31             | 300           | 2453007.054| 13.983   | 0.007             |
| 2004 01 02             | 13:31:59             | 300           | 2453007.066| 13.992   | 0.007             |
| 2004 01 02             | 13:48:17             | 300           | 2453007.077| 13.988   | 0.007             |
| 2004 01 02             | 14:04:59             | 300           | 2453007.089| 13.992   | 0.007             |
| 2004 01 02             | 14:21:37             | 300           | 2453007.100| 14.006   | 0.008             |
| 2004 01 02             | 14:37:55             | 300           | 2453007.111| 14.041   | 0.008             |
Table 5—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD    | $e$ (mag) | $e_{err}$ (mag) |
|-----------------------|----------------------|---------------|-------|----------|-----------------|
| 2004 01 02            | 14:54:20             | 300           | 2453007.123 | 14.031    | 0.007           |
| 2004 01 02            | 15:29:14             | 300           | 2453007.147 | 14.028    | 0.007           |
| 2004 01 02            | 15:45:25             | 300           | 2453007.158 | 14.031    | 0.007           |
| 2004 01 02            | 16:01:40             | 300           | 2453007.170 | 14.027    | 0.007           |
| 2004 01 02            | 16:19:13             | 300           | 2453007.182 | 14.015    | 0.007           |
| 2004 01 02            | 16:35:30             | 300           | 2453007.193 | 14.019    | 0.007           |
| 2004 01 02            | 16:52:17             | 300           | 2453007.205 | 14.031    | 0.007           |
| 2004 01 02            | 17:08:34             | 300           | 2453007.216 | 14.034    | 0.007           |
| 2004 01 02            | 17:25:09             | 300           | 2453007.228 | 14.038    | 0.007           |
| 2004 01 02            | 17:41:39             | 300           | 2453007.239 | 14.045    | 0.007           |
| 2004 01 02            | 18:01:28             | 300           | 2453007.253 | 14.038    | 0.007           |
| 2004 01 02            | 18:18:19             | 300           | 2453007.264 | 14.019    | 0.007           |
| 2004 01 02            | 18:35:03             | 300           | 2453007.276 | 14.004    | 0.007           |
| 2004 01 02            | 18:51:36             | 300           | 2453007.288 | 13.994    | 0.007           |
| 2004 01 02            | 19:08:12             | 300           | 2453007.299 | 14.002    | 0.007           |
| 2004 01 02            | 19:25:11             | 300           | 2453007.311 | 14.005    | 0.007           |
| 2004 01 03            | 16:05:05             | 300           | 2453008.172 | 14.015    | 0.009           |
| 2004 01 03            | 16:21:41             | 300           | 2453008.184 | 13.999    | 0.009           |
| 2004 01 03            | 16:38:03             | 300           | 2453008.195 | 14.002    | 0.009           |
| 2004 01 03            | 16:54:46             | 300           | 2453008.206 | 13.984    | 0.009           |
| 2004 01 03            | 17:11:18             | 300           | 2453008.218 | 13.996    | 0.009           |
| 2004 01 03            | 17:27:37             | 300           | 2453008.229 | 13.981    | 0.009           |
| 2004 01 03            | 17:44:25             | 300           | 2453008.241 | 13.964    | 0.009           |
| 2004 01 03            | 18:01:43             | 300           | 2453008.253 | 13.972    | 0.009           |
| 2004 01 03            | 18:18:13             | 300           | 2453008.264 | 13.965    | 0.009           |
| 2004 01 03            | 18:34:42             | 300           | 2453008.276 | 13.986    | 0.009           |
| 2004 01 03            | 18:51:14             | 300           | 2453008.287 | 13.977    | 0.009           |
| 2004 01 03            | 19:07:52             | 300           | 2453008.299 | 13.960    | 0.009           |
| 2004 01 03            | 19:24:43             | 300           | 2453008.311 | 13.973    | 0.009           |
| 2004 01 03            | 19:41:02             | 300           | 2453008.322 | 13.949    | 0.009           |
| 2004 01 03            | 19:57:38             | 300           | 2453008.333 | 13.954    | 0.008           |
| 2004 01 03            | 20:14:43             | 300           | 2453008.345 | 13.959    | 0.008           |
| 2004 01 03            | 20:31:59             | 300           | 2453008.357 | 13.965    | 0.008           |
| 2004 01 03            | 20:53:05             | 300           | 2453008.372 | 13.969    | 0.008           |
| 2004 01 04            | 12:10:37             | 300           | 2453009.009 | 14.057    | 0.010           |
| 2004 01 04            | 12:27:18             | 300           | 2453009.021 | 14.064    | 0.010           |
