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DISCOVERY OF 19 NEW HISTORICAL NOVA CANDIDATES IN M31

HENZE, M.[1]; MEUSINGER, H.[1]; PIETSCH, W.[2]

[1] Thüringer Landessternwarte Tautenburg, D-07778 Tautenburg, Germany

[2] Max Planck Institute for Extraterrestrial Physics, D-85748 Garching, Germany

We have conducted a systematic search for historical novae in M31 on digitized archival plates. A comprehensive description of the data material, the method, and the results will be given in a separate paper (Henze et al., 2007). Here we present a brief summary of the attempt and announce, as the most important result, 19 new nova candidates.

The M31 field is the most frequently observed field in the archive of the Tautenburg Schmidt telescope (134/200/400). Our search is based upon 306 selected plates in the UBV bands taken in the years 1960 to 1996. A single plate covers an unvignetted field of $3\overset{\circ}{.}3 \times 3\overset{\circ}{.}3$ with a plate scale of 51.4 arcsec/mm. The limits of the B plates are typically in the range $B_{\rm lim} = 19^{\rm m} \ldots 21^{\rm m}$. Although the majority of these plates were not taken as a part of a systematic survey, they constitute a valuable observational material suited to search for bright variables in our neighbour galaxy.

All plates have been digitized with the Tautenburg Plate Scanner (Brunzendorf & Meusinger, 1999) and were reduced using the software package *Source Extractor* (Bertin & Arnouts, 1996). For the astrometric and photometric calibration of one selected reference plate per filter band we used the USNO-B1.0 catalogue (Monet et al., 2003) and the Local Group Survey catalogue (Massey et al., 2006), respectively. Special care was taken to consider the strongly fluctuating background surface brightness. All plates of the same filter band were transformed into the system of the corresponding reference plate which results in an overall astrometric uncertainty of ~ 0.5 arcsec and a relative photometric uncertainty of 0.2–0.3 mag. The absolute photometric uncertainties on the reference plates are about 0.5 mag over the magnitude interval 16–20 mag. Finally, the data set for every single plate was cross-correlated with the data sets from all other plates to create two catalogues: (a) the multi-detection table of $\sim 3 \times 10^5$ objects detected on at least two plates of the same colour and (B) the single-detection table of $\sim 1.1 \times 10^6$ objects detected on only one plate. Since we decided to use a low detection limit for the object detection, in order to reach a high completeness at faint magnitudes, the tables are substantially contaminated by noise detections. This has to be considered for the selection of novae candidates: single-detections were used only to *confirm* multi-detections or single-detections in other filter bands. For the multi-detection objects light curves were created and searched for typical nova features.

Typical features of nova light curves were modeled using novae in M31 which were previously discovered on Tautenburg plates by Moffat (1967) and Börngen (1968):

- **Short time span of observability:** Due to the distance of M31 and the plate limit of $\sim 20^{\mathrm{m}}$, novae have a typical time of observability of 20–30 days. The parameter value applied for the search was 50 days (U, V) and 70 days (B) respectively.
- **Prominent peak:** A nova light curve should show a significant peak which must be brighter than the plate limit and be outside the 1σ error range of the modified light curve *without* the peak.
- **Singular event:** Classical novae do not recur on a timescale less than 100 years. Therefore every nova event in our data base should be unique. We also searched for recurrent novae, namely such that show repeated outbursts on a timescale less than 100 years, but we did not find any.

Every promising candidate was individually checked on the original plates to decide whether it could be a nova or not. The spatial distribution of the 19 objects classified as formerly unknown nova candidates is shown in Fig. 1. The mapped area is a cutout from the field of the astrometric reference plate corresponding to the area containing the new candidates. The key data are summarized in Table 1. Another 32 previously catalogued novae were established by our program. This is the reason why the consecutive numbering in Table 1 starts with 33. The full set of data will be provided in Henze et al. (2007).

