

## Andrew J. Drake

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### Professional Preparation

1993 BSc, Physics, Auckland University, NZ.

1995 MSc, Nuclear Physics, Auckland University, New Zealand.

2000 PhD, Astronomy and Astrophysics, Mount Stromlo Observatory, ANU, Australia.

### Research and Professional Experience

2015-present, Staff Scientist, Department of Astronomy, Caltech, USA.

2005-2015, Staff Scientist, Center for Advanced Computing Research, Caltech, USA.

2002-2005, Princeton-Catolica Postdoctoral Prize Fellow, Dept. Astrophysical Sciences  
Princeton University, USA.

2000-2002, Postdoctoral Staff Scientist, Institute of Geophysics and Planetary Physics,  
Lawrence Livermore National Laboratory, USA.

1995-1996, Research Assistant, Nuclear Physics, Auckland University, NZ.

### Recent Significant Activities

- co-PI and project manager of the Catalina Real-time Transient Survey (CRTS).
- PI and project manager of the Supernova Hunt project.
- Architect and developer of the CRTS public data release archive.
- Lead software developer for Palomar-Quest and CRTS synoptic transient surveys.

### Awards and External Funding

2002-2005, Princeton University Prize Fellowship.

2003-2005, PI, \$40K FONDECYT grant, "Discovery of Halo White Dwarfs".

2009-2013, co-I, \$480K grant, NSF OCI grant, "High Throughput Real-Time Astronomy:  
Discrimination, Dissemination and Decision".

2009-2013, co-PI, \$900K, NSF AST grant (0909182), "The Catalina Real-time Transient Survey".

2010-2012, PI, \$11K HST grant, "Determining the Nature of an Extraordinary Optical Transient".

2013-2014, co-PI, \$230K, NSF AST grant (1313422), "Open Exploration of the time domain  
with the Catalina Real-time Transient Survey".

2014-2016, co-PI, \$200K, NSF AST continuing grant (1413600), CRTS-II.

2015-2017, co-I, \$300K, NSF AST (1518308), "A Systematic Approach to QSO Variability."

2017-2018, co-PI, \$100K, NSF AST continuing grant, CRTS-II.

## Invited Talks

2010 AAS AGM, invited press release on CRTS supernovae discoveries.  
2010 Invited speaker on CRTS, Astronomy Colloquium, Caltech.  
2011 Plenary speaker on CRTS, IAU conference, MEARIM-II, Cape Town, South Africa.  
2011 Invited speaker on VOEvent, ThunderKat workshop, Arneston, South Africa.  
2011 Invited talk on CRTS, IAUS 285: New Horizons in Time Domain Astronomy, Oxford, UK.  
2012 Invited speaker on CRTS, Gaia transients workshop, Bologna, Italy.  
2013 Invited speaker on CRTS, Hotwiring the Transient Universe 3, Santa Fe, USA.  
2014 Invited speaker on Catalina Binaries, Stellar Tango at the Rockies '14, Alberta, Canada.  
2016 Plenary speaker on CRTS, Wide-field Variability Surveys: a 21st-century perspec., Chile.

## Observational Experience

Hubble Space Telescope + WFC3, Swift telescope + UVOT and XRT, Keck + LRIS and NIRSPEC, Gemini North and South + GMOS, Palomar 5m + DBSP and WFC, SMARTS, Macho (GMT).

## Programming Knowledge

C, C++, Python, Perl, SQL, Lua, IRAF, XML, Javascript, HTML

## Bibliography

*ADS citation stats: h-index=42, g-index=83, i10-index=110, citations=8000+*

**Drake, A.J.**, et al. *Results of a systematic search for outburst events in 1.4 million galaxies*, 2019, MNRAS, 482, 98

