



<https://www.cfht.hawaii.edu/>

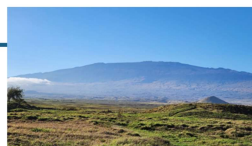
<https://www.cfht.hawaii.edu/en/science/CommunitySurvey/>

Executive Director Jean-Gabriel Cuby [cuby@cfht.hawaii.edu](mailto:cuby@cfht.hawaii.edu)

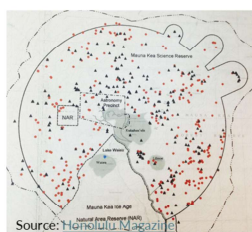
Director of Science Operations Nadine Manset [manset@cfht.hawaii.edu](mailto:manset@cfht.hawaii.edu)

## Acknowledgment

- CFHT operates on the land of the Kānaka Maoli people, near the summit of Maunakea
- There are hundreds of historic sites, archaeological remains, shrines and burials on its slopes and summit.
- We are committed to working closely with local communities in Hawai'i to define a shared governance model of community astronomy on Maunakea.
- "Astronomy's relationship with the lands and communities of Maunakea". Cuby, Matsuda, Matsuda, Adamson, O'Meara, Manset, Proc. SPIE 13094-47 (2024) (available on arXiv)



Copyright Herbert K. Kane, LLC



Source: Honolulu Magazine



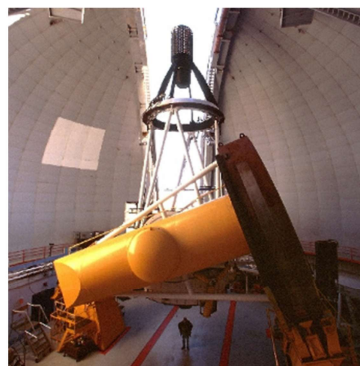
2/27/2025

CFHT Community Surveys

2

## CFHT Governance

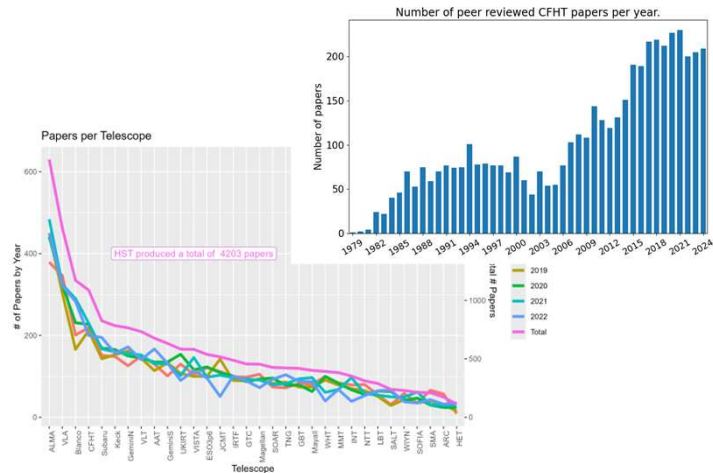
- Three agencies (tripartite agreement):
  - The National Research Council of Canada – NRC
  - The Centre National de la Recherche Scientifique – CNRS (France)
  - The University of Hawai‘i – UH
- Associate Partnerships:
  - Current:
    - ASIAA/Institute of Astronomy & Astrophysics, Academia Sinica (Taiwan) until January 2026
    - The National Astronomical Observatories of the Chinese Academy of Sciences (NAOC) until January 2027
  - Past:
    - South Korea (KASI)
    - Brazil (LNA)

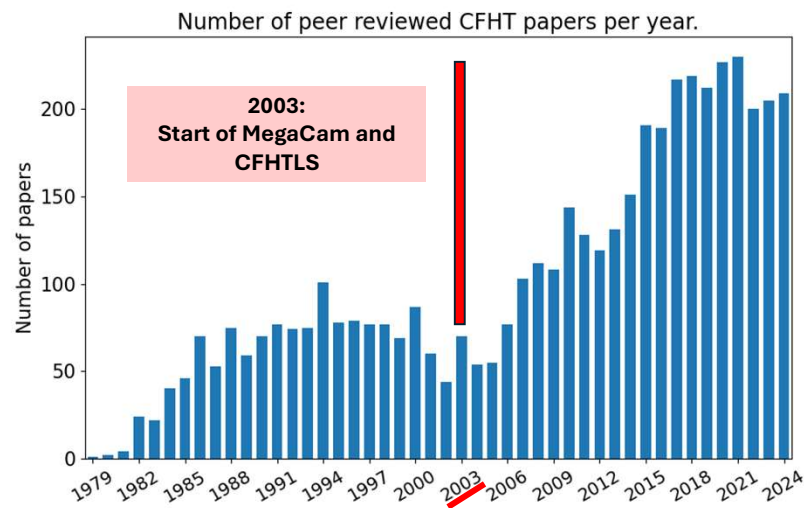


# CFHT in a Nutshell



- Operations started in 1979
- 3.6m aperture, equatorial mount
- 5 instruments
- Very productive telescope
- Active outreach and community engagement program





