CFHT's Productivity and Impact

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Introduction

- Refereed papers based on CFHT data 1980 ->
- These papers represent CFHT's contribution to the advancement of astronomy
  - And the ROI of the funding agencies
- Through 2011 there have been 2000 refereed papers that have used CFHT data
- These 2000 papers have received over 92000 citations!
- How has CFHT's productivity and impact varied? Compare to other observatories?
- What has been the productivity of the various instruments? Which instruments have had the highest impact?
- All this and more will be revealed!

First paper: - 1980PASP...92..409V

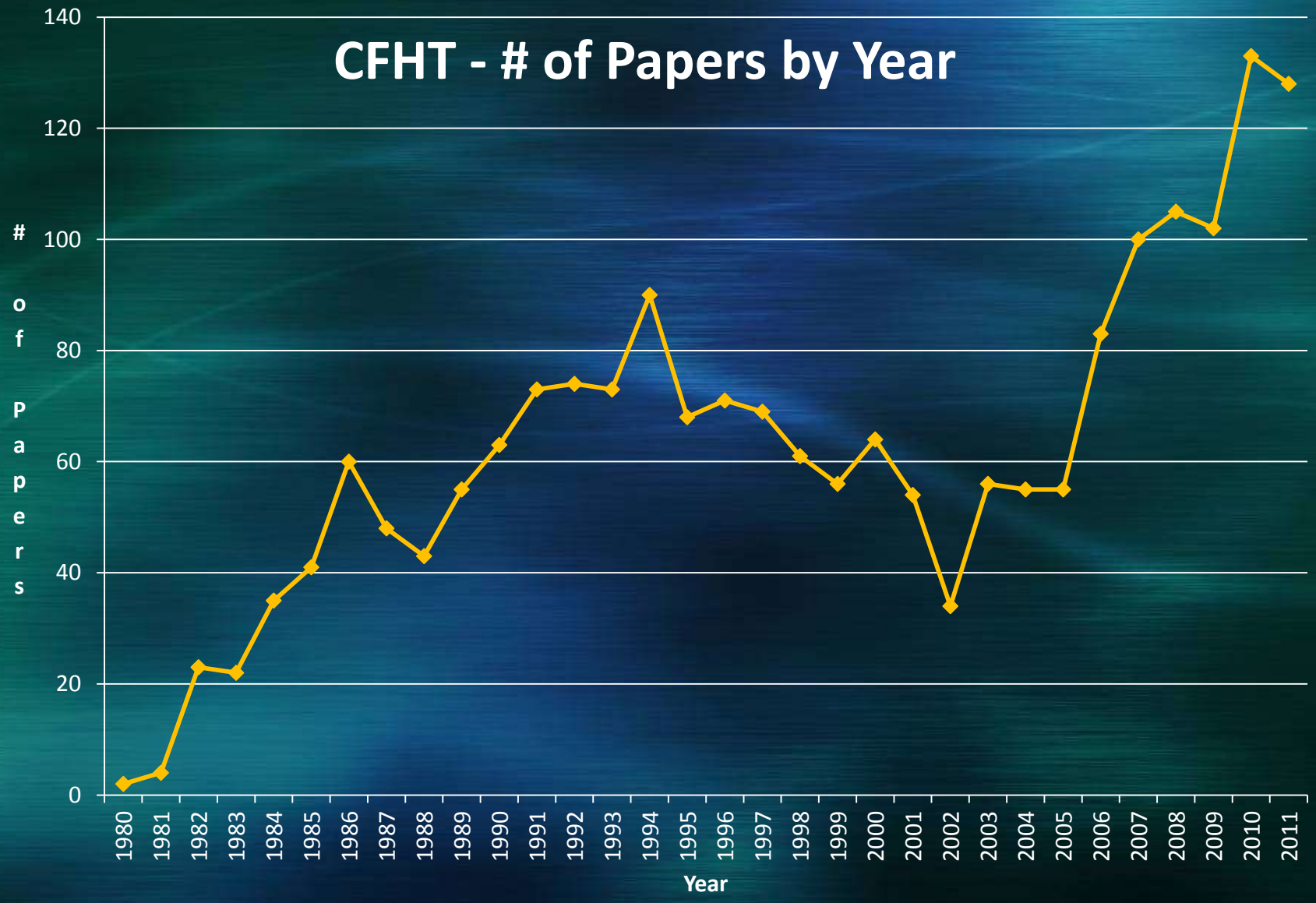
The compact galaxy NGC 3928 = Mk 190 is assigned type E0 in the *Second Reference Catalogue of Bright Galaxies* (de Vaucouleurs, de Vaucouleurs, and Corwin 1976) and is classified S0 by Borngen and Kalloglyan (1975). Intgegrated photographic surface photometry by Borngen, Kalloglyan, and Egikyan (1976) yields V = 12.88, (B-V) = 0.82, and (U-B) – 0.06 for this object. The later value is unusually blue for and early-type galaxy. To check on the E/S0 classification a 60 minute III a-J + GG 385 exposure of this compact object was obtained through the *f*/4.2 wide-field corrector at the prime focus of the CFH 3.6-m telescope **in seeing < 1.0".** This photograph shows that NGC 3928 is, in fact, a very small face-on spiral with a bright core having a diameter of 8" and a disk diameter 29" containing well-defined spiral arms. According to Sargent (1972) the bright core of this Markarian galaxy exhibits λ3727 and Hβ emission. Published radial velocity observations of NGC 3928 are consistent with the assumption that it is a member of the Ursa Major Cloud of galaxies which is located at a distance of ~ 10 Mpc. At this distance the spiral arm region of this galaxy extends from 190 pc to 700 pc from its nucleus. With these dimensions NGC 3928 is perhaps the smallest galaxy in which well-defined sprial structure has ever been observed. The regularity of the spiral arms in this galaxy is quite unexpected because its luminosity (M_V ~ -17.1 + 5 log *h* is so low.

Methodology

- The # of publications is a measure of the productivity of an observatory
  - But how relevant/important is the work?
- Citation counts are a standard measure of the impact of paper, i.e., the more citations the more relevant the work
- List of papers retrieved (usually) from observatory websites or obtained from observatory librarians (Thanks!)
- No checking of these lists – trust observatory judgment on what constitutes an observatory paper
  - *"A paper based on data acquired at the observatory"*
- Many papers based on data obtained from more than one observatory
  - Give each observatory full credit for these papers
- Citations / Author list for each paper retrieved from ADS

Telescopes Included – Compare to CFHT

Observatory	Telescope	# of Telescopes	Source of Paper List
AAO	AAT	1	Annual Reports
CTIO	Blanco	1	Librarian
CFHT	CFHT	1	Librarian
ESO	ESO3p6	1	Online Database
Gemini	Gemini	2	Librarian
HET	HET	1	Online Database
HST	HST	1	Online Database
JACH	JCMT	1	Online Database
Keck	Keck	2	Librarian
LBT	LBT	1	ADS
Magellan	Magellan	2	Web Pages
KPNO	Mayall	1	Librarian
MMT	MMT	1	ADS
ESO	NTT	1	Online Database
SOAR	SOAR	1	Online Database
Subaru	Subaru	1	Web Pages
JACH	UKIRT	1	Web Pages
ESO	VLT	4	Online Database
WIYN	WIYN	1	Librarian