**Drake, A.J.**, et al. *The Catalina Surveys Southern periodic variable star catalogue*, 2017, MNRAS, 469, 3688

**Drake, A.J.**, et al. *Ultra-short Period Binaries from the Catalina Surveys*, 2014, ApJ, 790, 157

**Drake, A.J.**, et al. *Cataclysmic Variables from the Catalina Real-time Transient Survey*, 2014, MNRAS, 441, 1186

**Drake, A.J.**, et al. *The Catalina Surveys Periodic Variable Star Catalog*, 2014, ApJS, 213, 9

**Drake, A.J.**, et al. *Evidence for a Milky Way Tidal Stream Reaching Beyond 100 kpc*, 2013, ApJ, 765, 154

**Drake, A. J.**, et al. *Probing the Outer Galactic halo with RR Lyrae from the Catalina Surveys*, 2013, ApJ, 763, 32

**Drake, A.J.**, et al. *The Discovery and Nature of Optical Transient CSS100217:102913+404220*, 2011, ApJ, 705, 136

**Drake, A.J.**, et al. *Discovery of the Extremely Energetic Supernova 2008fz*, 2010, ApJL, 718, 127.

**Drake, A.J.**, et al. *First Results from the Catalina Real-time Transient Survey*, 2009, ApJ, 696, 870

**Drake, A.J.**, *Chromospherically Active Stars in the Galactic Bulge*, 2006, AJ, 131, 1044.

- Drake, A.J.**, *Cluster candidates from the USNO-A2.0 catalogue*, 2005, A&A, 435, 545
- Drake, A.J.**, et al. *Resolving the Nature of the LMC Microlensing Event LMC-5*, 2004, ApJL, 607, 29.
- Drake, A.J.**, Cook, K.H., *Photometric Transits from the MACHO Project Database*, 2004, ApJ, 604, 379.
- Drake, A.J.**, *On the Selection of Photometric Planetary Transits*, 2003, ApJ, 589, 1020
- Drake, A.J.**, and Cook, K., *A Search for Stellar Obscuration Events due to Dark Clouds*, 2003, ApJ, 589, 281
- Alcock, C., ... **Drake, A.J.** et al. (alphabetical authorship). *Astrometry with the Macho database I. HPM stars towards the Galactic bulge and Magellanic Clouds*, 2001, ApJ, 562, 337.
- Alcock, C., et al., **Drake, A.J.**, (alphabetical authorship), *The Macho Project: Microlensing Optical Depth towards the Galactic Bulge from Difference Image Analysis* 2000, ApJ, 541, 734
- Alcock, C., et al., **Drake A.J.** (alphabetical authorship), *Difference Image Analysis of Galactic Microlensing, I. Data Analysis*, 1999, ApJ, 521, 602
- Alcock, C., et al., **Drake A.J.** (alphabetic authorship), *Difference Image Analysis of Galactic Microlensing II. Microlensing Events*, 1999, ApJS, 124, 171
- Drake, A. J.**, et al. *Discovery of eclipsing white dwarf systems in a search for Earth-size companions*, 2010, arXiv:1009.3048

#### Co-authored papers:

- Graham, M.J., D. Stern, **Drake, A.J.** et al., et al. *Understanding Extreme Quasar Optical Variability With CRTS: II. Changing State Quasars*, 2019, MNRAS, submitted
- Pastorello, A., ... **Drake, A.J.** et al., *Luminous Red Novae: Stellar Mergers or Giant Eruptions?*, 2019, MNRAS, submitted.
- Perley, D.A., ... **Drake, A.J.** et al., *The Fast, Luminous Ultraviolet Transient AT2018cow: Extreme Supernova, or Disruption of a Star by an Intermediate-Mass Black Hole?*, 2019, MNRAS, 484, 1031
- Papageorgiou, A., ... **Drake, A.J.** et al., *An Updated Catalog of 4680 Northern Eclipsing Binaries with Algol-Type light curve morphology in the Catalina Sky Surveys*, 2018, ApJS, 238, 4
- Ross, Nicholas P., ... **Drake, A.J.**, et al., *A new physical interpretation of optical and infrared variability in quasars*, 2018, MNRAS, 480, 4468
- Stern, Daniel, ... **Drake, A.J.** et al., *A Mid-IR Selected Changing-Look Quasar and Physical Scenarios for Abrupt AGN Fading*, 2018, ApJ, 864, 27
- Belokurov, V., ... **Drake, A.J.** et al., *Unmixing the Galactic Halo with RR Lyrae tagging*, 2018, MNRAS, 477, 1472