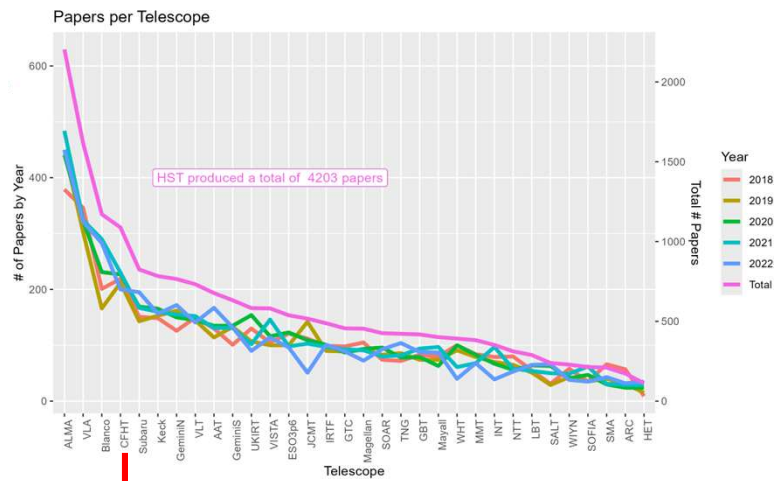
2/27/2025

CFHT Community Surveys

5

ADS libraries, per instrument, per LP, etc.

<https://www.cfht.hawaii.edu/en/science/Publications/ADSLibraries.php>



Number of papers for the years 2018 to 2022, ordered by observatory. CFHT has had a little over 200 papers per year between 2017 and 2022. **Plot courtesy of Crabtree.**

2/27/2025

CFHT Community Surveys

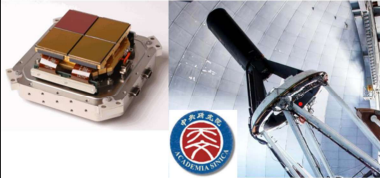
6



2025 update from Dennis Crabtree - telescope productivity for the period 2018 – 2022 - Productivity is the number of papers per telescope – multi-telescope facilities such as Keck have their numbers normalized

# CFHT Instruments

## WIRCam

- 20' x 20' NIR imager
- 128 Mpix @ 0.306 arcsec/pix
- Broad band and Narrow band filters



- SPIRou**  National Research Council Canada Conseil national de recherches Canada 
- High Resolution NIR spectropolarimeter
  - 970-2490 nm -  $R = 70,000$
  - $1 \text{ m.s}^{-1}$  radial velocity accuracy

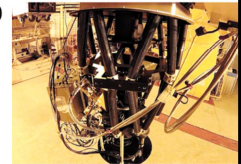
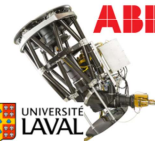
## MegaCam

- $1^\circ \times 1^\circ$  optical imager
- 360 Mpix @ 0.189 arcsec/pix
- Broad band and NB filters



## SITELLE

- $11' \times 11'$  Fourier Transform Spectro-image
- 350-900 nm
- $2k \times 2k$  @ 0.32 arcsec/pix
- $R = 6,000 - 10,000$



## ESPaDOs

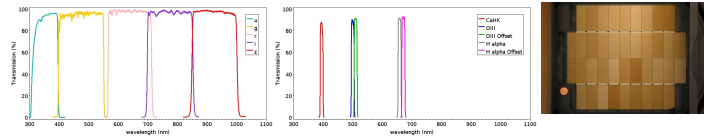
- High Resolution optical spectropolarimeter
- 370-10,000 nm -  $R = 70,000$
- $20 \text{ m.s}^{-1}$  radial velocity accuracy



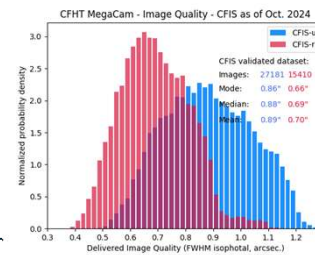
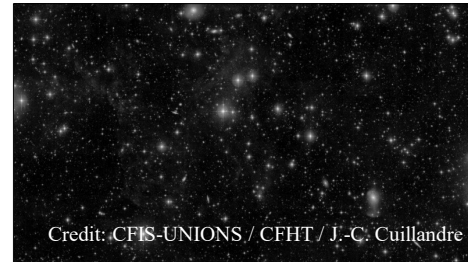
WIRCAM reaches a limiting magnitude of 23.3 (Vega) at  $5\sigma$  in the  $H$ -band on a point-source for an exposure time of 1-hour and  $0.7''$  seeing.