CFHT - # of Papers by Year
# of Papers
140
120
100
80
60
40
20
0
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
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2003
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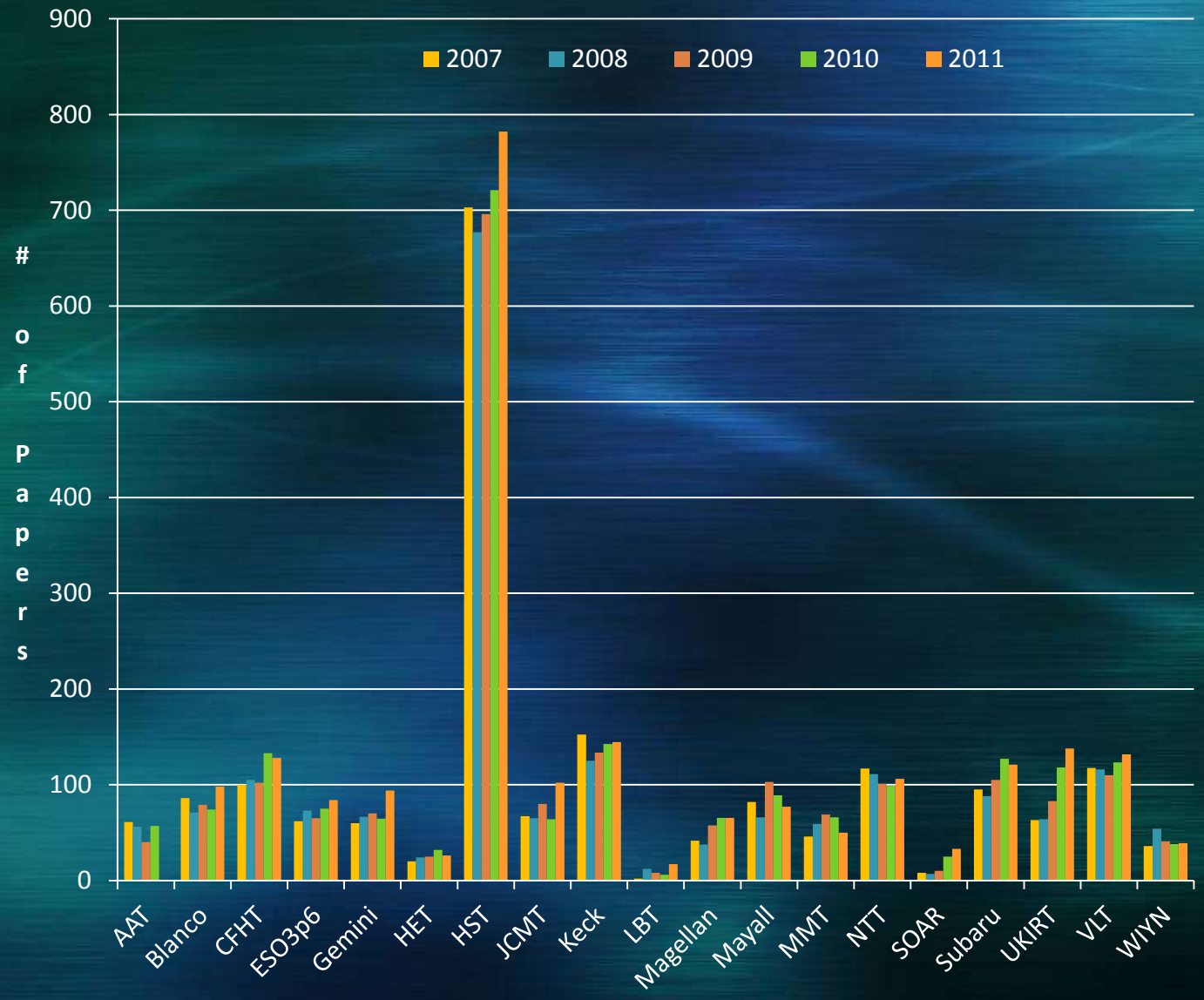
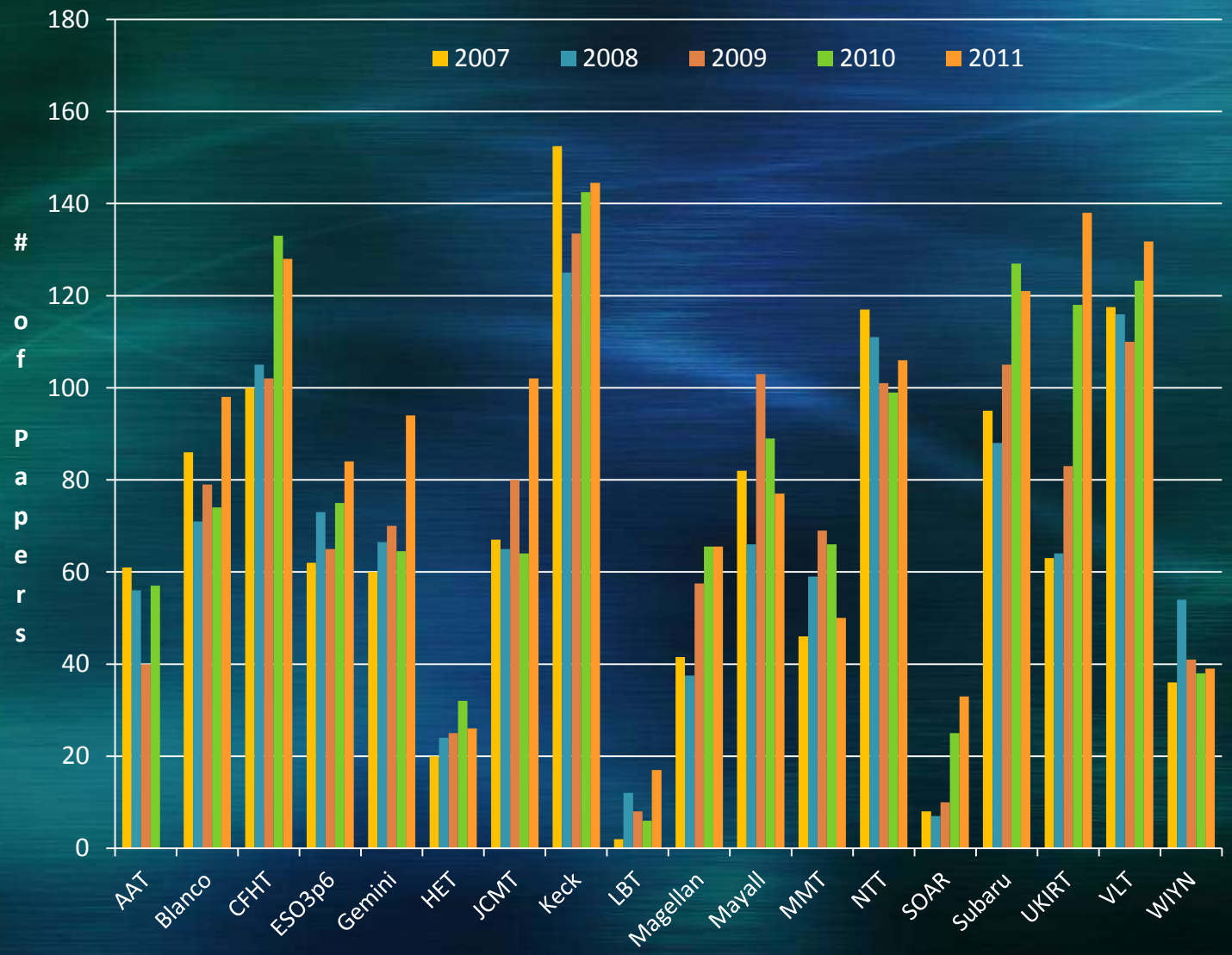
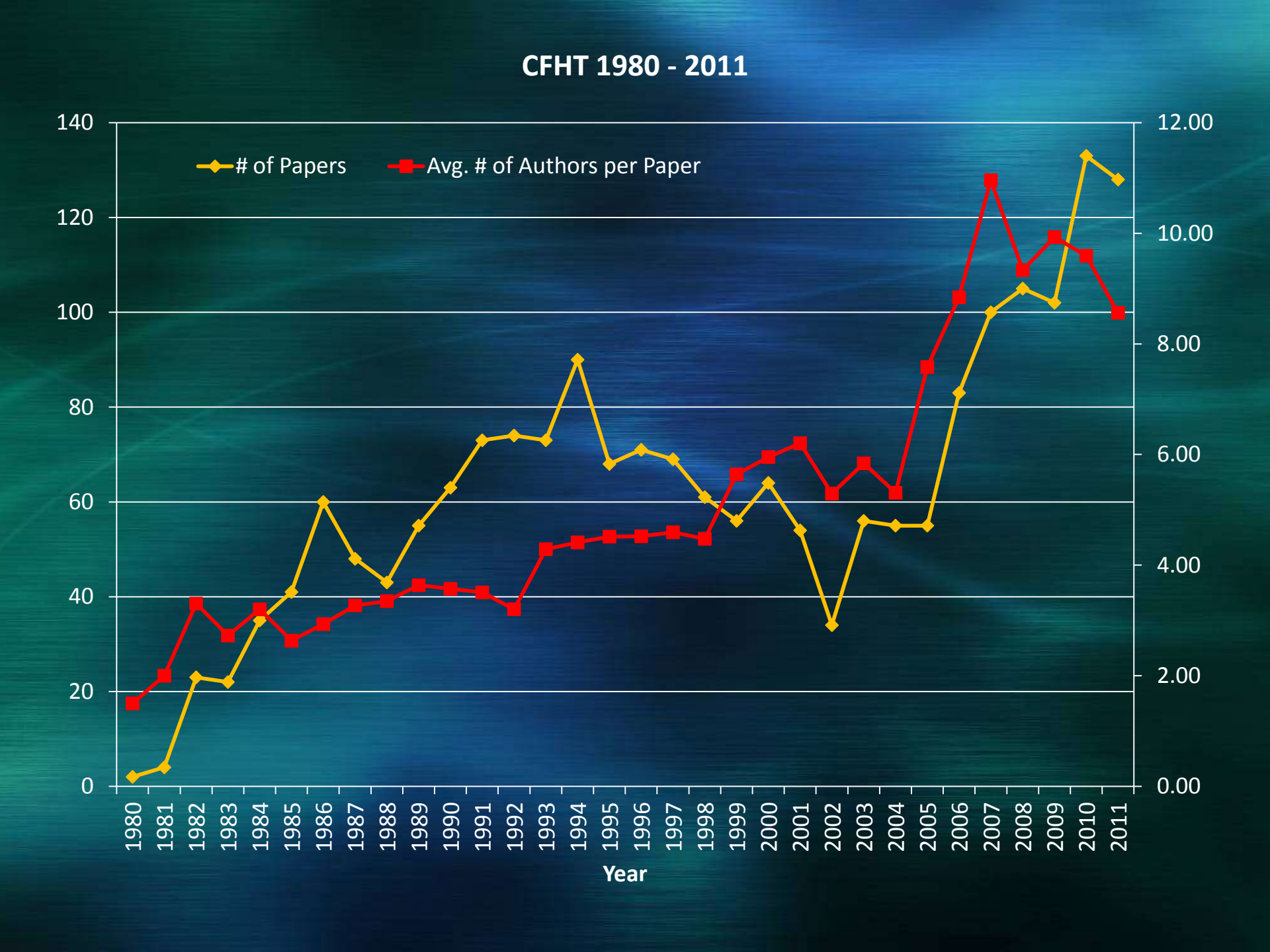
2006
2007
2008
2009
2010
2011
Year

2007 – 2011: Productivity - # of Papers / Telescope



2007 – 2011: Productivity - # of Papers / Telescope




CFHT 1980 - 2011
# of Papers
Avg. # of Authors per Paper
140
120
100
80
60
40
20
0
12.00
10.00
8.00
6.00
4.00
2.00
0.00
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
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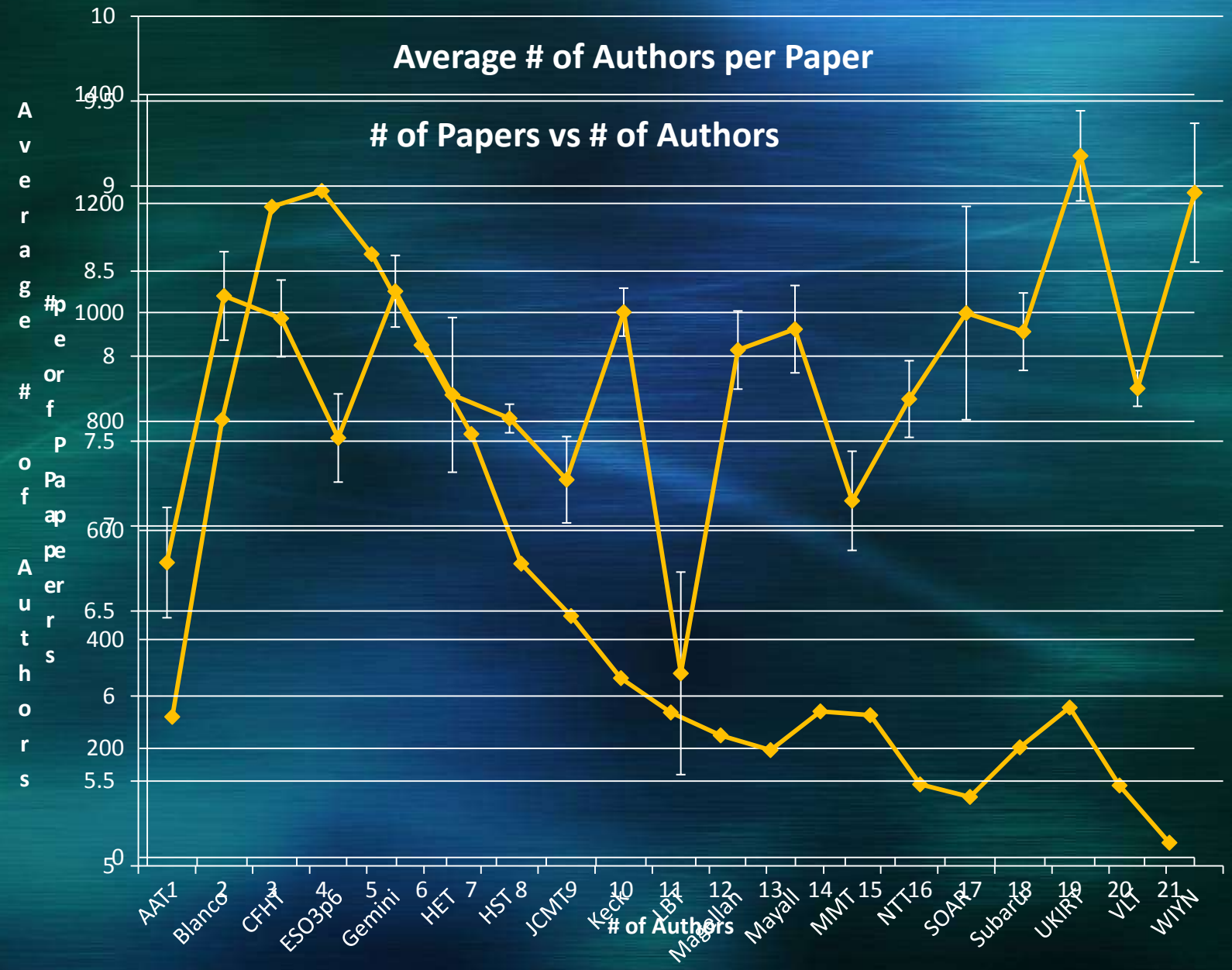
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Year