- Elias-Rosa, N., ... **Drake, A.J.**, et al., *SN<sub>hunt</sub>151: an explosive event inside a dense cocoon*, 2018, MNRAS, 475, 2614
- Graham, M.J., ... **Drake A.J.** et al., *Understanding extreme quasar optical variability with CRTS: I. Major AGN flares*, 2017, MNRAS, 470, 4112
- Pastorello, A., ... **Drake A.J.** et al., *Supernovae 2016bdu and 2005gl, and their link with SN 2009ip-like transients: another piece of the puzzle*, 2017, MNRAS, 474, 197
- Ting-Chang Yang, M., ... **Drake, A.J.**, et al., *Long-term Periodicities of Cataclysmic Variables with Synoptic Surveys*, 2017, PASP, 129, 4202
- Mahabal, A.A., ... **Drake, A.J.**, et al., *Deep Learnt Classification of Light Curves*, Proc. IEEE Symp. on Computational Intelligence and Data Mining, 2017, p. 2757, IEEE Press.
- Stern, Daniel, ... **Drake, A.J.** et al., *Extreme Variability in a Broad Absorption Line Quasar*, 2017, ApJ, 839, 106
- Navarrete, C., ... **Andrew J. Drake**, *A fork in the Sagittarius trailing debris*, 2017, MNRAS, 467, 1329
- Roy, R., ... **Drake, A.J.** et al., *SN 2012aa - a transient between Type Ibc core-collapse and superluminous supernovae*, 2016, A&A 596, 67
- Tartaglia, L., ... **Drake A.J.** et al., *Interacting supernovae and supernova impostors. LSQ13zm: an outburst heralds the death of a massive star*, 2016, 459, 1039
- Coppejans, D.L., ... **Andrew J. Drake**, *Statistical properties of dwarf novae-type cataclysmic variables: The Outburst Catalogue*, 2016, MNRAS, 456, 4441
- Abeysekara, A.U., ... **Drake A.J.** et al., *Gamma rays from the quasar PKS 1441+25: story of an escape*, 2015, ApJL 815, L22
- Hyunsung, D. Jun, ... **Andrew J. Drake**, et al., *Infrared Time Lags for the Periodic Quasar PG 1302-102*, 2015, ApJL, 814, 12
- Bellm, Eric C., ... **Drake, A.J.** et al., *Properties and Evolution of the Redback Millisecond Pulsar Binary PSR J2129-0429*, 2015, ApJ, 816, 74
- Graham, M.J., ... **Drake, A.J.** et al., *A systematic search for close supermassive black hole binaries in the Catalina Real-Time Transient Survey*, 2015, MNRAS, 453, 1562
- Campbell, H.C., **Drake, A.J.** et al., *Total eclipse of the heart: The AM CVn Gaia14aa ASSASN-14cn*, 2015, MNRAS, 452, 1060
- Graham, M.J., ... **A.J. Drake**, et al., *A possible close supermassive black-hole binary in a quasar with optical periodicity*, 2015, Nature, 518, 7537
- Brown, M.E., ... **Drake, A.J.** et al., *A serendipitous all sky survey for bright objects in the outer solar system*, 2015, AJ, 149, 69
- Parsons, S.G., ... **A.J. Drake**, et al., *Fourteen new eclipsing white dwarf plus main-sequence binaries from the SDSS and Catalina surveys*, 2015, MNRAS, 449, 2194
- Hajdu G., ... **Drake, A.J.** et al., *New RR Lyrae variables in binary systems*, 2015, MNRAS, 449, L113

