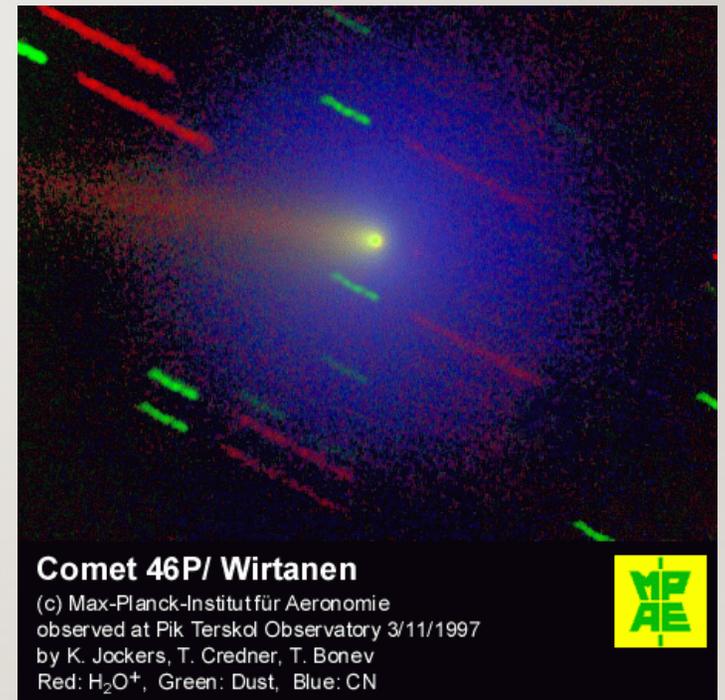


Comet 46P/Wirtanen

Observing Campaign

49th Division for Planetary Sciences Meeting

17 October 2017



Preliminary Announcements

- Toast to Mike A'Hearn on Thursday evening
 - 8:30 in the Hotel Bar
- We are planning a symposium in celebration of Mike and his legacy on the field of cometary science
 - Summer of 2019
 - Center around first results from the Wirtanen Campaign
 - More information will come later
- Sign up for the Wirtanen campaign mailing list if you haven't already

Workshop Organization / Outline

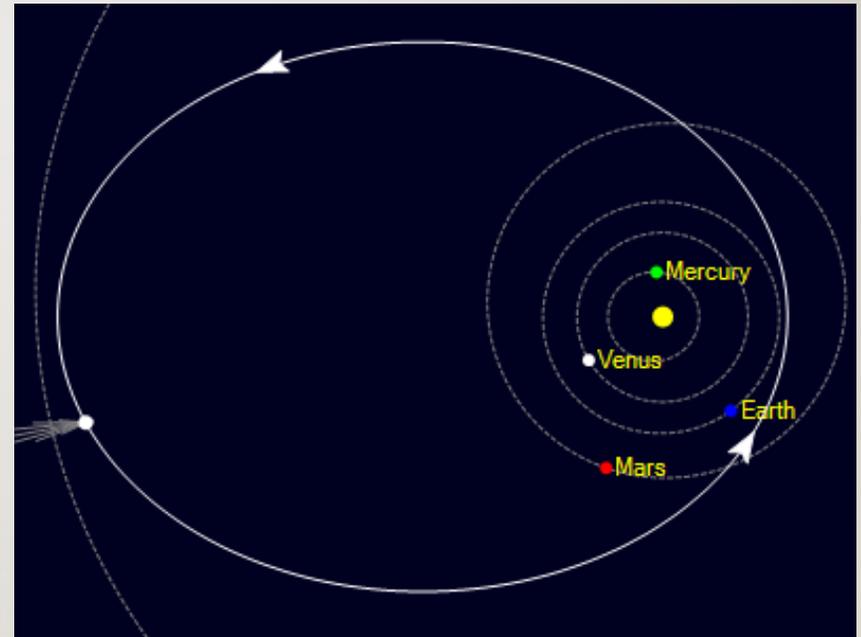
- Why Wirtanen?
- Why now?
- What do we know about Wirtanen?
- Summary of the observing campaign
- Demonstration of Website
- Related campaigns
- Proposed and planned observations
- Discussion

Comet Wirtanen – The Name

- **Pronounced WERE-tuh-nun**
 - Confirmed by multiple sources from Lick Observatory who worked with Carl and Edie Wirtanen