| 2004 01 04            | 12:49:37             | 300           | 2453009.036 | 14.060    | 0.010           |
| 2004 01 04            | 13:06:02             | 300           | 2453009.048 | 14.026    | 0.009           |
| 2004 01 04            | 13:22:18             | 300           | 2453009.059 | 14.023    | 0.009           |
| 2004 01 04            | 15:57:09             | 300           | 2453009.166 | 13.966    | 0.008           |
| 2004 01 04            | 16:13:39             | 300           | 2453009.178 | 13.974    | 0.008           |
| 2004 01 04            | 16:29:57             | 300           | 2453009.189 | 13.956    | 0.008           |
| 2004 01 04            | 16:46:23             | 300           | 2453009.201 | 13.947    | 0.008           |
| 2004 01 04            | 17:04:24             | 300           | 2453009.213 | 13.939    | 0.008           |
| 2004 01 04            | 17:20:49             | 300           | 2453009.225 | 13.926    | 0.008           |
Table 5—Continued

| Obs. Date | Obs. Time | Exp. Time | JD       | $e$    | $e_{ext}$ |
|-----------|-----------|-----------|----------|--------|-----------|
| (yyyy mm dd) | (hh:mm:ss) | (s)       | (mag)    | (mag)  |           |
| 2004 01 04 | 17:38:12  | 300       | 2453009.237 | 13.916 | 0.008     |
| 2004 01 04 | 17:54:44  | 300       | 2453009.248 | 13.939 | 0.008     |
| 2004 01 04 | 18:11:11  | 300       | 2453009.259 | 13.898 | 0.008     |
| 2004 01 04 | 18:27:30  | 300       | 2453009.271 | 13.884 | 0.008     |
| 2004 01 04 | 18:46:06  | 300       | 2453009.284 | 13.878 | 0.008     |
| 2004 01 04 | 19:02:31  | 300       | 2453009.295 | 13.854 | 0.007     |
| 2004 01 04 | 19:19:24  | 300       | 2453009.307 | 13.838 | 0.007     |
| 2004 01 04 | 19:35:49  | 300       | 2453009.318 | 13.855 | 0.008     |
| 2004 01 04 | 19:52:27  | 300       | 2453009.330 | 13.852 | 0.008     |
| 2004 01 04 | 20:10:56  | 300       | 2453009.343 | 13.811 | 0.007     |
| 2004 01 04 | 20:27:21  | 300       | 2453009.354 | 13.814 | 0.007     |
| 2004 01 04 | 20:43:50  | 300       | 2453009.366 | 13.809 | 0.007     |
| 2004 01 04 | 21:00:48  | 300       | 2453009.377 | 13.791 | 0.007     |
| 2004 01 04 | 21:17:11  | 300       | 2453009.389 | 13.768 | 0.007     |
| 2004 01 04 | 21:34:46  | 300       | 2453009.401 | 13.777 | 0.006     |
| 2004 01 05 | 13:36:53  | 300       | 2453010.069 | 13.854 | 0.009     |
| 2004 01 05 | 13:57:26  | 300       | 2453010.083 | 13.851 | 0.009     |
| 2004 01 05 | 14:14:16  | 300       | 2453010.095 | 13.853 | 0.010     |
| 2004 01 05 | 14:30:43  | 300       | 2453010.106 | 13.857 | 0.013     |
Table 6. Observational log and results in the BATC $f$ band in Period 2.

| Obs. Date  | Obs. Time  | Exp. Time | JD      | $f$  | $f_{err}$ |
|------------|------------|-----------|---------|------|-----------|
| (yyyy mm dd) | (hh:mm:ss) | (s)       | (mag)   | (mag) |
| 2003 12 30 | 12:49:12   | 300       | 2453004.036 | 14.430 | 0.012     |
| 2003 12 30 | 13:05:58   | 300       | 2453004.047 | 14.445 | 0.012     |
| 2003 12 30 | 13:22:14   | 300       | 2453004.059 | 14.436 | 0.012     |
| 2003 12 30 | 13:38:47   | 300       | 2453004.070 | 14.448 | 0.011     |
| 2003 12 30 | 13:59:29   | 300       | 2453004.085 | 14.426 | 0.012     |
| 2003 12 30 | 14:18:16   | 300       | 2453004.098 | 14.433 | 0.011     |
| 2003 12 30 | 14:34:44   | 300       | 2453004.109 | 14.425 | 0.011     |
| 2003 12 30 | 14:56:00   | 300       | 2453004.124 | 14.416 | 0.010     |
| 2003 12 30 | 15:12:26   | 300       | 2453004.135 | 14.406 | 0.011     |
| 2003 12 30 | 15:28:52   | 300       | 2453004.147 | 14.425 | 0.012     |
| 2003 12 30 | 15:45:31   | 300       | 2453004.158 | 14.381 | 0.012     |
| 2003 12 30 | 16:02:08   | 300       | 2453004.170 | 14.347 | 0.010     |
| 2003 12 30 | 16:18:23   | 300       | 2453004.181 | 14.359 | 0.010     |
| 2003 12 30 | 16:34:50   | 300       | 2453004.193 | 14.361 | 0.010     |
| 2003 12 30 | 16:51:27   | 300       | 2453004.204 | 14.334 | 0.010     |
| 2003 12 30 | 17:07:55   | 300       | 2453004.216 | 14.351 | 0.009     |
| 2003 12 30 | 17:24:32   | 300       | 2453004.227 | 14.324 | 0.009     |
| 2003 12 30 | 17:40:55   | 300       | 2453004.238 | 14.326 | 0.008     |
| 2003 12 30 | 17:57:27   | 300       | 2453004.250 | 14.321 | 0.008     |
| 2003 12 30 | 18:17:44   | 300       | 2453004.264 | 14.327 | 0.008     |
| 2003 12 30 | 18:34:29   | 300       | 2453004.276 | 14.331 | 0.008     |
| 2003 12 30 | 18:50:58   | 300       | 2453004.287 | 14.322 | 0.008     |
| 2003 12 30 | 19:07:16   | 300       | 2453004.298 | 14.323 | 0.008     |
| 2003 12 30 | 19:23:43   | 300       | 2453004.310 | 14.328 | 0.009     |
| 2003 12 30 | 19:40:27   | 300       | 2453004.322 | 14.337 | 0.009     |