- Torrealba, G., Catelan, M., **Drake, A.J.**, et al. *Discovery of 9,000 new RR Lyrae in the Southern Catalina Surveys*, 2014, MNRAS, 446, 2251
- Breedt, E., Gaensicke, B.T., **Drake, A.J.** et al. *One thousand cataclysmic variables from the Catalina Real-time Transient Survey*, 2014, MNRAS, 443, 3174
- Ackermann, M., ... **Drake, A.J.** et al. *Multifrequency Studies of the Peculiar Quasar 4C +21.35 During the 2010 Flaring Activity*, 2014, ApJ, 786, 157
- Benetti, S., ... **Drake, A.J.** et al. *The supernova CSS121015:004244+132827: a clue for understanding super-luminous supernovae*, 2014, MNRAS, 441, 289
- Graham, M.J., Djorgovski, S.G., **Drake, A.J.** et al. *A novel variability-based method for quasar selection: evidence for a rest frame 54 day characteristic timescale*, 2014, MNRAS, 439, 703
- Hovatta, T., ... **Drake, A.J.** et al. *Connection between optical and gamma-ray variability in blazars*, 2014, MNRAS, 439, 690
- Brown, M.E., **A.J. Drake**, *A serendipitous all sky survey for bright objects in the outer solar system*, 2015, AJ, 149, 69
- D'Ammando, F., ... **Drake, A.J.** et al. *Multiwavelength observations of the gamma-ray-emitting narrow-line Seyfert 1 PMN J0948+0022 in 2011*, 2014, MNRAS, 438, 3521
- Fraser, M., ... **Drake, A.J.** et al. *Detection of an outburst one year prior to the explosion of SN 2011ht*, 2013, ApJ, 779, 8
- Graham, M.J., **Drake, A.J.** et al. *A comparison of period finding algorithms*, 2013, MNRAS, 434, 3423
- Graham, M.J., **Drake, A.J.** et al. *Using conditional entropy to identify periodicity*, 2013, MNRAS, 434, 2629
- D'Ammando, F., ... **Drake, A.J.** et al. *The ordinary life of the gamma-ray emitting narrow-line Seyfert 1 galaxy PKS 1502+036*, 2013, MNRAS, 433, 952
- Mukadam, A.S., ... **Drake, A.J.** et al. *Enigmatic Recurrent Pulsational Variability of the Accreting White Dwarf EQ Lyn*, 2013, AJ, 146, 54
- Graham, M.J., **Drake, A. J.** et al. *Machine-assisted discovery of relationships in astronomy*, 2013, MNRAS, 431, 2371
- Prieto, J.L., Brimacombe, J., **Drake, A.J.**, Howerton, S. *The Rise of the Remarkable Type II<sub>n</sub> Supernova SN 2009ip*, 2013, ApJL, 763, L27
- Parsons, S.G., Gansicke, B.T., Marsh, T.R., **Drake, A.J.**, et al. *Eclipsing Post Common Envelope Binaries from the Catalina Surveys*, 2013, MNRAS, 429, 256
- Breedt, E. Gaensicke, B.T. Marsh, T.R. Steeghs, D., **Drake, A.J.**, C.M. Copperwheat *CSS100603:112253-111037: A helium-rich dwarf nova with a 65 minute orbital period*, 2012, MNRAS, 425, 2548
- Breedt, E., Gaensicke, B. T., Girven, J., **Drake, A.J.**, et al. *The evolutionary state of short-period magnetic white dwarf binaries*, 2012, MNRAS, 423, 1437