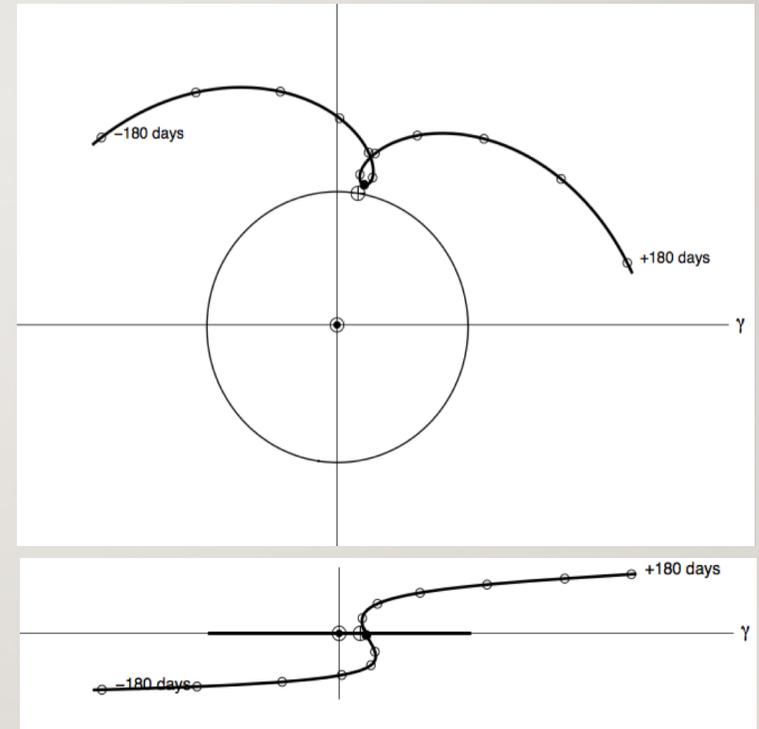
Why is Comet Wirtanen Special?

- Interesting comet
 - Small, hyperactive nucleus
 - “Twin” of Hartley 2
 - Could evolve into a PHO
- Potential (likely?) spacecraft mission target
 - Orbit is very favorable
 - $q = 1.055 \text{ AU}$, $i = 11.7^\circ$,
 - $Q = 5.13 \text{ AU}$, $P = 5.43 \text{ yr}$
 - Already selected as a target:
 - Rosetta, Comet Hopper, Others?
 - Strong possibility of being a future target



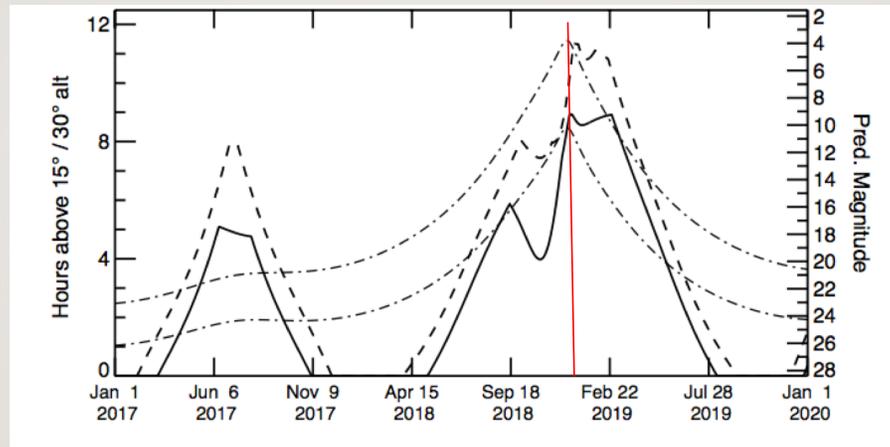
Why Now?

- 2018 is an historic apparition!
- Close approach to Earth - 0.077 AU
 - 16 December 2018
 - One of the closest comets in modern era
 - Observing conditions are better than for other comets
- Comet will be bright
 - Predicted to reach naked eye brightness
- Geometric conditions allow long-duration observations
 - Up for many hours over most of a year,
 - Pre- and post-perihelion, North and South
- Excellent opportunity to characterize its behavior, learn about the comet and reduce risk and cost of future comet missions
- **Observing proposal deadlines are coming up!**