| 2003 12 30 | 19:56:56   | 300       | 2453004.333 | 14.342 | 0.008     |
| 2003 12 30 | 20:16:31   | 300       | 2453004.347 | 14.342 | 0.008     |
| 2003 12 30 | 20:33:06   | 300       | 2453004.358 | 14.312 | 0.008     |
| 2003 12 30 | 20:49:41   | 300       | 2453004.370 | 14.329 | 0.008     |
| 2003 12 30 | 21:06:01   | 300       | 2453004.381 | 14.285 | 0.009     |
| 2003 12 30 | 21:22:48   | 300       | 2453004.393 | 14.322 | 0.009     |
| 2003 12 30 | 21:39:34   | 300       | 2453004.404 | 14.316 | 0.009     |
| 2003 12 30 | 21:56:09   | 300       | 2453004.416 | 14.367 | 0.010     |
| 2003 12 31 | 13:22:43   | 300       | 2453005.059 | 14.223 | 0.009     |
| 2003 12 31 | 13:39:20   | 300       | 2453005.071 | 14.217 | 0.010     |
| 2003 12 31 | 13:55:44   | 300       | 2453005.082 | 14.200 | 0.009     |
| 2003 12 31 | 14:12:16   | 300       | 2453005.094 | 14.216 | 0.010     |
| 2003 12 31 | 14:28:30   | 300       | 2453005.105 | 14.261 | 0.010     |
| 2003 12 31 | 14:45:01   | 300       | 2453005.116 | 14.251 | 0.010     |
| 2003 12 31 | 15:02:28   | 300       | 2453005.128 | 14.274 | 0.010     |
| 2003 12 31 | 15:18:54   | 300       | 2453005.140 | 14.294 | 0.011     |
| 2003 12 31 | 15:35:08   | 300       | 2453005.151 | 14.294 | 0.010     |
| 2003 12 31 | 15:51:32   | 300       | 2453005.162 | 14.289 | 0.010     |
| 2003 12 31 | 16:07:58   | 300       | 2453005.174 | 14.292 | 0.010     |
| 2003 12 31 | 16:25:23   | 300       | 2453005.186 | 14.230 | 0.009     |
Table 6—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD  | f (mag) | f<sub>err</sub> (mag) |
|------------------------|----------------------|---------------|-----|---------|---------------------|
| 2003 12 31             | 16:42:52             | 300           | 2453005.198 | 14.233   | 0.010               |
| 2003 12 31             | 16:59:07             | 300           | 2453005.209 | 14.235   | 0.009               |
| 2003 12 31             | 17:15:36             | 300           | 2453005.221 | 14.234   | 0.009               |
| 2003 12 31             | 17:25:44             | 300           | 2453005.228 | 14.238   | 0.011               |
| 2003 12 31             | 17:31:52             | 300           | 2453005.232 | 14.195   | 0.010               |
| 2003 12 31             | 17:48:30             | 300           | 2453005.244 | 14.224   | 0.010               |
| 2003 12 31             | 18:05:15             | 300           | 2453005.255 | 14.203   | 0.010               |
| 2003 12 31             | 18:48:24             | 300           | 2453005.285 | 14.175   | 0.010               |
| 2003 12 31             | 19:05:39             | 300           | 2453005.297 | 14.187   | 0.010               |
| 2003 12 31             | 21:28:10             | 300           | 2453005.396 | 14.003   | 0.007               |
| 2003 12 31             | 21:44:24             | 300           | 2453005.408 | 13.970   | 0.007               |
| 2004 01 01             | 12:42:27             | 300           | 2453006.031 | 14.227   | 0.008               |
| 2004 01 01             | 12:58:54             | 300           | 2453006.043 | 14.213   | 0.008               |
| 2004 01 01             | 13:15:40             | 300           | 2453006.054 | 14.196   | 0.007               |
| 2004 01 01             | 13:32:55             | 300           | 2453006.066 | 14.204   | 0.008               |
| 2004 01 01             | 14:01:09             | 300           | 2453006.086 | 14.190   | 0.008               |
| 2004 01 01             | 14:17:49             | 300           | 2453006.097 | 14.186   | 0.007               |
| 2004 01 01             | 14:35:52             | 300           | 2453006.110 | 14.207   | 0.007               |
| 2004 01 01             | 14:52:48             | 300           | 2453006.122 | 14.207   | 0.007               |
| 2004 01 01             | 15:19:36             | 300           | 2453006.140 | 14.224   | 0.007               |
| 2004 01 01             | 15:35:55             | 300           | 2453006.152 | 14.229   | 0.007               |
| 2004 01 01             | 15:52:26             | 300           | 2453006.163 | 14.237   | 0.008               |
| 2004 01 01             | 16:47:57             | 300           | 2453006.202 | 14.255   | 0.008               |
| 2004 01 01             | 17:06:29             | 300           | 2453006.215 | 14.242   | 0.008               |
| 2004 01 01             | 17:44:02             | 300           | 2453006.241 | 14.219   | 0.007               |
| 2004 01 01             | 18:00:49             | 300           | 2453006.252 | 14.204   | 0.007               |
| 2004 01 01             | 18:17:21             | 300           | 2453006.264 | 14.200   | 0.007               |