- Prieto, Jose L., Lee, J. C., **Drake, A.J.** *SN 2008jb: A "Lost" Core-Collapse Supernova in a Star-Forming Dwarf Galaxy at 10 Mpc*, 2012, ApJ, 745, 70
- Parsons, S.G., ..., **Drake, A.J.** et al. *The shortest period detached white dwarf + main-sequence binary*, 2012, MNRAS, 419, 304
- van Velzen, Sjoert, ... **Drake, Andrew J.** *Optical Discovery of Probable Stellar Tidal Disruption Flares*, 2011, ApJ, 741, 73
- Parsons, S.G., Marsh, T.R., Gansicke, B.T., **Drake, A.J.**, Koester, D. *A Deeply Eclipsing Detached Double Helium White Dwarf Binary*, 2011, ApJ, 735, 30
- Denisenko, D.V., **Drake, A.J.**, et al. *New cataclysmic variable 1RXS J073346.0+261933 in Gemini*, 2011, Astronomy Letters, 37, 858
- Copperwheat, C.M., ... **Drake, A.J.** et al. *SDSS J0926+3624: the shortest period eclipsing binary star*, 2011, MNRAS, 410, 1113
- Kozowski, S., ..., **Drake A.J.**, et al. *SDWFS-MT-1: A Self-obscured Luminous Supernova at  $z = 0.2$* , 2010, ApJ, 722, 1624
- Moskvitin, A.S., ... **Drake, A.J.**, et al. *Spectral and photometric monitoring of distant core-collapse supernovae in the SAO RAS*, 2010, AstBu, 65, 230
- Wils, Patrick, Gansicke, Boris T., **Drake, A.J.**, Southworth, John. *Data mining for dwarf novae in SDSS, GALEX and astrometric catalogues*, 2010, MNRAS, 402, 436
- Gal-Yam, A., ..., **Drake, A.J.**, and others. *Supernova 2007bi as a pair-instability explosion*, 2009, Nature, 462, 624
- Bauer, A, ..., **Drake, A.J.** and others. *Highly Variable Objects in the Palomar-QUEST Survey: A Blazar Search Using Optical Variability*, 2009, ApJ, 705, 46
- Mahabal, A., ... **Drake, A.J.** et al. *Automated probabilistic classification of transients and variables*, 2008, AN, 329, 288
- Kallivayalil, N., ... **Drake, A.J.** and Geha, M. *The Proper Motion of the Large Magellanic Cloud Using HST*, 2006, ApJ, 638, 772
- Thomas, C. L., ... **Drake, A.J.**, and others, *Galactic Bulge Microlensing Events from the MACHO Collaboration*, 2005, ApJ, 631, 906
- Popowski, P., ... **Drake, A.J.**, and others, *Microlensing Optical Depth toward the Galactic Bulge Survey Using Clump Giants from the MACHO*, 2005, ApJ, 631, 879
- Cieslinski, D., Diaz, M., **Drake, A.J.**, Cook, K.H., *Discovery of New Eruptive Cataclysmic Variables Using the MACHO Database*, 2004, PASP, 116, 610
- Nikolaev, S., **Drake, A.J.**, et al. *Geometry of the Large Magellanic Cloud Disk: Results from MACHO and 2MASS*, 2004, ApJ, 601, 260

- Alcock, C., ... **Drake, A.J.**, and others, *The MACHO Project Large Magellanic Cloud Variable Star Inventory. XIII. Fourier Parameters for the First-Overtone RR Lyrae Variables and the LMC Distance*, 2004, AJ, 127, 334
- Alcock, C., ...**Drake, A.J.**, and others, *The MACHO Project Large Magellanic Cloud Variable Star Inventory. XI. Frequency Analysis of the Fundamental-Mode RR Lyrae Stars*, 2003, ApJ, 598, 597
- Geha, M., ... **Drake, A.J.**, and others, *Variability-selected Quasars in MACHO Project Magellanic Cloud Fields*, 2003, AJ, 125, 1
- Bennett, D.P., ... **Drake, A.J.**, and others, *Gravitational Microlensing Events Due to Stellar-Mass Black Holes*, 2002, ApJ, 579, 639
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *The MACHO Project Large Magellanic Cloud Variable Star Inventory. XII. Three Cepheid Variables in Eclipsing Binaries*, 2002, ApJ, 573, 338
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *Direct detection of a microlens in the Milky Way*, 2001, Nature, 414, 617
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *The Macho Project: Microlensing Detection Efficiency*, 2001, ApJS, 136, 439
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *The MACHO Project LMC Variable Star Inventory: X. The R Coronae Borealis Stars*, 2001, ApJ, 554, 298
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *The MACHO Project Hubble Space Telescope Follow-Up: Preliminary Results on the Location of the Large Magellanic Cloud Microlensing Source Stars*, 2001, ApJ, 552, 582
- Alard, C., ... **Drake, A.J.**, and others (alphabetical), *Mass-Losing Semiregular Variable Stars in Baade's Windows*, 2001, ApJ, 552, 289
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *MACHO 96-LMC-2: Lensing of a Binary Source in the LMC and Constraints on the Lensing Object*, 2001, ApJ, 552, 259
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *Macho Project Limits on Black Hole Dark Matter in the 1-30 Solar Mass Range*, 2001, ApJL, 550, 169
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *A 421-d activity cycle in the BeX recurrent transient A0538-66 from MACHO monitoring*, 2001, MNRAS, 321, 678
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *The Macho Project: Microlensing Results from 5.7 Years of LMC Observations*, 2000, ApJ, 542, 281
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *The MACHO Project Large Magellanic Cloud Variable-Star Inventory. IX. Frequency Analysis of the First-Overtone RR Lyrae Stars and the Indication for Non-radial Pulsations*, 2000, ApJ, 542, 257
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *Binary Microlensing Events from the MACHO Project*, 2000, ApJ, 541, 270
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *Searching for periodicities in the MACHO monitoring of LMC X-2*, 2000, MNRAS, 316, 729