For SITELLE, the  $H\alpha$  line sensitivity in the SN3 filter at a resolution of 5,000 is  $4 \times 10^{-17} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ arcsec}^{-2}$  in 4-hours under dark sky conditions and  $0.8''$  seeing.

# MegaCam



- 1,600+ papers ; 65,000+ citations
- 11 BB and NB filters (e.g. Pristine Survey)
- Low Surface Brightness mode
- Preparation of Euclid (UNIONS)
  - **500 nights over 10 years**
  - Enabled Canada's participation in the Euclid Consortium
- **The world's best wide-field UV (310-400 nm) camera for years to come**
- **Time-domain (availability & AEON)**



2/27/2025

CFHT Community Surveys

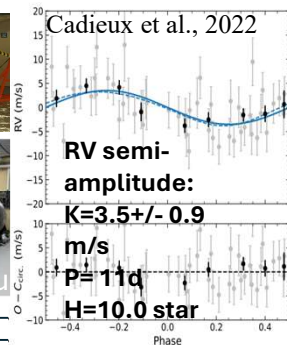
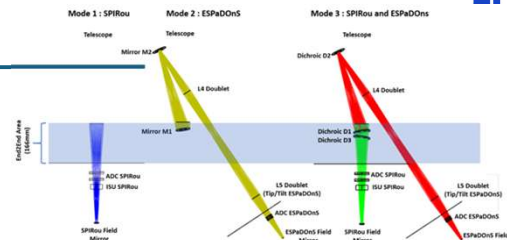
8

LSB down to  $28.5 \text{ mag arcsec}^{-2}$  (AB) in the g-band.

MegaCam reaches a limiting magnitude of 25.3 (AB) at  $10\sigma$  in the  $u$ -band on a point-source for a one-hour exposure under dark sky conditions and  $0.8''$  seeing.

## Wenaokeao (2026+)

- Wenaokeao, or Wena o ke ao: earliest glow of light
- Co-mount of ESPaDOnS and SPIRou (fibre-fed from Cassegrain focus)
- Both instruments have excellent polarimetric capabilities (linear and circular)
- Precision Radial Velocity (near IR)  $\sim 1 \text{ m s}^{-1}$
- **The only spectropolarimeter offering coverage 370 – 2350 nm at  $R \sim 70,000$**
- **Time Domain studies (current and via AEON)**



2/27/2025

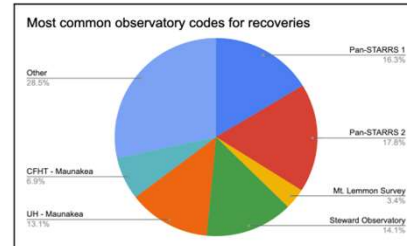
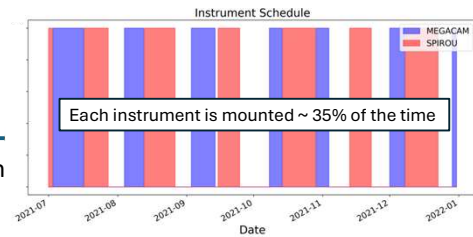
CFHT Community Surveys

SPIRou measures spectra of stars with an  $H$ -band magnitude (Vega) of  $\sim 3$  at a signal-to-noise ratio (SNR) of 300 in 30 s, or with an  $H$ -band magnitude of  $\sim 15$  at an SNR of 5 in 1 h.

ESPaDOnS measures spectra of stars with a  $V$ -band magnitude (Vega) of  $\sim 16$  at an SNR of 10 in 25 min. The radial velocity precision can reach  $\sim 20 \text{ m s}^{-1}$  using telluric lines imprinted in the spectra.