| 2004 01 01             | 18:36:26             | 300           | 2453006.277 | 14.199   | 0.007               |
| 2004 01 02             | 12:31:10             | 300           | 2453007.023 | 13.935   | 0.007               |
| 2004 01 02             | 12:48:55             | 300           | 2453007.036 | 13.936   | 0.007               |
| 2004 01 02             | 13:05:22             | 300           | 2453007.047 | 13.940   | 0.007               |
| 2004 01 02             | 13:21:39             | 300           | 2453007.058 | 13.924   | 0.006               |
| 2004 01 02             | 13:38:04             | 300           | 2453007.070 | 13.919   | 0.007               |
| 2004 01 02             | 13:54:20             | 300           | 2453007.081 | 13.923   | 0.006               |
| 2004 01 02             | 14:11:15             | 300           | 2453007.093 | 13.925   | 0.006               |
| 2004 01 02             | 14:27:45             | 300           | 2453007.104 | 13.940   | 0.007               |
| 2004 01 02             | 14:44:13             | 300           | 2453007.116 | 13.951   | 0.007               |
| 2004 01 02             | 15:09:27             | 300           | 2453007.127 | 13.949   | 0.006               |
| 2004 01 02             | 15:18:49             | 300           | 2453007.140 | 13.955   | 0.006               |
| 2004 01 02             | 15:35:18             | 300           | 2453007.151 | 13.945   | 0.006               |
| 2004 01 02             | 15:51:33             | 300           | 2453007.162 | 13.931   | 0.006               |
| 2004 01 02             | 16:08:00             | 300           | 2453007.174 | 13.939   | 0.006               |
| 2004 01 02             | 16:25:17             | 300           | 2453007.186 | 13.950   | 0.006               |
| 2004 01 02             | 16:41:46             | 300           | 2453007.197 | 13.929   | 0.006               |
| 2004 01 02             | 16:58:24             | 300           | 2453007.209 | 13.945   | 0.006               |
| Obs. Date | Obs. Time | Exp. Time | JD       | $f$ (mag) | $f_{err}$ (mag) |
|----------|-----------|-----------|----------|-----------|----------------|
| 2004 01 02 | 17:14:50  | 300       | 2453007.220 | 13.957    | 0.006          |
| 2004 01 02 | 17:31:14  | 300       | 2453007.232 | 13.962    | 0.006          |
| 2004 01 02 | 17:47:45  | 300       | 2453007.243 | 13.972    | 0.006          |
| 2004 01 02 | 18:07:42  | 300       | 2453007.257 | 13.942    | 0.006          |
| 2004 01 02 | 18:24:35  | 300       | 2453007.269 | 13.946    | 0.006          |
| 2004 01 02 | 18:41:11  | 300       | 2453007.280 | 13.933    | 0.006          |
| 2004 01 02 | 18:57:42  | 300       | 2453007.292 | 13.927    | 0.006          |
| 2004 01 02 | 19:14:30  | 300       | 2453007.303 | 13.915    | 0.006          |
| 2004 01 02 | 19:31:17  | 300       | 2453007.315 | 13.922    | 0.006          |
| 2004 01 03 | 16:11:29  | 300       | 2453008.176 | 13.946    | 0.008          |
| 2004 01 03 | 16:27:49  | 300       | 2453008.188 | 13.932    | 0.008          |
| 2004 01 03 | 16:44:21  | 300       | 2453008.199 | 13.932    | 0.008          |
| 2004 01 03 | 17:00:52  | 300       | 2453008.211 | 13.924    | 0.008          |
| 2004 01 03 | 17:17:24  | 300       | 2453008.222 | 13.906    | 0.008          |
| 2004 01 03 | 17:34:01  | 300       | 2453008.234 | 13.913    | 0.008          |
| 2004 01 03 | 17:50:30  | 300       | 2453008.245 | 13.897    | 0.008          |
| 2004 01 03 | 18:08:03  | 300       | 2453008.257 | 13.896    | 0.008          |
| 2004 01 03 | 18:24:19  | 300       | 2453008.269 | 13.887    | 0.008          |
| 2004 01 03 | 18:41:00  | 300       | 2453008.280 | 13.900    | 0.008          |
| 2004 01 03 | 18:57:22  | 300       | 2453008.292 | 13.886    | 0.008          |
| 2004 01 03 | 19:14:11  | 300       | 2453008.303 | 13.869    | 0.008          |
| 2004 01 03 | 19:30:51  | 300       | 2453008.315 | 13.874    | 0.007          |
| 2004 01 03 | 19:47:07  | 300       | 2453008.326 | 13.870    | 0.007          |
| 2004 01 03 | 20:04:00  | 300       | 2453008.338 | 13.886    | 0.007          |
| 2004 01 03 | 20:20:56  | 300       | 2453008.350 | 13.870    | 0.007          |
| 2004 01 03 | 20:38:29  | 300       | 2453008.362 | 13.881    | 0.007          |
| 2004 01 03 | 20:59:48  | 300       | 2453008.377 | 13.893    | 0.007          |
| 2004 01 04 | 12:16:42  | 300       | 2453009.013 | 13.959    | 0.009          |
| 2004 01 04 | 12:37:10  | 300       | 2453009.027 | 13.938    | 0.008          |
| 2004 01 04 | 12:55:51  | 300       | 2453009.041 | 13.983    | 0.009          |
| 2004 01 04 | 13:12:06  | 300       | 2453009.052 | 13.956    | 0.008          |