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- Alfonso, C., ... **Drake, A.J.**, and others (alphabetical), *Combined Analysis of the Binary Lens Caustic-crossing Event MACHO 98-SMC-1*, 2000, ApJ, 532, 340
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *Calibration of the MACHO photometry system*, 1999, PASP, 111, 1539
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical), *Discovery and Characterisation of a Caustic Crossing Microlensing Event in the SMC*, 1999, ApJ, 518, 44
- Alcock, C., ... **Drake, A.J.**, and others (alphabetical authorship), *Direct detection of a microlens in the Milky Way*, 2001, Nature, 414, 617
- Nelson, C.A., **Drake, A.J.**, and others *The MACHO Project HST Follow-Up: The Large Magellanic Cloud Microlensing Source Stars*, 2009, submitted ApJ, arXiv:0902.2213

### **Astronomical Discovery Notices**

Drake, A.J. et al. CBETs, (2007-2012 only):

3271, 3242, 3240, 3222, 3204, 3191, 3183, 3179, 3165, 3152, 3119, 3118, 3117, 3094, 3086, 3085, 3084, 3064, 3063, 3062, 3057, 3056, 3055, 3041, 3038, 3036, 3033, 3027, 3024, 3023, 3018, 3017, 3003, 2989, 2985, 2982, 2972, 2971, 2970, 2954, 2949, 2948, 2947, 2945, 2941, 2917, 2895, 2886, 2885, 2884, 2883, 2882, 2859, 2858, 2857, 2839, 2838, 2834, 2833, 2778, 2762, 2740, 2733, 2726, 2725, 2724, 2719, 2718, 2717, 2704, 2703, 2666, 2660, 2659, 2650, 2645, 2636, 2619, 2614, 2602, 2601, 2578, 2558, 2551, 2528, 2491, 2484, 2463, 2455, 2438, 2429, 2369, 2339, 2296, 2295, 2287, 2280, 2258, 2254, 2224, 2219, 2208, 2138, 2101, 2092, 2048, 2045, 2023, 1996, 1991, 1970, 1960, 1958, 1956, 1891, 1879, 1862, 1861, 1830, 1828, 1825, 1815, 1801, 1792, 1791, 1766, 1760, 1752, 1744, 1733, 1705, 1693, 1683, 1682, 1681, 1676, 1589, 1581, 1559, 1552, 1538, 1526, 1524, 1523, 1409, 1402, 1366, 1320, 1296, 1278, 1261, 1172.

Drake, A.J. et al. Astronomer's Telegrams, (2007-2012 only):

4498, 4463, 4334, 4315, 4279, 4081, 4011, 3941, 3928, 3879, 3873, 3852, 3795, 3716, 3706, 3496, 3416, 3354, 3343, 3340, 3324, 3262, 3215, 3097, 3081, 3031, 2978, 2938, 2897, 2852, 2784, 2725, 2694, 2630, 2620, 2555, 2544, 2508, 2359, 2331, 2318, 2266, 2210, 2149, 2100, 2087, 2086, 2057, 2043, 2029, 2009, 1980, 1950, 1940, 1937, 1911, 1885, 1860, 1823, 1772, 1768, 1738, 1734, 1571, 1566, 1521, 1510, 1479, 1447, 1404, 1399, 1388, 1374, 1339, 1337, 1250, 1234, 1083.