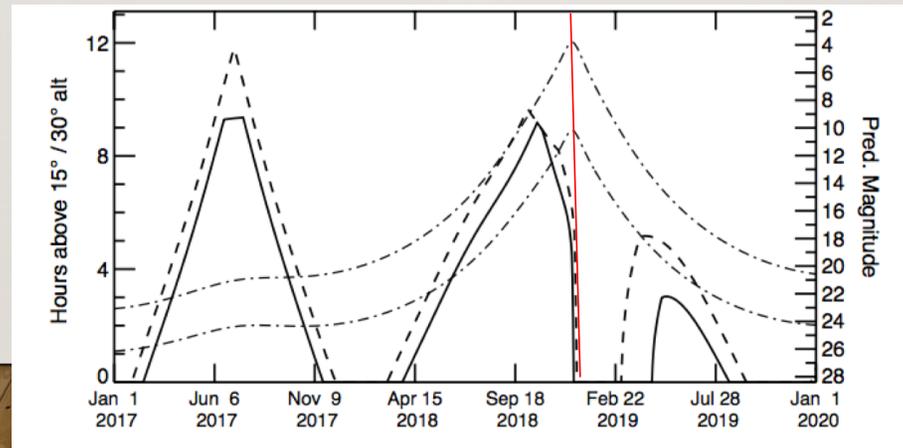


Wirtanen Visibility

MKO
(North)

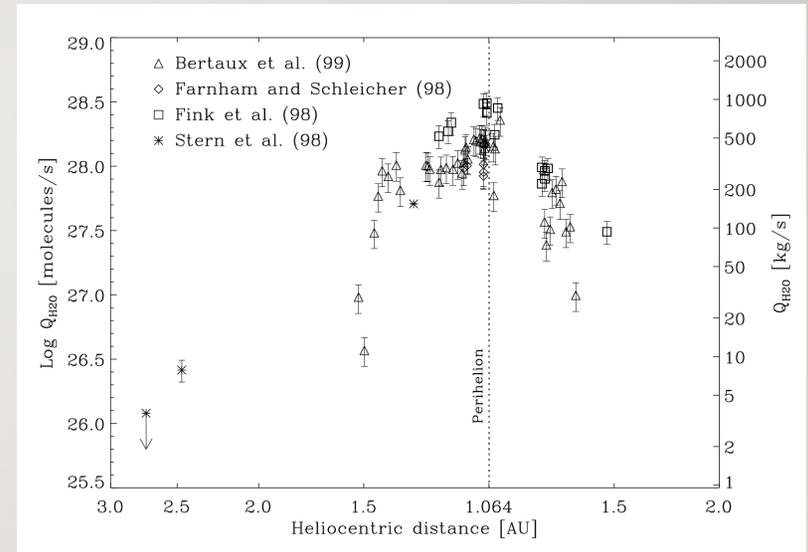


CTIO
(South)



What do we know now?

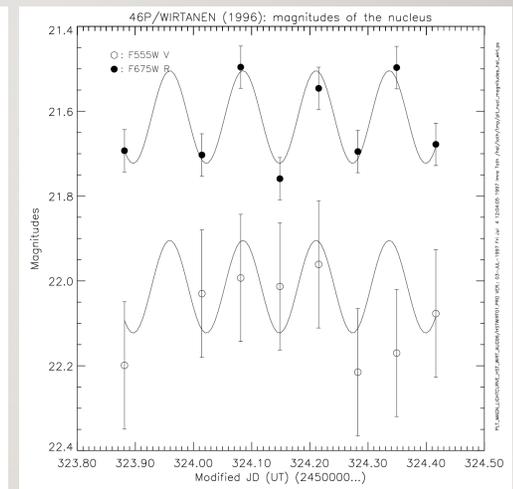
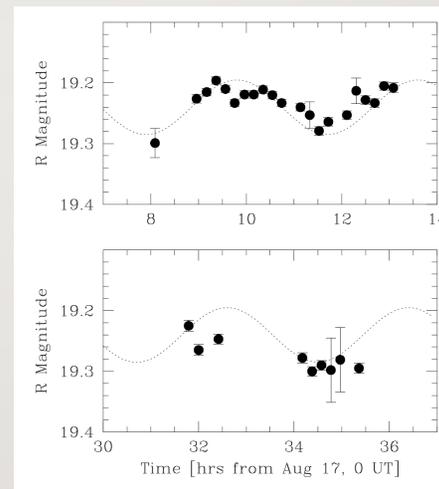
- Effective radius 0.58 km [Schulz & Schwehm 1999]
 - Axial ratio > 1.4 (HST lightcurve amplitude)
- Activity
 - $Q(\text{H}_2\text{O})_{\text{peak}} \sim 1\text{-}3 \times 10^{28} \text{ sec}^{-1}$
 - Suggests Wirtanen is a hyperactive comet
 - Active fraction $\sim 50 - 100\%$
 - $A_{\text{fp}}_{\text{peak}} \sim 150 \text{ cm}$ (less dusty than Hartley 2)
 - No secular changes over last few apparitions
 - Carbon-chain taxonomy: “Typical” [Farnham & Schleicher 1998]



What do we know now?