| 2004 01 04 | 13:28:24  | 300       | 2453009.063 | 13.962    | 0.008          |
| 2004 01 04 | 16:03:27  | 300       | 2453009.171 | 13.896    | 0.007          |
| 2004 01 04 | 16:19:44  | 300       | 2453009.182 | 13.875    | 0.007          |
| 2004 01 04 | 16:36:15  | 300       | 2453009.194 | 13.873    | 0.007          |
| 2004 01 04 | 16:52:29  | 300       | 2453009.205 | 13.847    | 0.007          |
| 2004 01 04 | 17:10:28  | 300       | 2453009.217 | 13.853    | 0.007          |
| 2004 01 04 | 17:26:55  | 300       | 2453009.229 | 13.849    | 0.007          |
| 2004 01 04 | 17:34:20  | 300       | 2453009.241 | 13.831    | 0.007          |
| 2004 01 04 | 18:01:00  | 300       | 2453009.252 | 13.833    | 0.007          |
| 2004 01 04 | 18:17:17  | 300       | 2453009.264 | 13.827    | 0.007          |
| 2004 01 04 | 18:33:34  | 300       | 2453009.275 | 13.816    | 0.007          |
| 2004 01 04 | 18:52:13  | 300       | 2453009.288 | 13.798    | 0.007          |
| 2004 01 04 | 19:08:50  | 300       | 2453009.299 | 13.780    | 0.007          |
| 2004 01 04 | 19:25:27  | 300       | 2453009.311 | 13.776    | 0.007          |
Table 6—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD | \( f \) (mag) | \( f_{err} \) (mag) |
|-----------------------|----------------------|--------------|----|-------------|---------------|
| 2004 01 04            | 19:41:55             | 300          | 2453009.322 | 13.788       | 0.007         |
| 2004 01 04            | 19:58:30             | 300          | 2453009.334 | 13.763       | 0.006         |
| 2004 01 04            | 20:16:54             | 300          | 2453009.347 | 13.741       | 0.006         |
| 2004 01 04            | 20:33:25             | 300          | 2453009.358 | 13.727       | 0.006         |
| 2004 01 04            | 20:50:09             | 300          | 2453009.370 | 13.717       | 0.006         |
| 2004 01 04            | 21:06:58             | 300          | 2453009.382 | 13.717       | 0.006         |
| 2004 01 04            | 21:23:19             | 300          | 2453009.393 | 13.706       | 0.006         |
| 2004 01 04            | 21:40:50             | 300          | 2453009.405 | 13.687       | 0.005         |
| 2004 01 04            | 13:44:57             | 300          | 2453010.075 | 13.767       | 0.008         |
| 2004 01 05            | 14:03:35             | 300          | 2453010.088 | 13.770       | 0.008         |
| 2004 01 05            | 14:20:23             | 300          | 2453010.099 | 13.759       | 0.010         |
| 2004 01 05            | 14:37:06             | 300          | 2453010.111 | 13.769       | 0.014         |
Table 7. Observational log and results in the BATC $i$ band in Period 2.

| Obs. Date | Obs. Time | Exp. Time | JD     | $i$  | $i_{err}$ |
|-----------|-----------|-----------|--------|------|----------|
| yyyy mm dd | hh:mm:ss  | s         |        |      |          |
| 2003 12 30 | 12:26:59  | 180       | 2453004.020 | 14.152 | 0.007    |
| 2003 12 30 | 12:38:17  | 180       | 2453004.028 | 14.163 | 0.007    |
| 2003 12 30 | 12:55:21  | 180       | 2453004.040 | 14.161 | 0.007    |
| 2003 12 30 | 13:12:06  | 180       | 2453004.051 | 14.164 | 0.007    |
| 2003 12 30 | 13:28:21  | 180       | 2453004.062 | 14.149 | 0.007    |
| 2003 12 30 | 13:45:10  | 180       | 2453004.074 | 14.150 | 0.007    |
| 2003 12 30 | 14:08:04  | 180       | 2453004.090 | 14.137 | 0.007    |
| 2003 12 30 | 14:24:34  | 180       | 2453004.101 | 14.161 | 0.007    |
| 2003 12 30 | 14:45:40  | 180       | 2453004.116 | 14.138 | 0.007    |
| 2003 12 30 | 15:02:05  | 180       | 2453004.127 | 14.148 | 0.007    |
| 2003 12 30 | 15:18:39  | 180       | 2453004.139 | 14.137 | 0.007    |
| 2003 12 30 | 15:34:56  | 180       | 2453004.150 | 14.130 | 0.007    |
| 2003 12 30 | 15:51:39  | 180       | 2453004.162 | 14.095 | 0.007    |
| 2003 12 30 | 16:08:12  | 180       | 2453004.173 | 14.068 | 0.007    |
| 2003 12 30 | 16:24:28  | 180       | 2453004.185 | 14.082 | 0.007    |
| 2003 12 30 | 16:40:56  | 180       | 2453004.196 | 14.058 | 0.007    |
| 2003 12 30 | 16:57:31  | 180       | 2453004.208 | 14.047 | 0.007    |
| 2003 12 30 | 17:14:12  | 180       | 2453004.219 | 14.062 | 0.006    |
| 2003 12 30 | 17:30:46  | 180       | 2453004.231 | 14.063 | 0.006    |
| 2003 12 30 | 17:47:04  | 180       | 2453004.242 | 14.060 | 0.006    |
| 2003 12 30 | 18:07:31  | 180       | 2453004.256 | 14.040 | 0.005    |
| 2003 12 30 | 18:24:04  | 180       | 2453004.268 | 14.060 | 0.005    |
| 2003 12 30 | 18:40:46  | 180       | 2453004.279 | 14.065 | 0.006    |
| 2003 12 30 | 18:57:07  | 180       | 2453004.291 | 14.047 | 0.006    |