## CFHT Operations

- Observations performed in service mode remotely from Waimea HQ
- Data reduction to remove the instrumental signatures
- **Baseline plan after 2026:** operate with MegaCam and Wenaookeao, each ~ 50% of the time
- CFHT recognized as a key player in Target of Opportunities observations, e.g. minor planet recoveries
- Real-time / Rapid Response ToO mode in development
- Funded by the National Science Foundation to join the Astronomical Event Observatory Network (2026 or 2027)



2/27/2025

CFHT Community Surveys

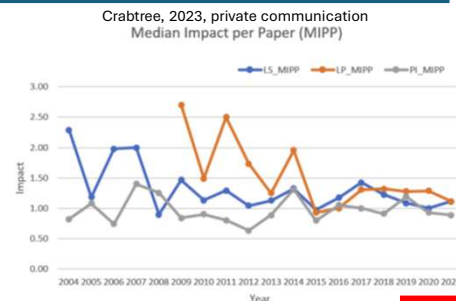
10

1-3 ToO programs are already accepted each semester (for fast transients).

CFHT contributes ~7% of recovered minor planets. REF: Minor Planet Center

## CFHT Time Allocation: PI, LPs, LS

- Since 2003, 35% of the observing time allocated to Large Programs (LP) and the CFHT Legacy Survey (CFHT-LS)
- The scientific impact and legacy value clearly increase from PI programs to Large Programs and Legacy Surveys
- Historically, France and Canada have contributed almost equally to LPs and LS
- UH and Associate Partners have occasionally joined the Large Programs



	Number of Publications	Number of Nights	Publications per night
PI programs	3481	~42 years	0.30
LPs (excluding CFHT-LS, and recent / ongoing LPs)	918	1220	0.75
CFHT-LS	666	450	1.5

2/27/2025

CFHT Community Surveys

11

Large Programs (at CFHT) are multi-semester programs that are still led by a PI and his/her team.

The CFHTLS combined the goals of many teams; it was defined by the community and not led by specific PI(s).

## New Opportunity: Community Surveys

- Large Programs: 2025 and 2026
- Community / Legacy Surveys afterwards (approx. 2028-2032)
- 800 to 1,400 nights, over 4 to 5 years (up to 85% of the time)
- Baseline: two instruments:
  - MegaCam – 1sq degree field of view wide field imager (dark time)
  - Wenaookeao – co-mount of ESPaDOnS and SPIRou (bright time)
- Competitive components of the surveys utilizing other instruments, WIRCam, SITELE or visitor instruments, will be considered.
- Maunakea Spectroscopic Explorer (MSE) activities will resume in 2033+ with first light envisioned for the late 2030s

2/27/2025

CFHT Community Surveys

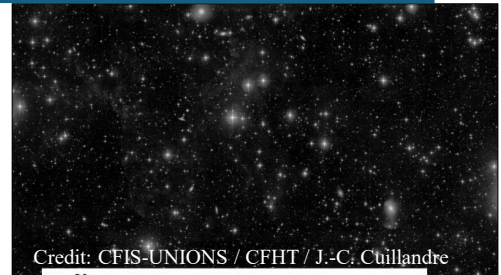
12

85% is for the 1400 nights.

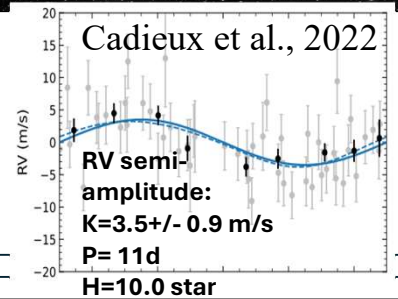
The community survey(s) will combine ideas/goals, with synergies possible  
(MegaCam images -> transients detection -> spectroscopic follow-up)

## Community Surveys: Examples of Possible Science Topics

- MegaCam
  - u-band “all-sky” survey, reference for 10+ years
  - Photo-z and / or Target selection for massive spectroscopic surveys
    - Ex: Pristine, UNIONS/Euclid
  - Preparation and/or follow-up of space missions
    - Ex: Euclid, Roman (?)
  - Time-domain, follow-up and monitoring of alerts from Rubin, LVK, CTA, GRB missions, IceCube/KM3NeT, etc.
- Wenaokeao
  - Exoplanet science: detection and characterization, atmospheres, etc.
  - Stellar magnetism
  - Planet formation
  - Galactic archeology
  - Stellar abundances
  - Rossiter-McLaughlin effect