- Rotation (Aug 1996, ~200 days pre-perihelion)

- 7.6 hr [Meech et al. 1997]
 - “Possible rotation”, double peaked
 - Amplitude 0.045 mag
- 6.0 hr [Lamy et al. 1998]
 - Large uncertainty – 8 data points
 - Amplitude 0.22 mag
- Not enough data to evaluate details
 - No spin pole orientation
 - Samarasinha et al. (1996) suggest it is likely to be in a NPA rotation state



Wirtanen Campaign

- Objective:
 - **Provide a central clearinghouse for basic information regarding comet 46P/Wirtanen to encourage and facilitate the acquisition, analysis and interpretation of observations, and to promote collaborations between researchers.**
- Based on the 2012 S1 ISON and 2013 A1 Siding Spring observing campaigns
- 46P Campaign Home Page: wirtanen.astro.umd.edu **Live now!**
 - Developed and tested using 45P, 41P and especially 2012 TC4

Web site content

- General history as well as highlights about the 2018 apparition
- Currently known physical characteristics of 46P/Wirtanen
- Geometric observing conditions for different sites
- Current events, status and secular lightcurve (when observed again)
- Interesting results and events that might be of interest to the community
 - Gallery of submitted images and plots
- Text that can be used as a basis for justification in observing proposals (planned)
- Links to other relevant sites of interest
- Information about Wirtanen observations

Observation Plan Log

- Record of the planned and collected observations of comet Wirtanen
 - Allow proposals to complement other observations
 - Prompt collaborations and interaction between observers
- Linked from the main Campaign web page
 - Collect information about Wirtanen observations (voluntary submission)
 - Dates, observatories, instruments etc.
 - Status (proposed, scheduled, and/or completed)
 - Different formats for displaying the information (list, calendar, etc)

Website Demo

- wirtanen.astro.umd.edu

Other Potential/Future Content

- Expand the campaign as warranted
- Possible additions
 - Network exploder to inform participants about timely events
 - Currently have our mailing list
 - Telecons/blogs to discuss recent events (when activity increases)
 - Suggestions from the community are welcome

Associated Campaigns

- 4*P/ Coma Observing Campaign (www.psi.edu/41P45P46P Nalin Samarasinha)
 - 45P/H-M-P, 41P/T-G-K and 46P/Wirtanen
 - Professional and high level amateurs contribute images of the coma for long duration monitoring of the coma morphology
 - Obtained observations of 45P and 41P earlier this year
 - 46P is next on the list
- Amateur Observers' Campaign (aop.astro.umd.edu Elizabeth Warner)
 - Public interest website
 - Promotes interaction between all levels of amateur observers and offers instruction and advice on improving observing capabilities

General Observation Strategies

- Maximize temporal coverage throughout the apparition
 - Obtain measurements as a function of time, whenever possible
 - Characterize long-term secular behavior
 - Characterize rotational phase dependence
- Exploit close approach
 - Obtain very high spatial resolution measurements
 - Obtain data that require a bright comet
 - Investigate the inner coma environment

Current Observing Plans

- Awarded time:
 - Chandra/HST coordinated observations (Bodewits) Dec 2018
 - Zwicky Transient Facility (ZTF, UM group + others)
 - Images the sky every 3 days, providing long-term monitoring of comets
- Proposed
 - SWIFT (Bodewits) Dec 2018
 - Transiting Exoplanet Survey Satellite (TESS, Farnham)
 - Monitors $24^\circ \times 96^\circ$ sectors of sky with 30 min cadence for 27+ days

Current Observing Plans

- Other plans that I'm aware of (no details)
 - Goldstone (Lance Benner)
 - TRAPPIST (Emmanuel Jehin)
 - Ultraviolet and Visual Echelle Spectrograph (UVES, Emmanuel Jehin)
 - LCOGT (Bodewits et al.)
 - DCT (Lowell & UM groups)
 - Note: Had plans to observe with JWST (Snodgrass, et al.) but launch delay cancels those plans. Look into observing later (2020).

Discussions / Comments

- Remember to input your observing plans to the campaign website
 - wirtanen.astro.umd.edu