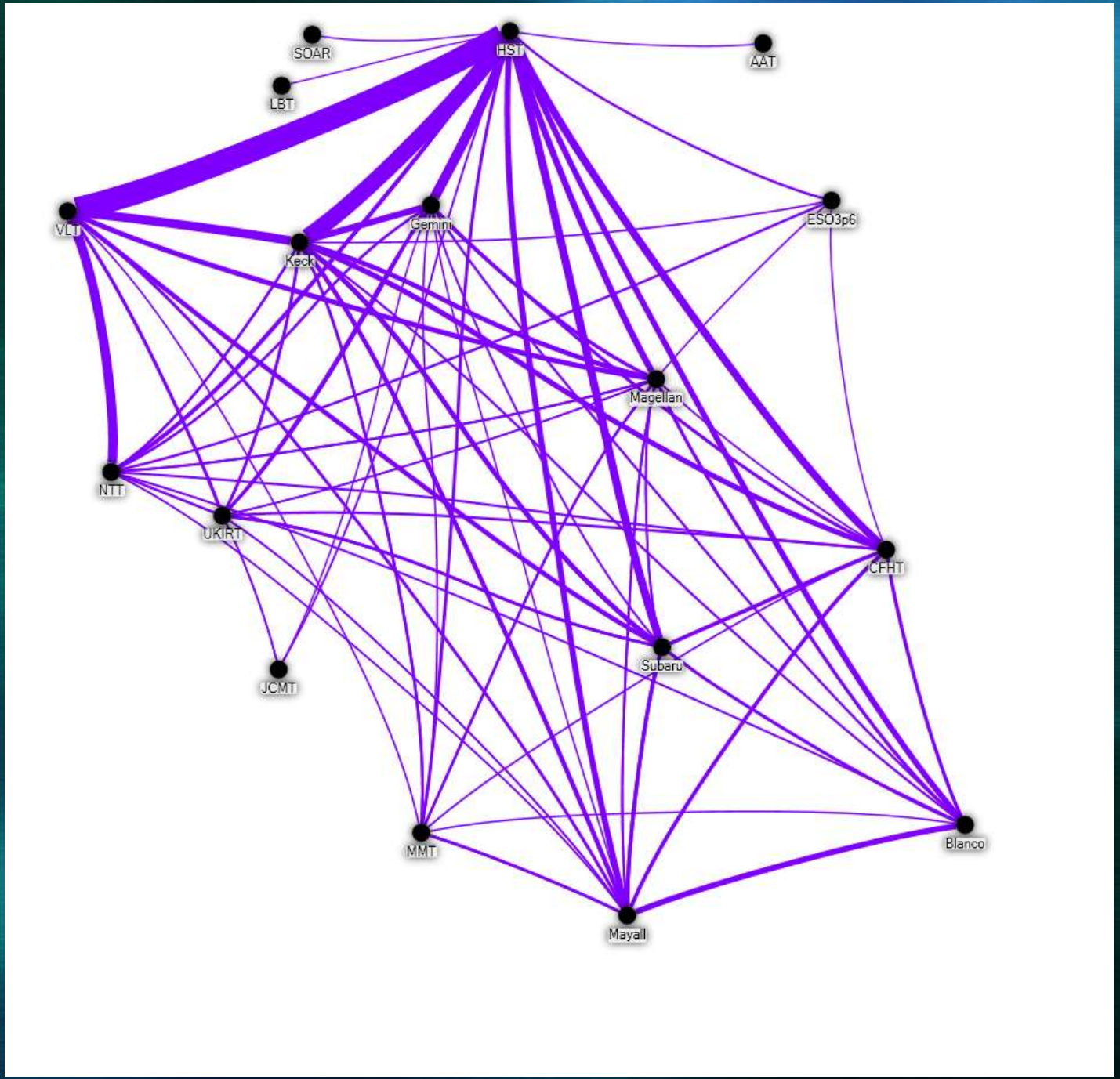

Average # of Authors per Paper
# of Papers vs # of Authors
Average # of Authors
# of Papers
# of Authors
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
1400
1200
1000
800
600
400
200
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
AAT
Blanco
CFHT
ESO3p6
Gemini
HET
HST
JCMT
Keck
LBT
Magellan
Mayall
MMT
NTT
SOAR
Subaru
UKIRT
VLT
WIYN

Whose paper is it?

- Significant # of papers include data from more than one telescope

	1	2	3	4	5	6	7	8
AAT	162	40	11	1	0	0	0	0
Blanco	122	130	68	30	19	24	13	2
CFHT	219	148	102	48	19	22	8	2
ESO3p6	201	102	44	7	2	1	2	0
Gemini	267	240	133	52	8	3	6	1
HET	55	40	20	8	4	0	0	0
HST	2216	958	278	70	21	23	11	2
JCMT	312	47	10	6	2	1	0	0
Keck	623	483	181	70	19	9	10	1
LBT	23	15	7	0	0	0	0	0
Magellan	187	200	86	40	11	3	7	1
Mayall	131	129	74	29	21	24	8	1
MMT	133	95	38	15	3	1	4	1
NTT	214	170	105	33	8	1	2	1
SOAR	43	21	12	3	3	0	1	0
Subaru	233	158	63	30	20	25	5	2
UKIRT	221	147	68	19	3	4	4	0
VLT	1263	745	260	71	22	20	11	2
WIYN	86	67	32	11	5	1	6	0

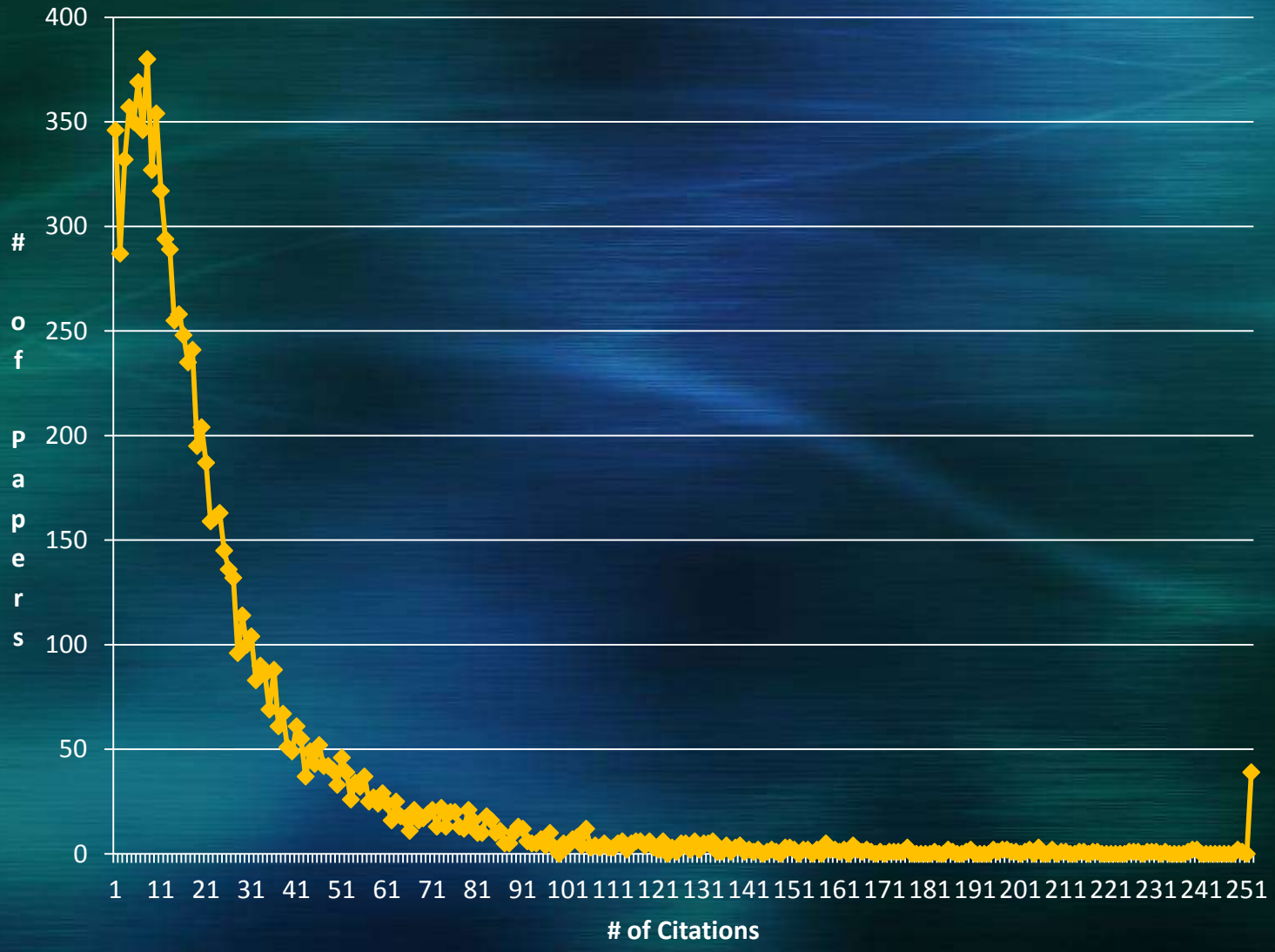
Telescope	% Unique
AAT	75.7%
Blanco	29.9%
CFHT	38.6%
ESO3p6	56.0%
Gemini	37.6%
HET	43.3%
HST	61.9%
JCMT	82.5%
Keck	44.6%
LBT	51.1%
Magellan	35.0%
Mayall	31.4%
MMT	45.9%
NTT	40.1%
SOAR	51.8%
Subaru	43.5%
UKIRT	47.4%
VLT	52.8%
WIYN	41.3%


SOAR
HST
AAT
LBT
VLT
Gemini
ESO3p6
Keck
Magellan
NTT
UKIRT
CFHT
Subaru
JCMT
MMT
Blanco
Mayall

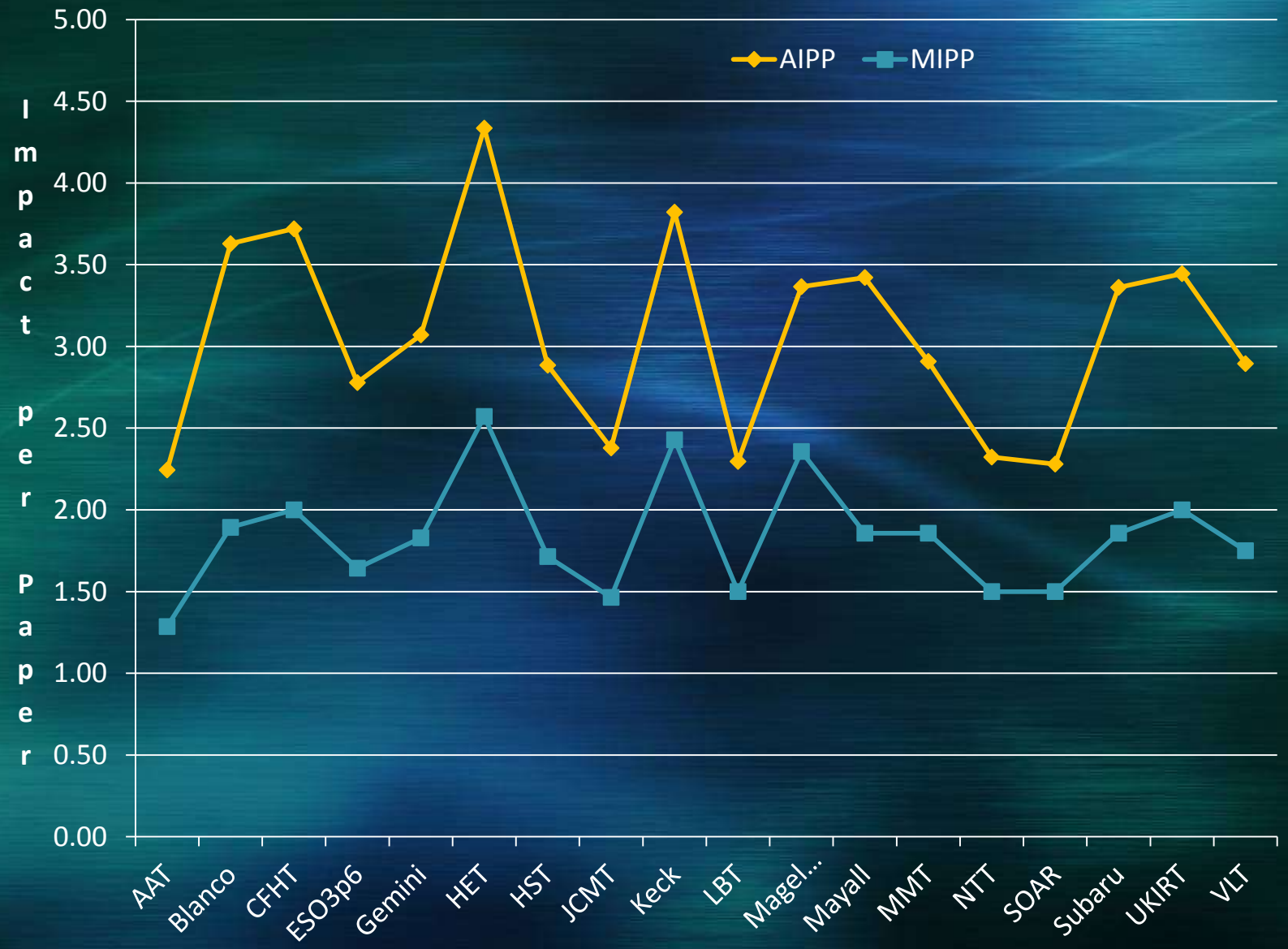
Performance Metric

- Citations counts grow as a paper ages
  - Peak citation/count/year occurs ~ 2-3 years after publication
- Need a standard citation (impact) metric
  - Allows comparison of papers of different ages
  - Common treatment of impact for the complete sample
- Use the *median citation count* for AJ papers of a given year as a standard measure
- **Impact** is defined as the ratio of the citations of a paper to the median # of citations for AJ papers of the same year
- Using ApJ rather AJ would simply change the length of our standard measuring stick (meter – yard)
- **AIPP – Average Impact per Paper**
- **MIPP – Median Impact per Paper**