Credit: CFIS-UNIONS / CFHT / J.-C. Chailandre



2/27/2025

CFHT Community Surveys

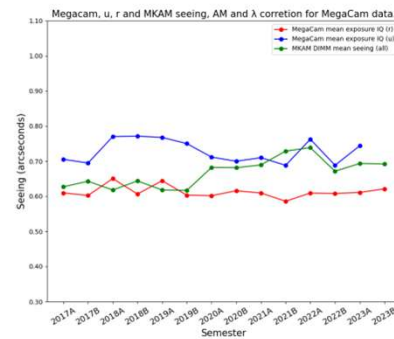
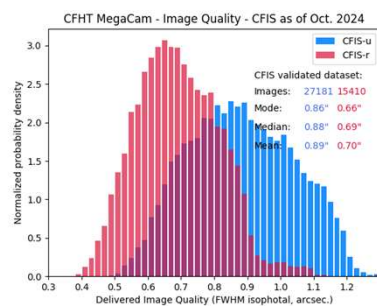
## Ideal Survey

---

- Ambitious
  - Serving the widest possible community
  - Significant science impact and legacy value
  - Combination of goals and ideas
- 
- Targets/fields observable all year long
  - Some observations suitable for above-median seeing
  - Some observations suitable for non-photometric conditions

## Weather and Sky Conditions

- Averaged over the last 5 years, for all instruments, ~25% of the time was lost to weather.
- The seeing is generally well below 1 arcsec.



2/27/2025

CFHT Community Surveys

15

The histograms show what can be expected for all the exposures of a given Large Program; the histograms only include the CFIS exposures, not those for any of the other programs executed (each having its own seeing constraint). The plot at right shows that the seeing has been stable over the past few years. The Image Quality measured in the u-band is higher than that measured in the r-band because of the effect of the wavelength. MKAM is a separate telescope and instrument located on a near CFHT (between CFHT and Gemini).



## Community Surveys: Process

---

- Fall of 2024: initial call for ideas
- Now: CFHT and its Science Advisory Council (SAC) are now following up and **soliciting other communities** that may be interested
- May 26-28, 2025: presentations and discussions at the [Users' Meeting, Canada](#)
- **A Steering Group will be put in place to design the survey(s) with multiple science goals based on the contributions received and the discussions at the Users' Meeting**
  - Expectation is that the survey will be peer-reviewed
  - The survey will be inclusive of and will combine many ideas and goals
- Notional timeline: mid-2025 to end of 2026 to design the survey, review it, revise it and, if applicable, negotiate with new partners
- Start of the survey expected mid-2027, early 2028 at the latest

2/27/2025

CFHT Community Surveys

16

UM2025 <https://www.cfht.hawaii.edu/en/news/UM2025/>

Registration deadline March 11

<https://www.cfht.hawaii.edu/en/news/UM2025/registration/register.php>



## Community Surveys Session at CFHT's Users' Meeting

---

- [User Meeting, May 26-28, Lac-à-l'Eau-Claire, Québec, Canada, and remotely](#)
- Interested individuals/projects/institutions are welcome to attend and submit abstracts to present their proposals – Abstract submission deadline is March 11
- Or contact CFHT's Executive Director ([cuby@cfht.hawaii.edu](mailto:cuby@cfht.hawaii.edu)) and/or Director of Science Operations ([manset@cfht.hawaii.edu](mailto:manset@cfht.hawaii.edu))
- Program:
  - Results of previous Large Programs
  - Preparation of the Community Surveys
  - Science highlights
  - New ideas for telescope and instrument upgrades to extend the life of CFHT until construction of the Maunakea Spectroscopic Explorer (MSE) can begin.
  - Community astronomy: next steps towards mutual stewardship between astronomical and local communities in Hawai'i

## Next steps

---

- Are you curious about the CS? Read more on this page  
<https://www.cfht.hawaii.edu/en/science/CommunitySurvey/>
- Do you want to hear more about the CS and join the discussions?  
Please register to the CFHT Users' Meeting  
<https://www.cfht.hawaii.edu/en/news/UM2025/>
- Would you like to share an idea for a CS or propose an idea? Please  
email JG Cuby ([cuby@cfht.hawaii.edu](mailto:cuby@cfht.hawaii.edu)) and N. Manset  
([manset@cfht.hawaii.edu](mailto:manset@cfht.hawaii.edu))

## Useful links

---

- Community Survey  
<https://www.cfht.hawaii.edu/en/science/CommunitySurvey/>
- CFHT Users' Meeting May 26-28, 2025  
<https://www.cfht.hawaii.edu/en/news/UM2025/>
- MegaCam  
<https://www.cfht.hawaii.edu/Instruments/Imaging/MegaPrime/>
- Wenaokeao (formerly known as VISION)  
<https://www.cfht.hawaii.edu/en/instruments/VISION/>
- Weather and sky conditions:  
<https://www.cfht.hawaii.edu/en/science/WeatherAndSky>