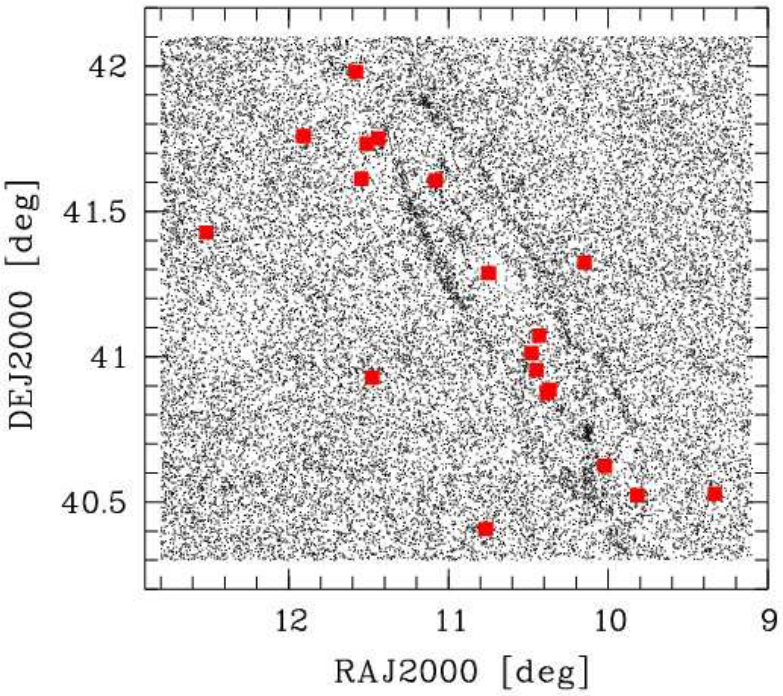

Figure 1. Distribution of the new 19 Tautenburg nova candidates over the galaxy M31. Black dots indicate the objects detected on the reference plate. The outer spiral arms of the galaxy are clearly recognizable by their overabundance of detected objects. Big filled squares mark the new nova candidates

Table 1: Basic data for the new nova candidates: identification number (1), right ascension and declination for J2000 (2,3), magnitude of the detected maximum and filter band (4), Julian date (5), and year of the outburst (6).

ID	α [°]	δ [°]	mag	JD	year
(1)	(2)	(3)	(4)	(5)	(6)
33	11.90747	41.75843	19.4 (B)	2437913	1962
34	10.01956	40.62433	18.5 (V)	2438373	1963
35	11.43947	41.75058	17.7 (U)	2439417	1966
36	9.33152	40.52856	18.9 (B)	2440917	1970
37	10.38148	40.87432	17.7 (B)	2441328	1972
38	9.81823	40.52356	18.9 (B)	2441680	1972
39	10.36907	40.88704	18.7 (V)	2442741	1975
40	10.44820	40.95410	18.2 (U)	2442775	1975
41	11.47816	40.92837	19.3 (B)	2444194	1979
42	10.14823	41.32396	17.8 (U)	2444490	1980
43	10.47874	41.01253	18.1 (U)	2444490	1980
44	10.74837	41.28688	18.0 (U)	2444490	1980
45	11.08057	41.60674	19.4 (B)	2445940	1984
46	11.51205	41.73243	18.9 (U)	2446299	1985
47	11.58009	41.97954	18.5 (U)	2446299	1985
48	12.51510	41.42756	18.8 (U)	2446299	1985
49	10.43303	41.07269	16.9 (B)	2448893	1992
50	10.76761	40.40784	17.5 (B)	2450316	1996
51	11.54533	41.61147	19.4 (B)	2450317	1996

Finally, we would like to emphasize that the good astrometric accuracy of this "new historical" novae makes them suitable for the correlation with previously found ones in order to search for recurrent novae. With the only exception of nova 39, none of our new nova candidates could be identified on POSS II plates, in the SIMBAD database, or in the GCVS (Artyukhina et al., 1995). The position of nova 39 coincides, with a position difference of 1 arcsec, with the nova number 32 in Table 4 of Baade & Arp (1964) discovered between the years 1945–1949. Therefore, nova 39 is a good candidate for a recurrent nova with repeated outbursts on a timescale less than 100 years. Unfortunately, Baade & Arp do not report the epoch of their observation and thus the recurrence time can be estimated only roughly to 26–30 years. Additional information on the actual epoch of the Baade & Arp nova 32 / Table 4 would be useful. Because the 1975 outburst of nova 39 has not been reported so far, we list it as a new nova candidate, even though it is probably a recurrent nova.

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ERRATUM FOR IBVS 5701

The star listed as V2028 Cyg in IBVS 5701 should be V2088 Cyg.

Geir Klingenberg