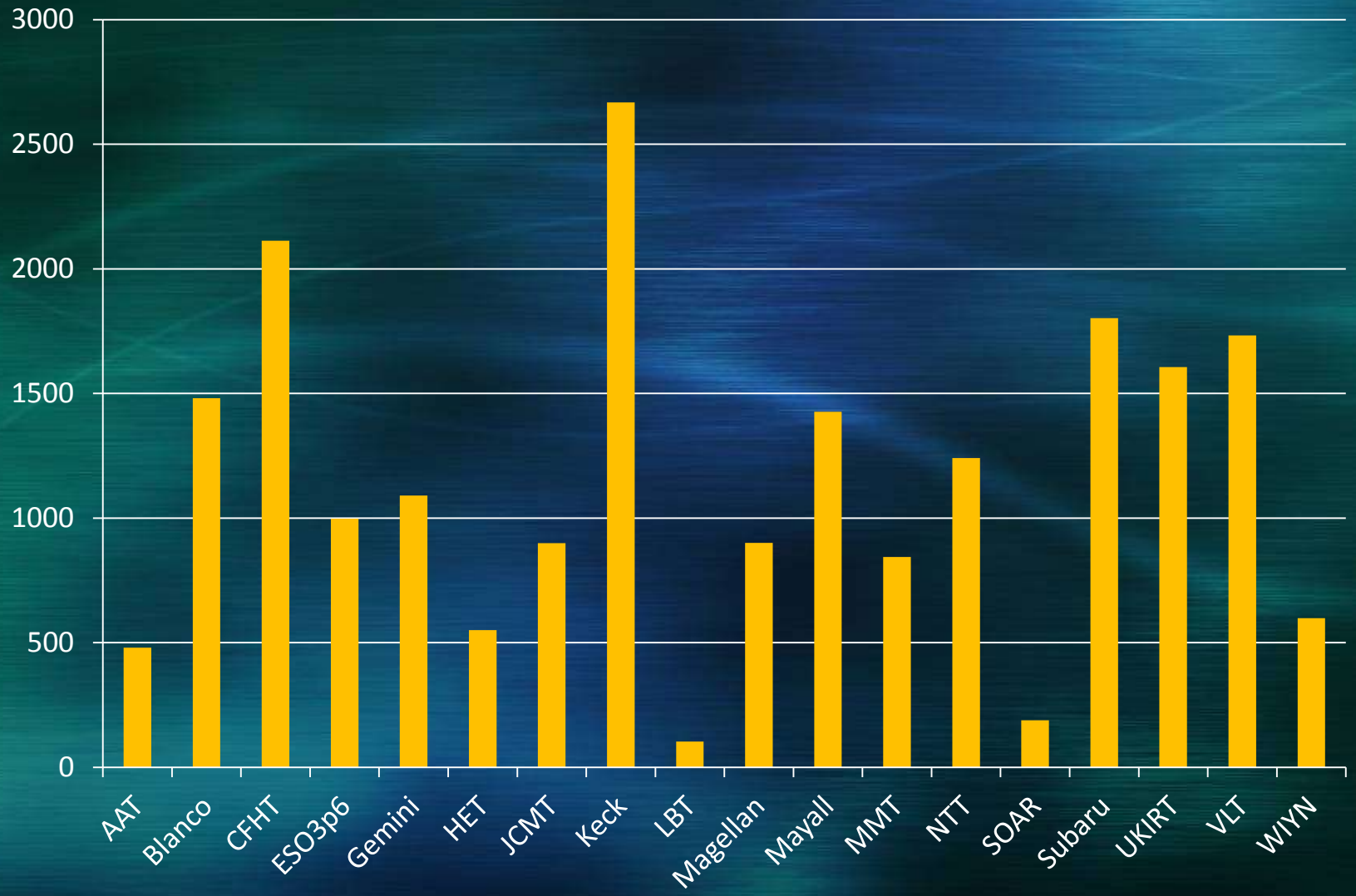
Citation Distribution

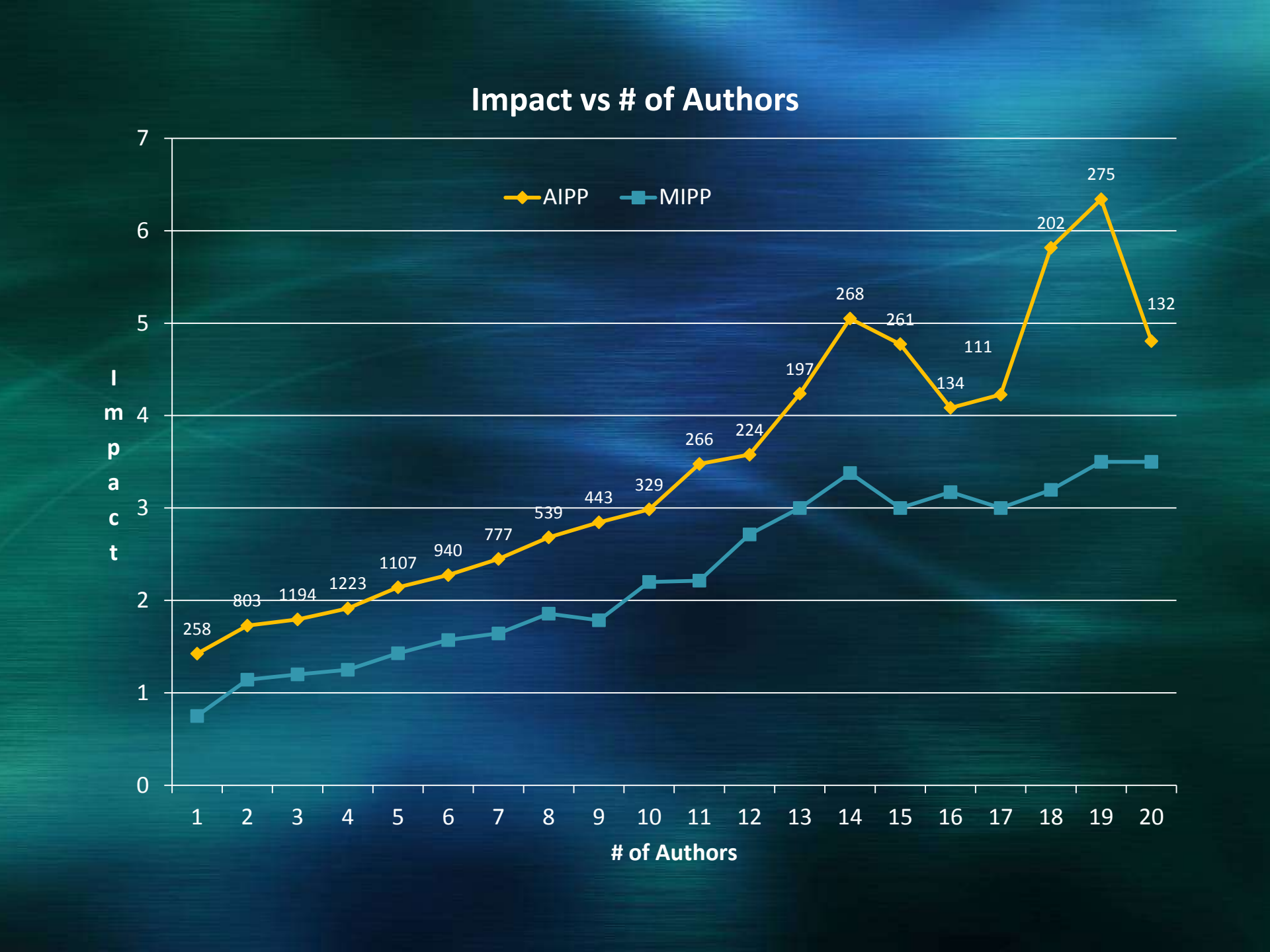


Impact per Paper



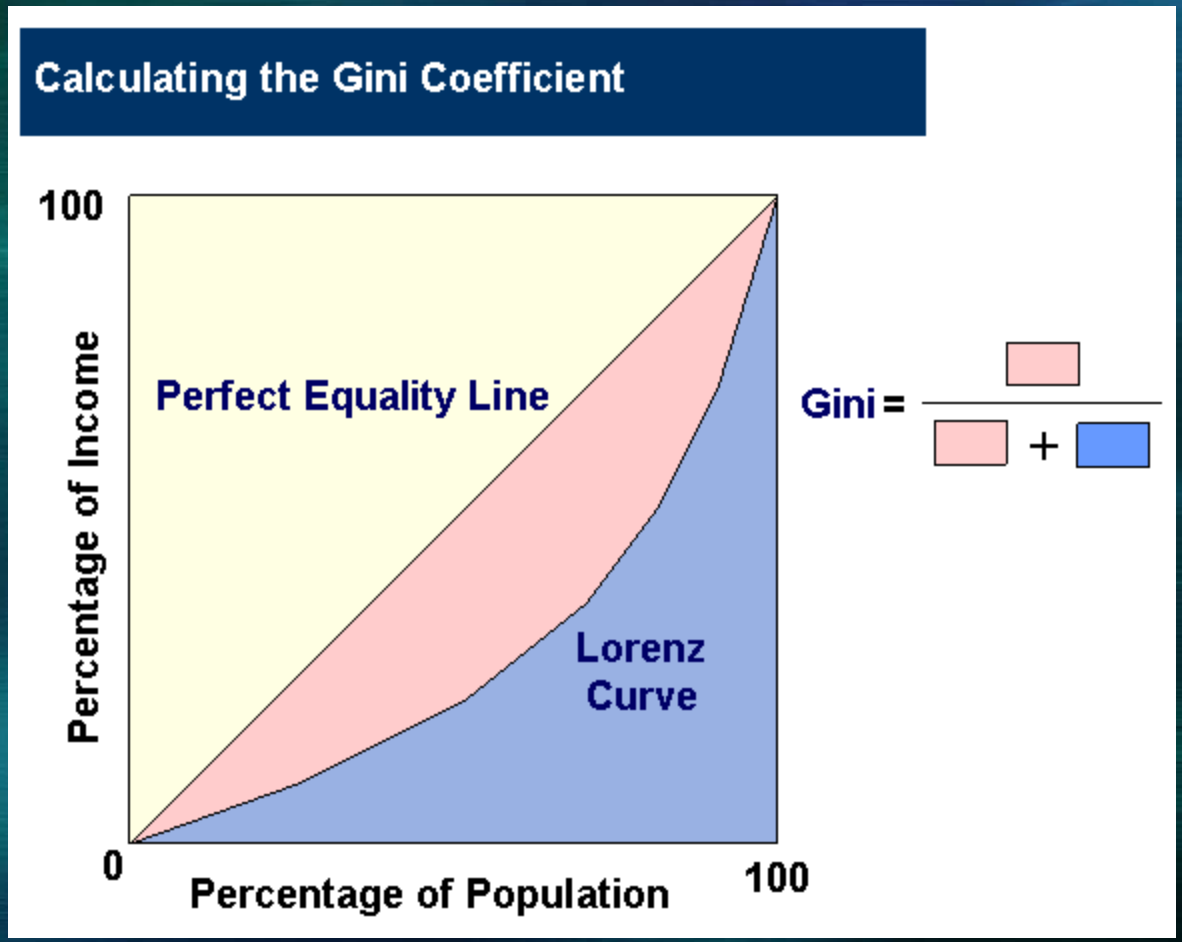
Total Impact per Telescope: 2007-2011



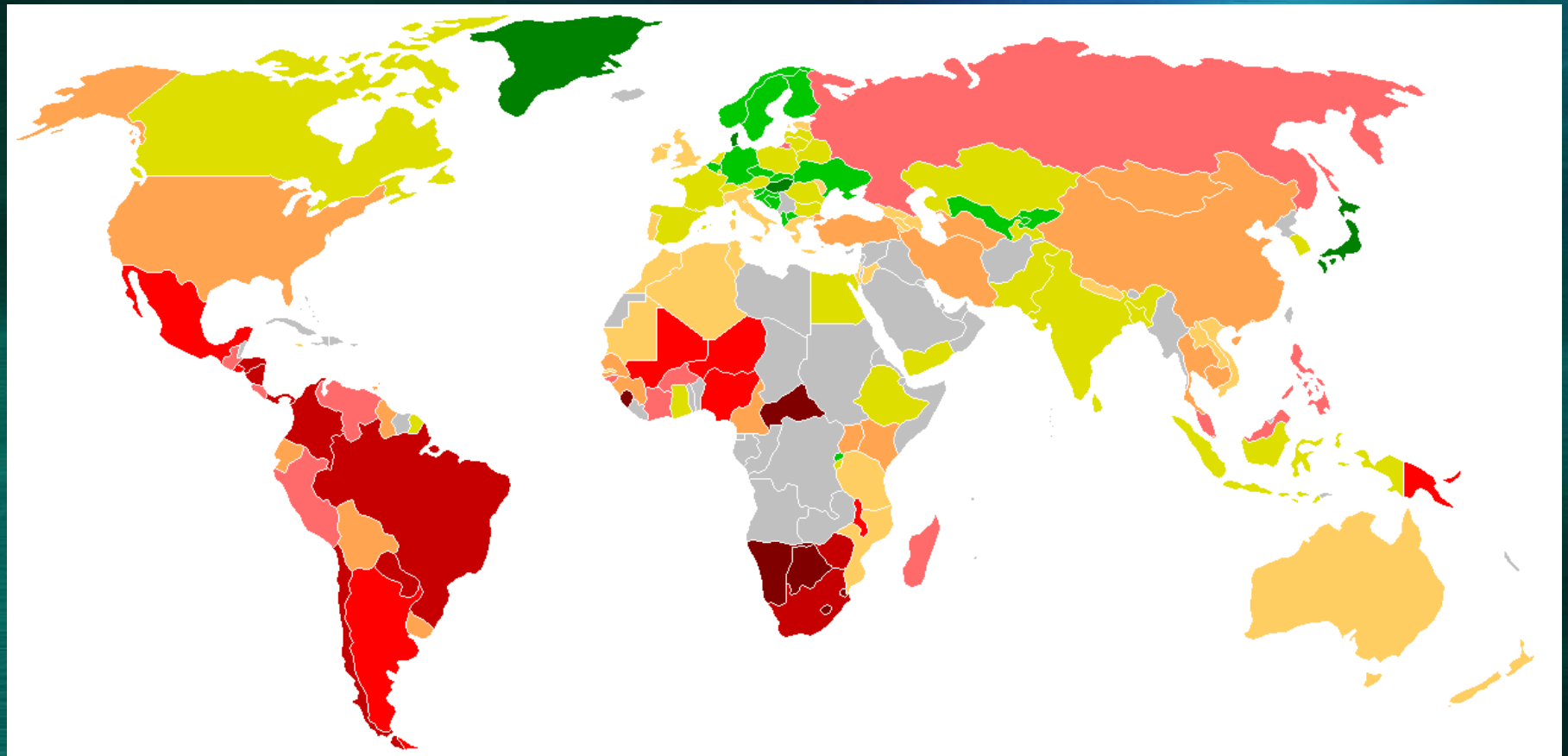

Impact vs # of Authors
AIPP
MIPP
Impact
# of Authors
0
1
2
3
4
5
6
7
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
258
803
1194
1223
1107
940
777
539
443
329
266