| 2003 12 30 | 19:13:34  | 180       | 2453004.302 | 14.049 | 0.006    |
| 2003 12 30 | 19:30:03  | 180       | 2453004.314 | 14.058 | 0.006    |
| 2003 12 30 | 19:46:32  | 180       | 2453004.325 | 14.063 | 0.006    |
| 2003 12 30 | 20:03:16  | 180       | 2453004.337 | 14.060 | 0.005    |
| 2003 12 30 | 20:22:50  | 180       | 2453004.350 | 14.056 | 0.005    |
| 2003 12 30 | 20:39:26  | 180       | 2453004.362 | 14.030 | 0.005    |
| 2003 12 30 | 20:55:46  | 180       | 2453004.373 | 14.037 | 0.006    |
| 2003 12 30 | 21:12:17  | 180       | 2453004.385 | 14.038 | 0.006    |
| 2003 12 30 | 21:29:10  | 180       | 2453004.396 | 14.051 | 0.006    |
| 2003 12 30 | 21:45:42  | 180       | 2453004.408 | 14.044 | 0.006    |
| 2003 12 30 | 22:02:15  | 180       | 2453004.419 | 14.041 | 0.006    |
| 2003 12 31 | 12:08:13  | 180       | 2453005.007 | 13.931 | 0.006    |
| 2003 12 31 | 13:04:33  | 180       | 2453005.046 | 13.954 | 0.006    |
| 2003 12 31 | 13:11:32  | 180       | 2453005.051 | 13.925 | 0.006    |
| 2003 12 31 | 13:29:01  | 180       | 2453005.063 | 13.943 | 0.006    |
| 2003 12 31 | 13:45:27  | 180       | 2453005.074 | 13.958 | 0.006    |
| 2003 12 31 | 14:01:52  | 180       | 2453005.086 | 13.966 | 0.006    |
| 2003 12 31 | 14:18:20  | 180       | 2453005.097 | 13.944 | 0.006    |
| 2003 12 31 | 14:34:37  | 180       | 2453005.108 | 13.977 | 0.006    |
| 2003 12 31 | 14:51:05  | 180       | 2453005.120 | 13.972 | 0.006    |
| 2003 12 31 | 15:08:44  | 180       | 2453005.132 | 14.016 | 0.006    |
Table 7—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD | $i$ (mag) | $i_{err}$ (mag) |
|------------------------|----------------------|---------------|----|-----------|-----------------|
| 2003 12 31             | 15:25:00             | 180           | 2453005.143 | 13.999     | 0.006           |
| 2003 12 31             | 15:41:15             | 180           | 2453005.155 | 14.001     | 0.006           |
| 2003 12 31             | 15:57:38             | 180           | 2453005.166 | 14.014     | 0.006           |
| 2003 12 31             | 16:14:13             | 180           | 2453005.178 | 13.982     | 0.006           |
| 2003 12 31             | 16:32:29             | 180           | 2453005.190 | 13.981     | 0.006           |
| 2003 12 31             | 16:48:59             | 180           | 2453005.202 | 13.967     | 0.006           |
| 2003 12 31             | 17:05:15             | 180           | 2453005.213 | 13.959     | 0.006           |
| 2003 12 31             | 17:21:39             | 180           | 2453005.224 | 13.967     | 0.006           |
| 2003 12 31             | 17:37:56             | 180           | 2453005.236 | 13.954     | 0.007           |
| 2003 12 31             | 17:55:05             | 180           | 2453005.248 | 13.953     | 0.006           |
| 2003 12 31             | 18:38:10             | 180           | 2453005.278 | 13.927     | 0.006           |
| 2003 12 31             | 19:13:31             | 180           | 2453005.302 | 13.909     | 0.006           |
| 2003 12 31             | 19:32:00             | 180           | 2453005.315 | 13.896     | 0.006           |
| 2003 12 31             | 19:50:10             | 180           | 2453005.327 | 13.896     | 0.006           |
| 2003 12 31             | 20:06:35             | 180           | 2453005.339 | 13.887     | 0.005           |
| 2003 12 31             | 20:23:09             | 180           | 2453005.350 | 13.862     | 0.006           |
| 2003 12 31             | 20:39:34             | 180           | 2453005.362 | 13.841     | 0.005           |
| 2003 12 31             | 20:56:27             | 180           | 2453005.374 | 13.813     | 0.005           |
| 2003 12 31             | 21:17:46             | 180           | 2453005.388 | 13.781     | 0.005           |
| 2003 12 31             | 21:34:15             | 180           | 2453005.400 | 13.716     | 0.005           |
| 2003 12 31             | 21:50:40             | 180           | 2453005.411 | 13.702     | 0.005           |
| 2004 01 01             | 12:29:54             | 180           | 2453006.022 | 13.938     | 0.005           |
| 2004 01 01             | 12:48:43             | 180           | 2453006.035 | 13.941     | 0.005           |
| 2004 01 01             | 13:05:12             | 180           | 2453006.046 | 13.909     | 0.005           |
| 2004 01 01             | 13:22:28             | 180           | 2453006.058 | 13.905     | 0.005           |
| 2004 01 01             | 13:50:10             | 180           | 2453006.078 | 13.905     | 0.005           |
| 2004 01 01             | 14:07:23             | 180           | 2453006.090 | 13.906     | 0.005           |