224
197
268
261
134
111
202
275
132

Gini Coefficient

- A measure of statistical dispersion
  - most prominently used as a measure of inequality of income distribution

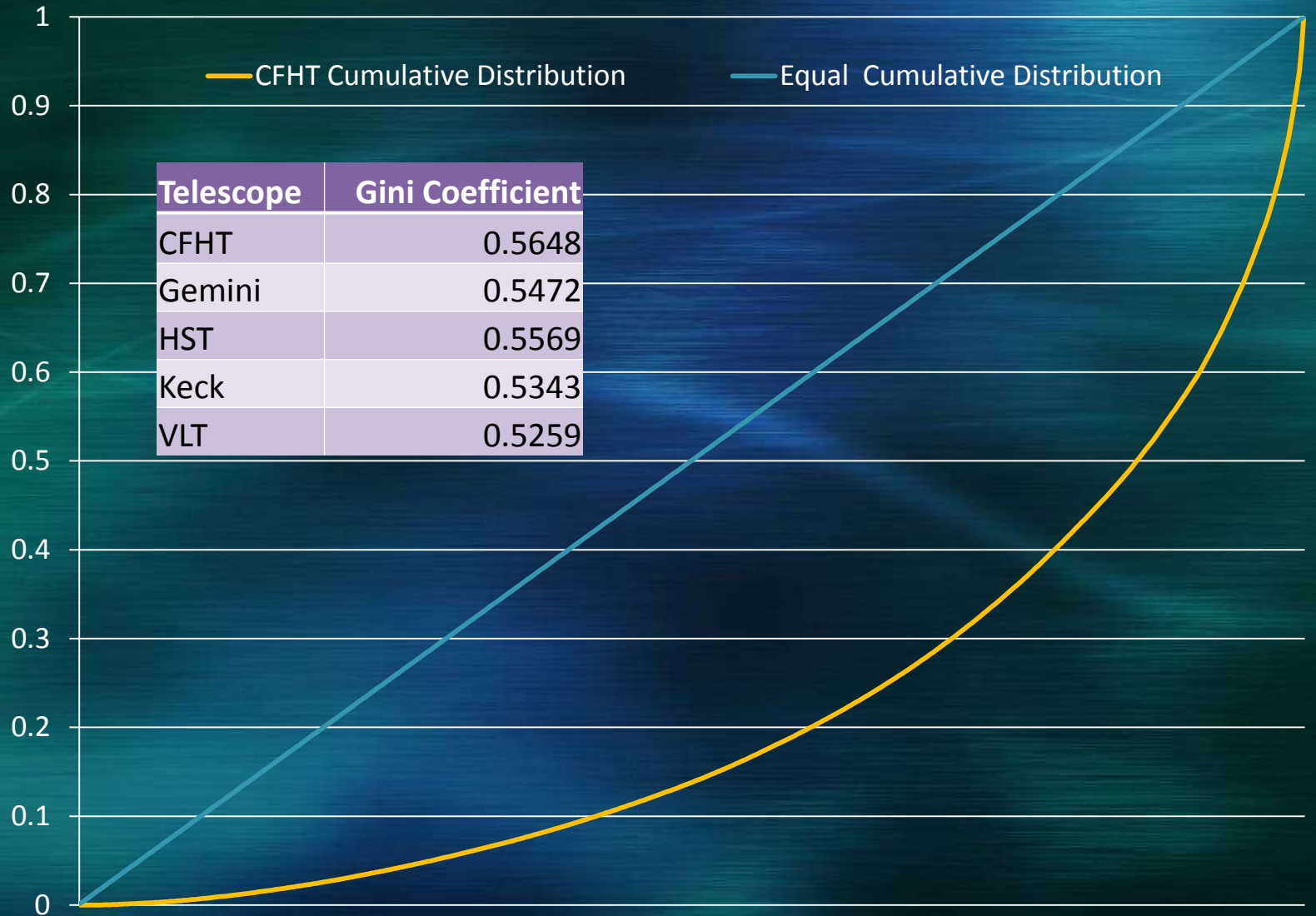


World Gini Coefficients

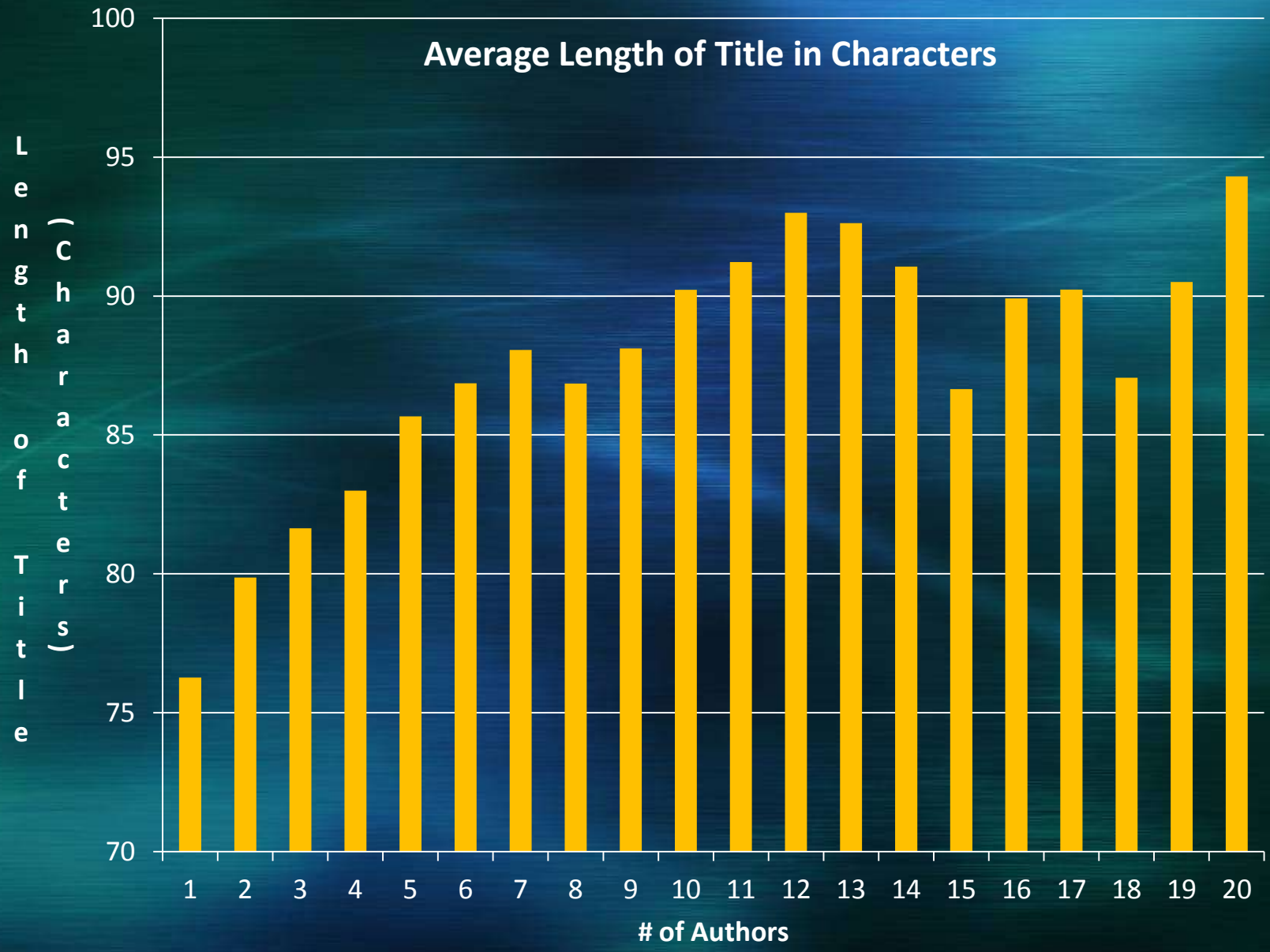


Color	Gini coefficient		0,35 - 0,39		0,55 - 0,59
	< 0,25		0,40 - 0,44		> 0,60
	0,25 - 0,29		0,45 - 0,49		NA
	0,30 - 0,34		0,50 - 0,54		