| 2004 01 01             | 14:23:55             | 180           | 2453006.101 | 13.914     | 0.005           |
| 2004 01 01             | 14:42:11             | 180           | 2453006.114 | 13.935     | 0.005           |
| 2004 01 01             | 15:09:09             | 180           | 2453006.132 | 13.940     | 0.005           |
| 2004 01 01             | 15:25:42             | 180           | 2453006.144 | 13.956     | 0.005           |
| 2004 01 01             | 15:42:00             | 180           | 2453006.155 | 13.944     | 0.005           |
| 2004 01 01             | 16:37:43             | 180           | 2453006.194 | 13.970     | 0.005           |
| 2004 01 01             | 16:56:15             | 180           | 2453006.207 | 13.983     | 0.005           |
| 2004 01 01             | 17:33:35             | 180           | 2453006.233 | 13.961     | 0.005           |
| 2004 01 01             | 17:50:22             | 180           | 2453006.244 | 13.932     | 0.005           |
| 2004 01 01             | 18:06:56             | 180           | 2453006.256 | 13.934     | 0.005           |
| 2004 01 01             | 18:26:01             | 180           | 2453006.269 | 13.935     | 0.005           |
| 2004 01 02             | 12:38:34             | 180           | 2453007.028 | 13.683     | 0.005           |
| 2004 01 02             | 12:55:13             | 180           | 2453007.039 | 13.674     | 0.004           |
| 2004 01 02             | 13:11:27             | 180           | 2453007.051 | 13.678     | 0.004           |
| 2004 01 02             | 13:27:53             | 180           | 2453007.062 | 13.679     | 0.004           |
| 2004 01 02             | 13:44:11             | 180           | 2453007.073 | 13.657     | 0.004           |
| 2004 01 02             | 14:00:54             | 180           | 2453007.085 | 13.674     | 0.004           |
| 2004 01 02             | 14:17:33             | 180           | 2453007.097 | 13.689     | 0.005           |
Table 7—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD | $i$ (mag) | $i_{\text{err}}$ (mag) |
|------------------------|----------------------|---------------|----|-----------|-------------------|
| 2004 01 02             | 14:33:50             | 180           | 2453007.108 | 13.687    | 0.004             |
| 2004 01 02             | 15:00:17             | 180           | 2453007.119 | 13.699    | 0.004             |
| 2004 01 02             | 15:25:09             | 180           | 2453007.122 | 13.697    | 0.004             |
| 2004 01 02             | 15:41:22             | 180           | 2453007.155 | 13.684    | 0.004             |
| 2004 01 02             | 15:57:37             | 180           | 2453007.166 | 13.677    | 0.004             |
| 2004 01 02             | 16:15:05             | 180           | 2453007.178 | 13.691    | 0.004             |
| 2004 01 02             | 16:31:26             | 180           | 2453007.190 | 13.693    | 0.004             |
| 2004 01 02             | 16:48:00             | 180           | 2453007.201 | 13.689    | 0.004             |
| 2004 01 02             | 17:04:30             | 180           | 2453007.213 | 13.699    | 0.004             |
| 2004 01 02             | 17:21:04             | 180           | 2453007.224 | 13.708    | 0.004             |
| 2004 01 02             | 17:37:21             | 180           | 2453007.235 | 13.698    | 0.004             |
| 2004 01 02             | 17:57:21             | 180           | 2453007.249 | 13.680    | 0.004             |
| 2004 01 02             | 18:14:02             | 180           | 2453007.261 | 13.691    | 0.004             |
| 2004 01 02             | 18:30:44             | 180           | 2453007.272 | 13.675    | 0.004             |
| 2004 01 02             | 18:47:16             | 180           | 2453007.284 | 13.664    | 0.004             |
| 2004 01 02             | 19:03:47             | 180           | 2453007.295 | 13.651    | 0.004             |
| 2004 01 02             | 19:20:35             | 180           | 2453007.307 | 13.675    | 0.004             |
| 2004 01 03             | 15:58:14             | 180           | 2453008.167 | 13.680    | 0.005             |
| 2004 01 03             | 16:17:35             | 180           | 2453008.180 | 13.682    | 0.005             |
| 2004 01 03             | 16:33:56             | 180           | 2453008.191 | 13.677    | 0.005             |
| 2004 01 03             | 16:50:38             | 180           | 2453008.203 | 13.680    | 0.005             |
| 2004 01 03             | 17:07:10             | 180           | 2453008.214 | 13.667    | 0.005             |
| 2004 01 03             | 17:23:31             | 180           | 2453008.226 | 13.668    | 0.005             |