CFHT Distribution of Impact

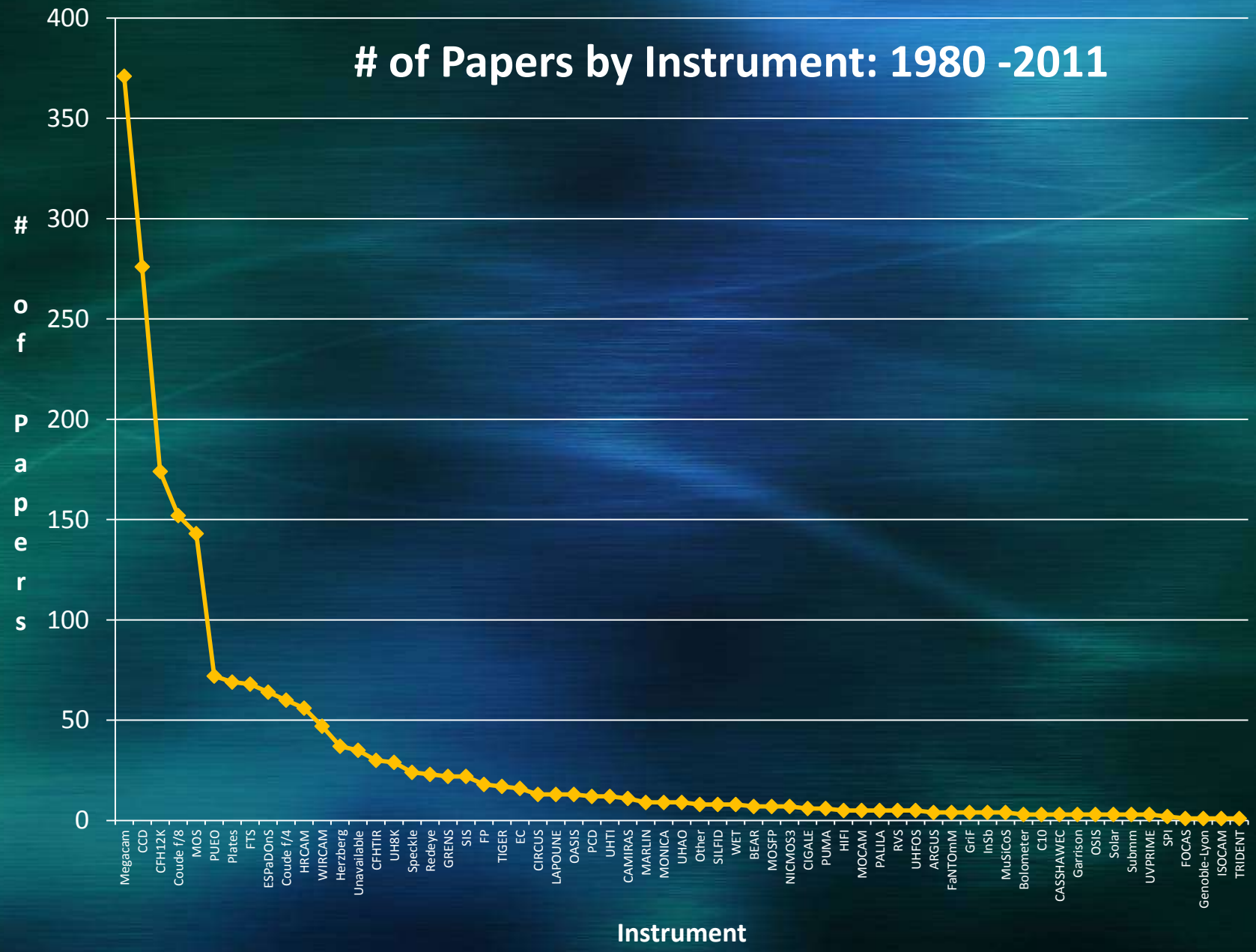


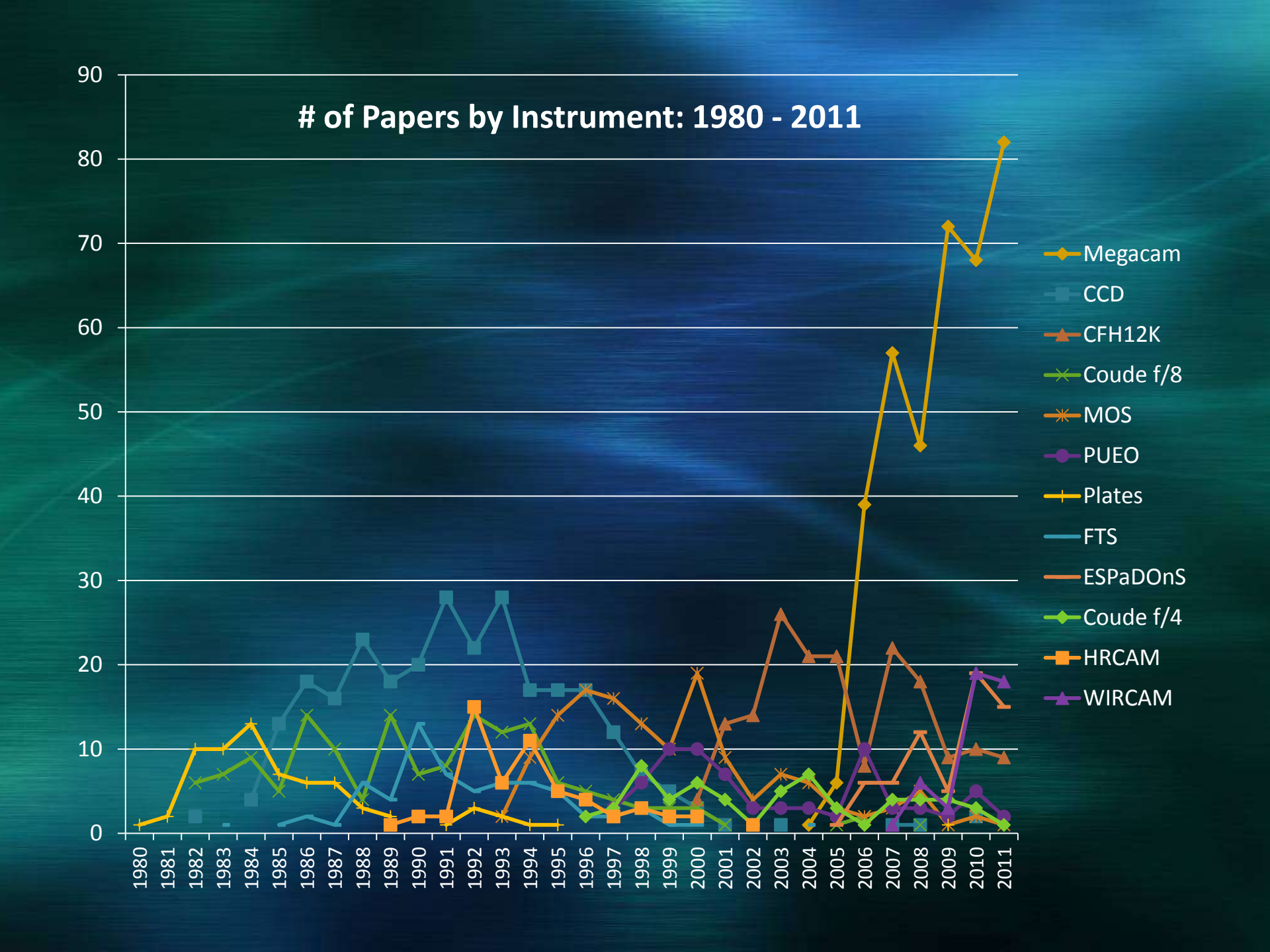
Telescope	Gini Coefficient
CFHT	0.5648
Gemini	0.5472
HST	0.5569
Keck	0.5343
VLT	0.5259


Average Length of Title in Characters
Length of Title (Characters)
100
95
90
85
80
75
70
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
# of Authors

Instrument Productivity and Impact

- Identify instrument(s) used to acquire data used in publication
- Investigate productivity and impact of various instruments


# of Papers by Instrument: 1980 -2011
# of Papers
400
350
300
250
200
150
100
50
0
Megacam
CCD
CFH12K
Coude f/8
MOS
PUEO
Plates
FTS
ESPaDOnS
Coude f/4
HRCAM
WIRCAM
Herzberg
Unavailable
CFHTIR
UH8K
Speckle
Redeye
GRENS
SIS
FP
TIGER
EC
CIRCUS
LAPOUNE
OASIS
PCD
UHTI
CAMIRAS
MARLIN
MONICA
UHAO
Other
SILFID
WET
BEAR
MOSFP
NICMOS3
CIGALE
PUMA
HIFI
MOCAM
PALILA
RVS
UHFOS
ARGUS
FaNTOmM
GriF
InSb
MuSiCoS
Bolometer
C10
CASSHAWEC
Garrison
OSIS
Solar
Submm
UVPRIME
SPI
FOCAS
Genoble-Lyon
ISOCAM
TRIDENT
Instrument


# of Papers by Instrument: 1980 - 2011
90
80
70
60
50
40
30
20
10
0
1980
1981
1982
1983
1984
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1986
1987
1988
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2003
2004
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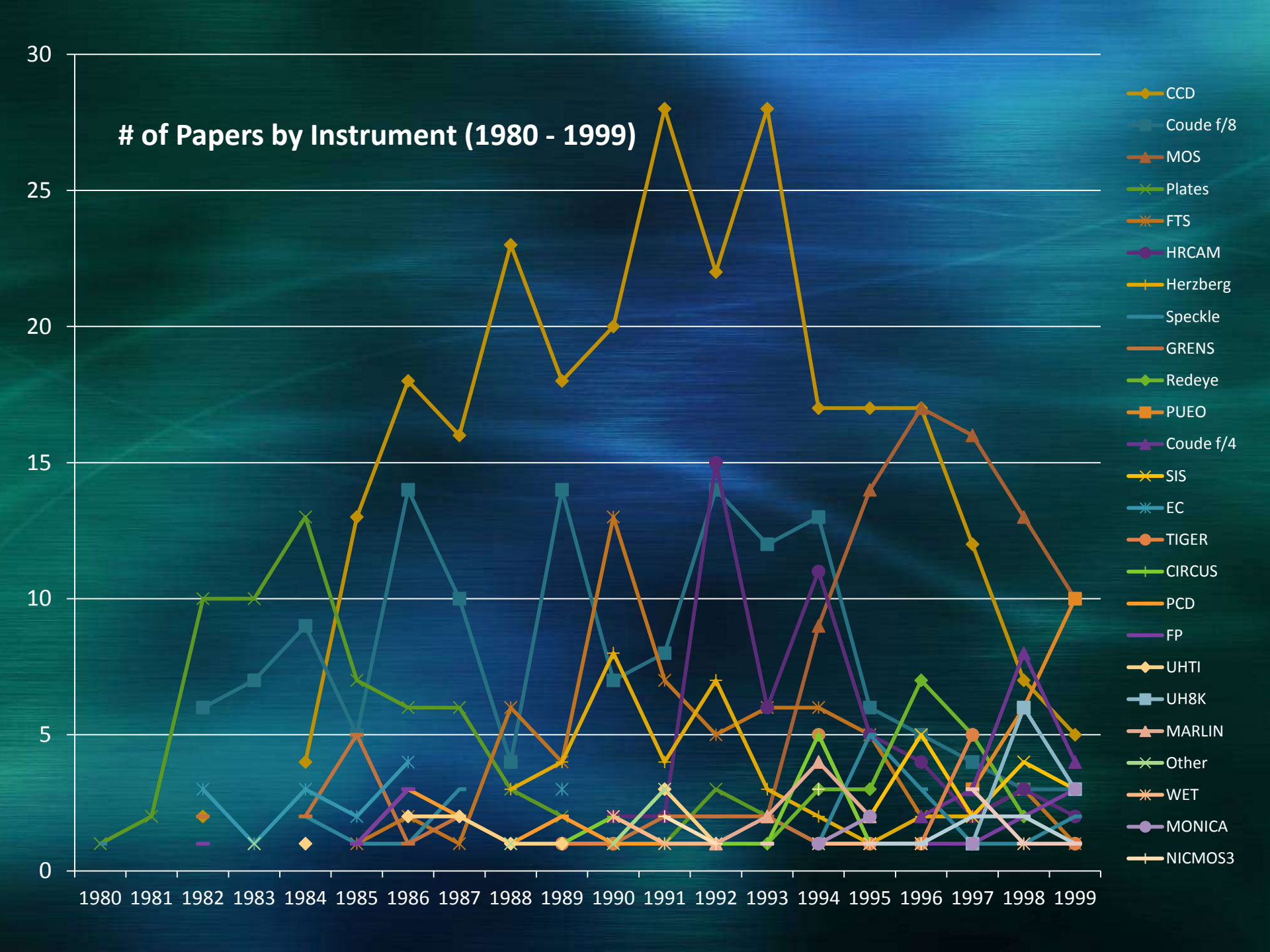
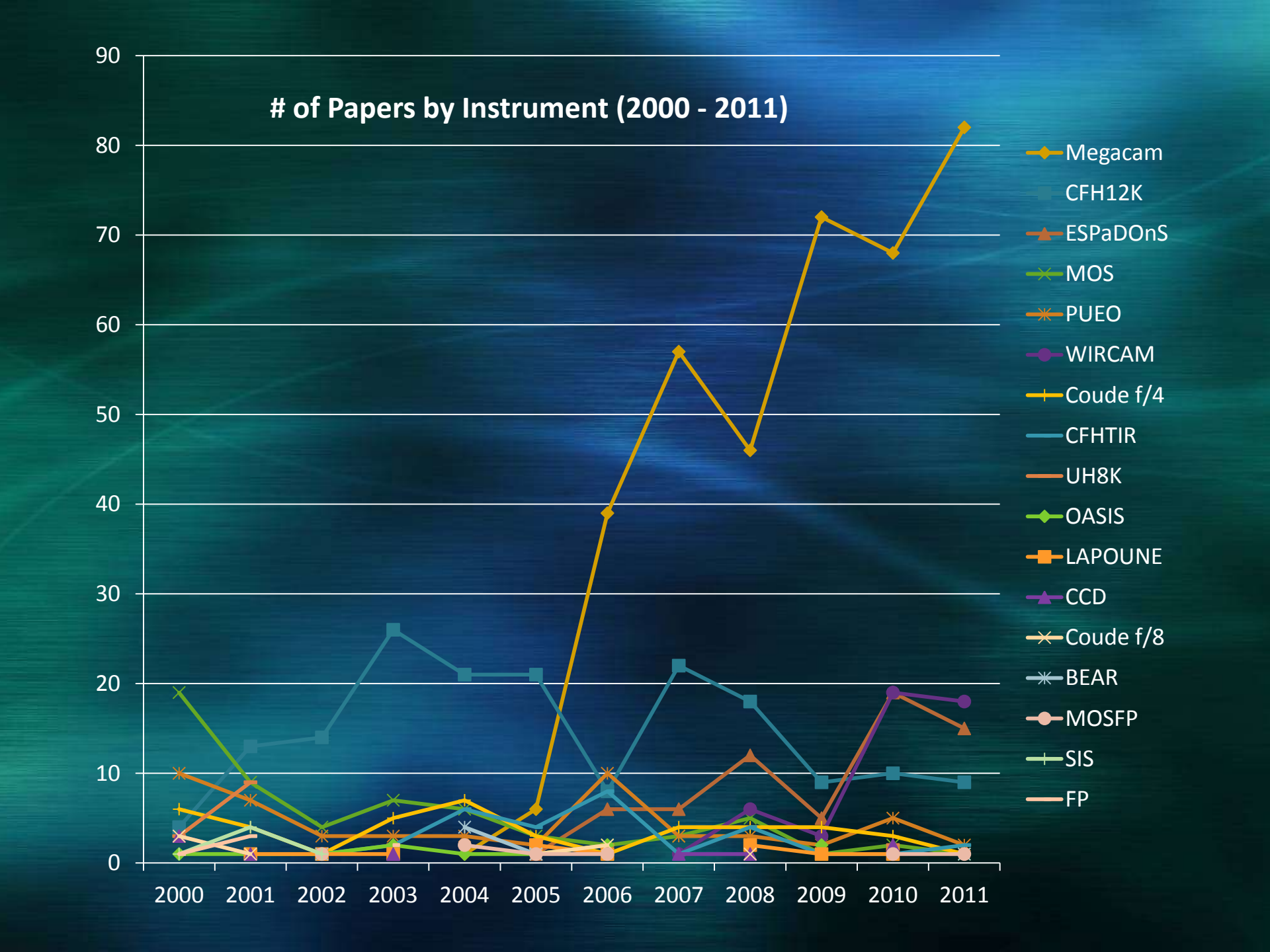
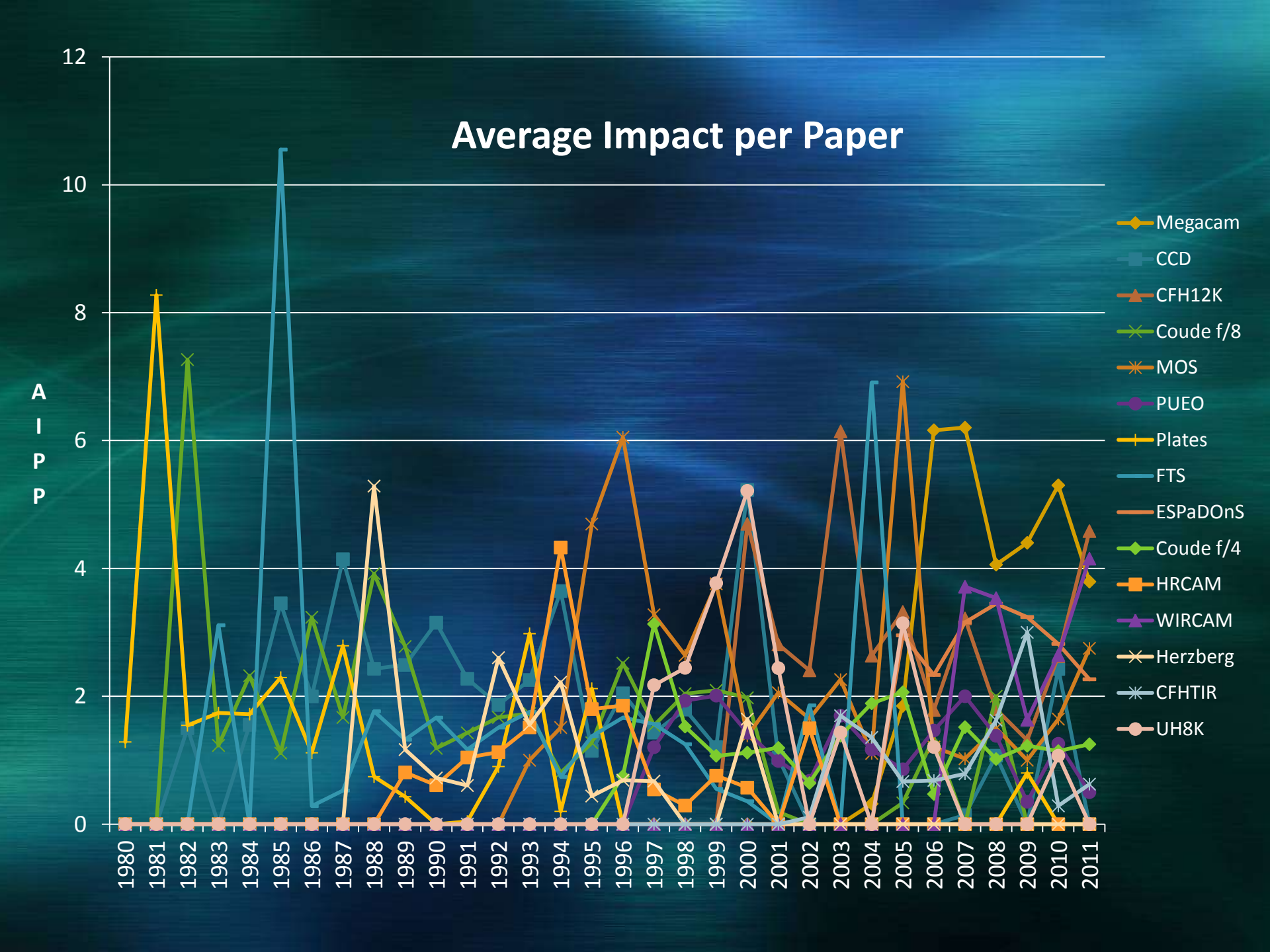
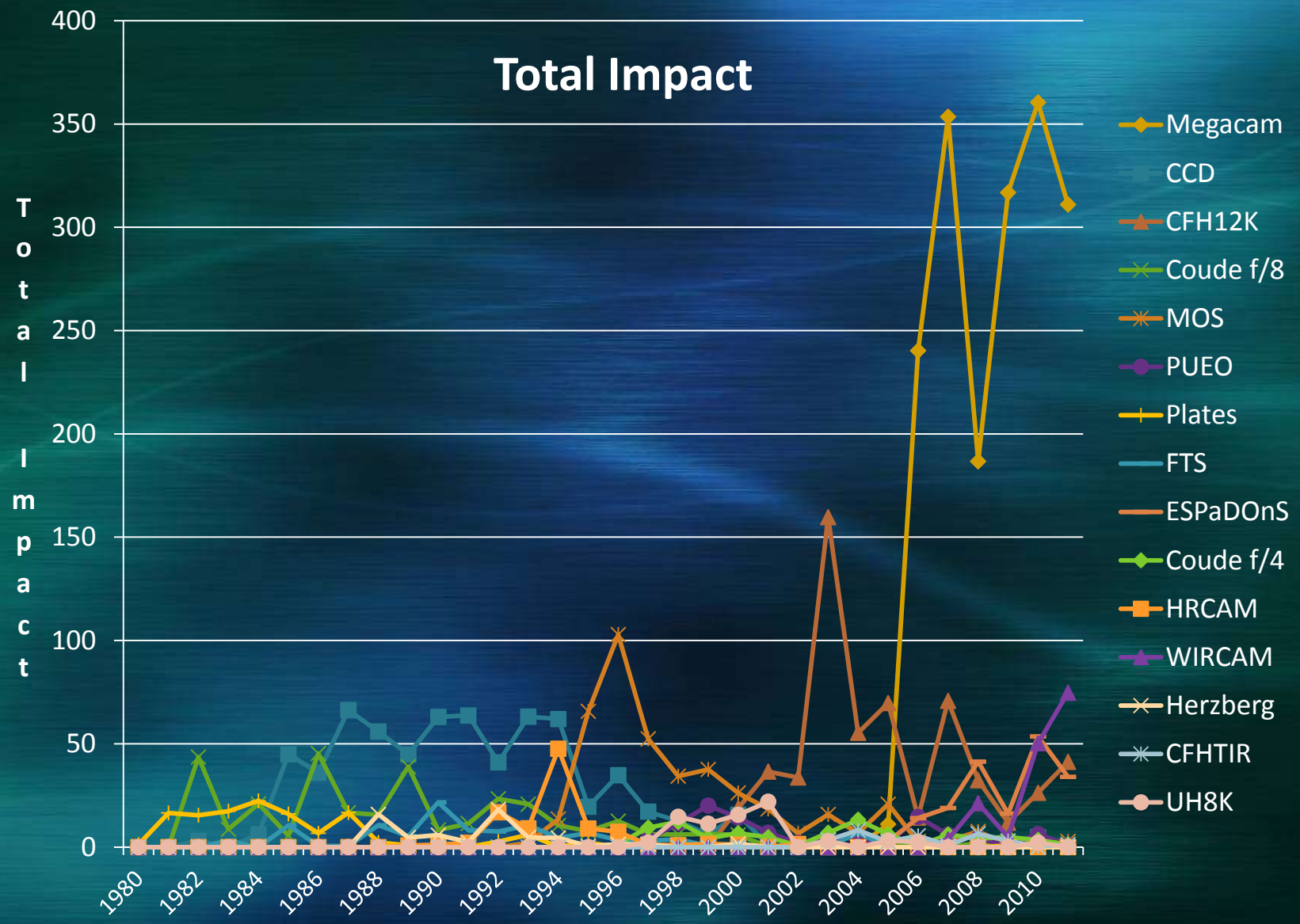
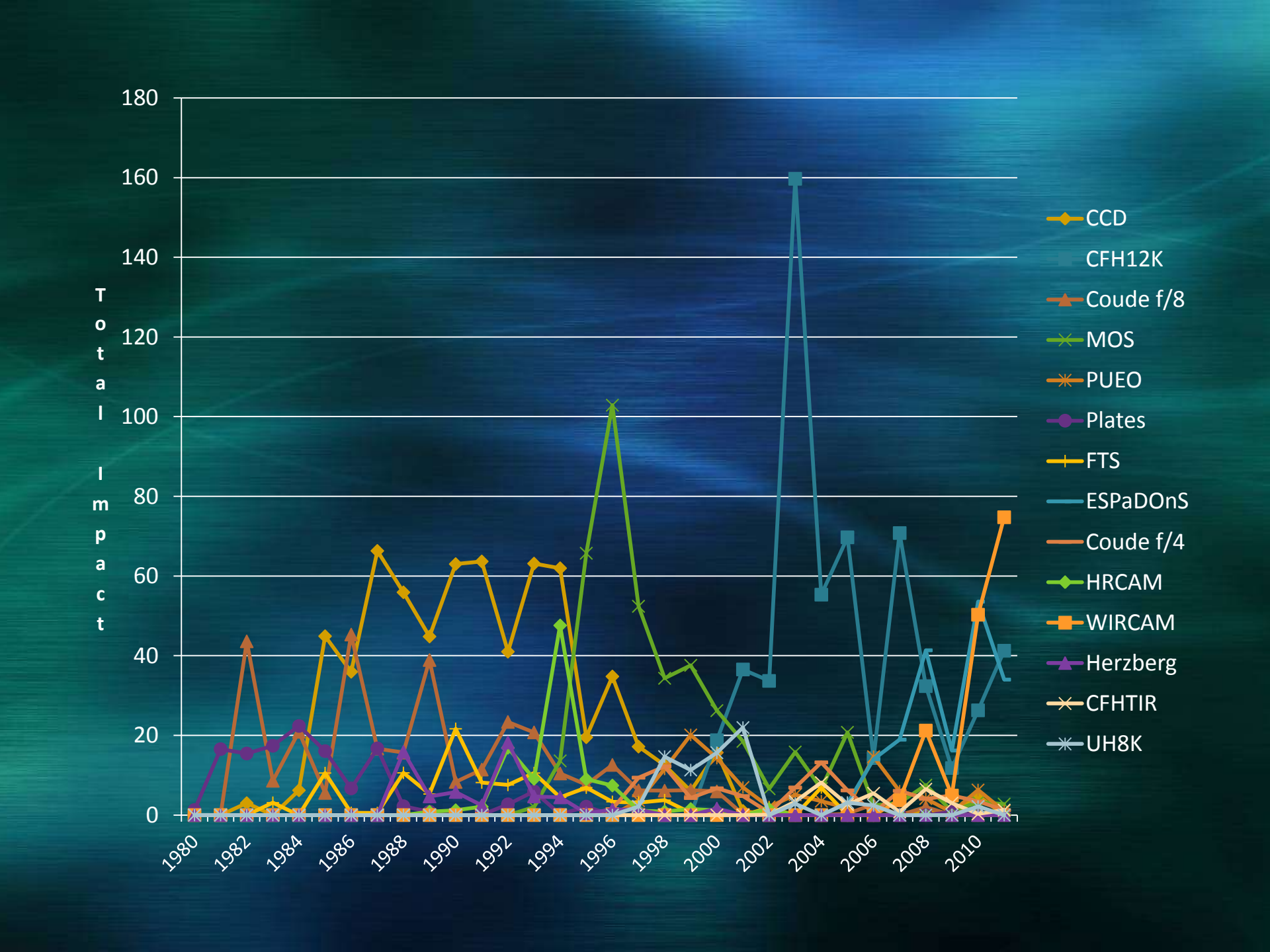
2006
2007
2008
2009
2010
2011
Megacam
CCD
CFH12K
Coude f/8
MOS
PUEO
Plates
FTS
ESPaDOnS
Coude f/4
HRCAM
WIRCAM