| 2004 01 03             | 17:40:18             | 180           | 2453008.237 | 13.655    | 0.005             |
| 2004 01 03             | 17:57:35             | 180           | 2453008.249 | 13.652    | 0.005             |
| 2004 01 03             | 18:14:09             | 180           | 2453008.261 | 13.624    | 0.005             |
| 2004 01 03             | 18:30:26             | 180           | 2453008.272 | 13.657    | 0.005             |
| 2004 01 03             | 18:47:04             | 180           | 2453008.284 | 13.642    | 0.005             |
| 2004 01 03             | 19:03:35             | 180           | 2453008.295 | 13.627    | 0.005             |
| 2004 01 03             | 19:20:29             | 180           | 2453008.307 | 13.629    | 0.005             |
| 2004 01 03             | 19:36:57             | 180           | 2453008.318 | 13.636    | 0.005             |
| 2004 01 03             | 19:53:13             | 180           | 2453008.330 | 13.640    | 0.005             |
| 2004 01 03             | 20:10:24             | 180           | 2453008.342 | 13.644    | 0.005             |
| 2004 01 03             | 20:27:21             | 180           | 2453008.353 | 13.643    | 0.005             |
| 2004 01 03             | 20:48:33             | 180           | 2453008.368 | 13.656    | 0.004             |
| 2004 01 04             | 12:06:32             | 180           | 2453009.006 | 13.709    | 0.006             |
| 2004 01 04             | 12:23:90             | 180           | 2453009.017 | 13.718    | 0.005             |
| 2004 01 04             | 12:43:48             | 180           | 2453009.032 | 13.712    | 0.005             |
| 2004 01 04             | 13:01:58             | 180           | 2453009.044 | 13.723    | 0.005             |
| 2004 01 04             | 13:18:13             | 180           | 2453009.055 | 13.706    | 0.005             |
| 2004 01 04             | 15:52:13             | 180           | 2453009.162 | 13.658    | 0.005             |
| 2004 01 04             | 16:09:33             | 180           | 2453009.174 | 13.640    | 0.005             |
| 2004 01 04             | 16:25:51             | 180           | 2453009.186 | 13.627    | 0.005             |
| 2004 01 04             | 16:42:19             | 180           | 2453009.197 | 13.636    | 0.005             |
Table 7—Continued

| Obs. Date (yyyy mm dd) | Obs. Time (hh:mm:ss) | Exp. Time (s) | JD (s) | i (mag) | i_{err} (mag) |
|-----------------------|----------------------|---------------|--------|---------|---------------|
| 2004 01 04            | 16:58:33             | 180           | 2453009.208 | 13.610 | 0.005         |
| 2004 01 04            | 17:16:36             | 180           | 2453009.221 | 13.577 | 0.005         |
| 2004 01 04            | 17:33:17             | 180           | 2453009.233 | 13.582 | 0.005         |
| 2004 01 04            | 17:50:25             | 180           | 2453009.244 | 13.599 | 0.005         |
| 2004 01 04            | 18:07:07             | 180           | 2453009.256 | 13.577 | 0.005         |
| 2004 01 04            | 18:23:25             | 180           | 2453009.267 | 13.573 | 0.005         |
| 2004 01 04            | 18:41:46             | 180           | 2453009.280 | 13.568 | 0.005         |
| 2004 01 04            | 18:58:27             | 180           | 2453009.292 | 13.549 | 0.005         |
| 2004 01 04            | 19:15:08             | 180           | 2453009.303 | 13.514 | 0.004         |
| 2004 01 04            | 19:31:45             | 180           | 2453009.315 | 13.547 | 0.005         |
| 2004 01 04            | 19:48:09             | 180           | 2453009.326 | 13.529 | 0.004         |
| 2004 01 04            | 20:06:37             | 180           | 2453009.339 | 13.515 | 0.005         |
| 2004 01 04            | 20:23:15             | 180           | 2453009.350 | 13.506 | 0.004         |
| 2004 01 04            | 20:39:46             | 180           | 2453009.362 | 13.488 | 0.004         |
| 2004 01 04            | 20:56:28             | 180           | 2453009.374 | 13.489 | 0.004         |
| 2004 01 04            | 21:13:05             | 180           | 2453009.385 | 13.466 | 0.004         |
| 2004 01 04            | 21:30:37             | 180           | 2453009.397 | 13.453 | 0.004         |
| 2004 01 05            | 13:22:30             | 180           | 2453010.058 | 13.514 | 0.005         |
| 2004 01 05            | 13:53:18             | 180           | 2453010.080 | 13.464 | 0.005         |
| 2004 01 05            | 14:09:54             | 180           | 2453010.091 | 13.463 | 0.005         |
| 2004 01 05            | 14:26:34             | 180           | 2453010.103 | 13.488 | 0.007         |