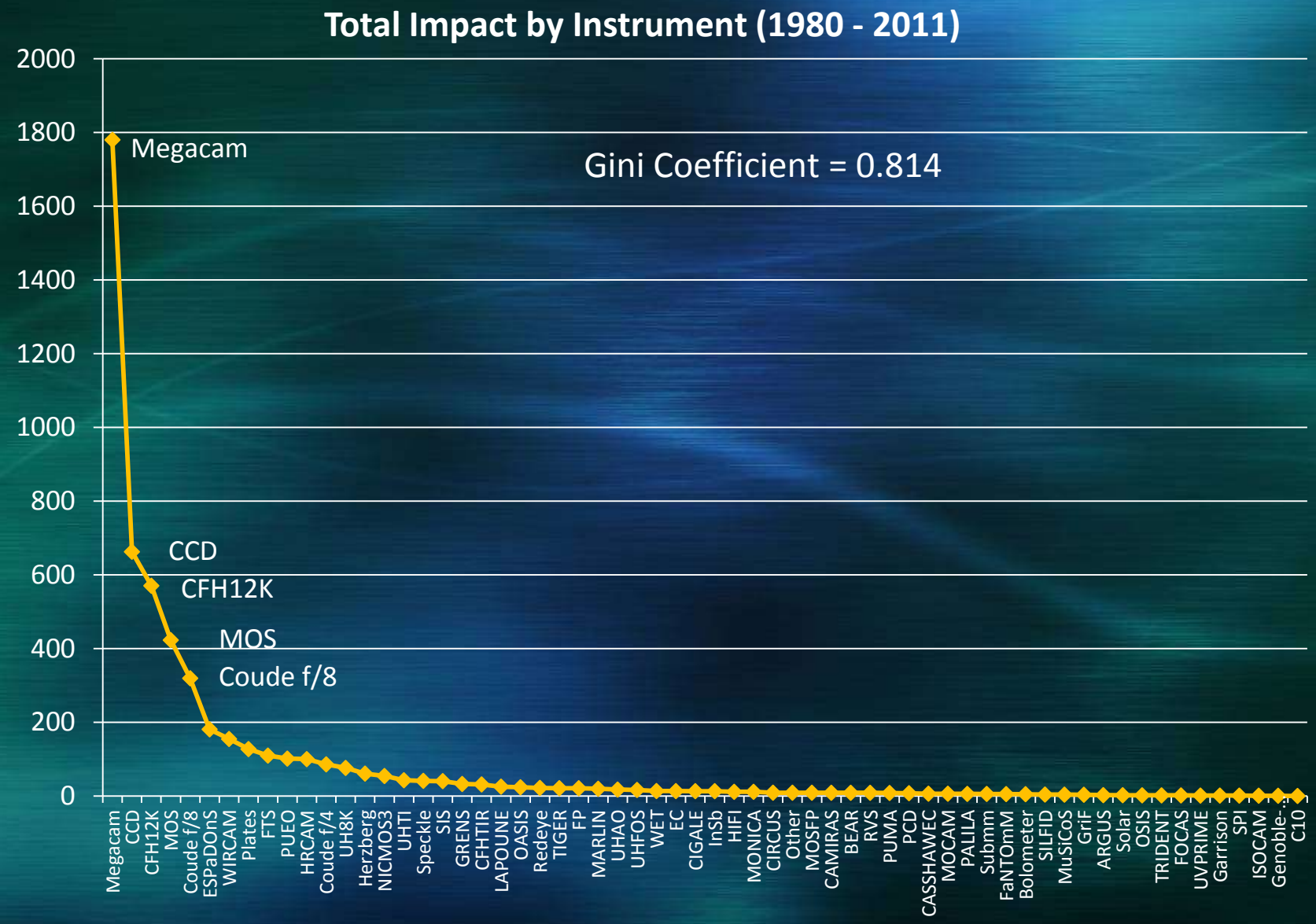

# of Papers by Instrument (1980 - 1999)
30
25
20
15
10
5
0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
CCD
Coude f/8
MOS
Plates
FTS
HRCAM
Herzberg
Speckle
GRENS
Redeye
PUEO
Coude f/4
SIS
EC
TIGER
CIRCUS
PCD
FP
UHTI
UH8K
MARLIN
Other
WET
MONICA
NICMOS3


# of Papers by Instrument (2000 - 2011)
90
80
70
60
50
40
30
20
10
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Megacam
CFH12K
ESPaDOnS
MOS
PUEO
WIRCAM
Coude f/4
CFHTIR
UH8K
OASIS
LAPOUNE
CCD
Coude f/8
BEAR
MOSFP
SIS
FP


Average Impact per Paper
AIPP
0
2
4
6
8
10
12
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Megacam
CCD
CFH12K
Coude f/8
MOS
PUEO
Plates
FTS
ESPaDOnS
Coude f/4
HRCAM
WIRCAM
Herzberg
CFHTIR
UH8K


Total Impact
Total Impact
400
350
300
250
200
150
100
50
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
Megacam
CCD
CFH12K
Coude f/8
MOS
PUEO
Plates
FTS
ESPaDOnS
Coude f/4
HRCAM
WIRCAM
Herzberg
CFHTIR
UH8K

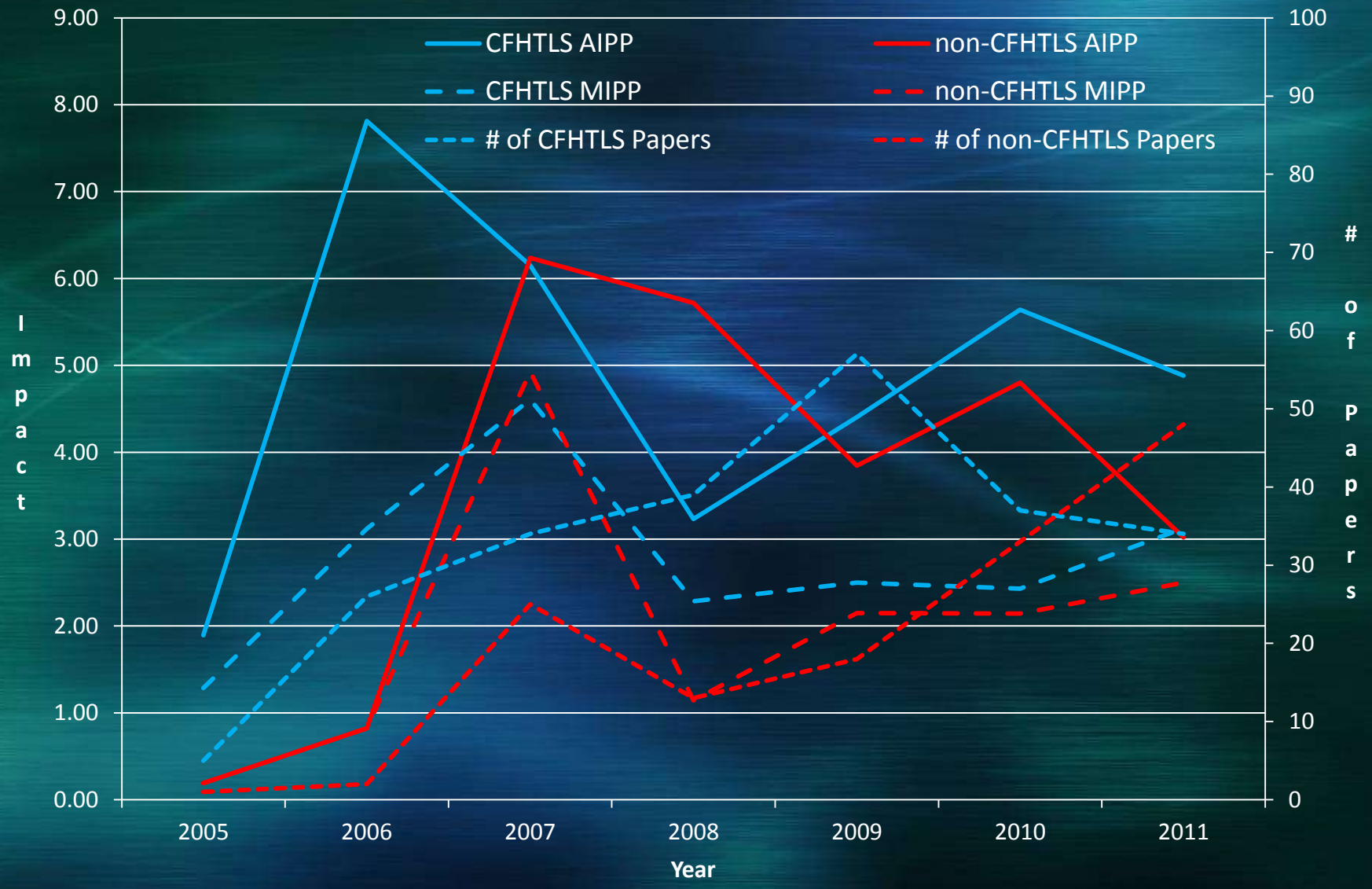

Total Impact
180
160
140
120
100
80
60
40
20
0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
CCD
CFH12K
Coude f/8
MOS
PUEO
Plates
FTS
ESPaDOnS
Coude f/4
HRCAM
WIRCAM
Herzberg
CFHTIR
UH8K

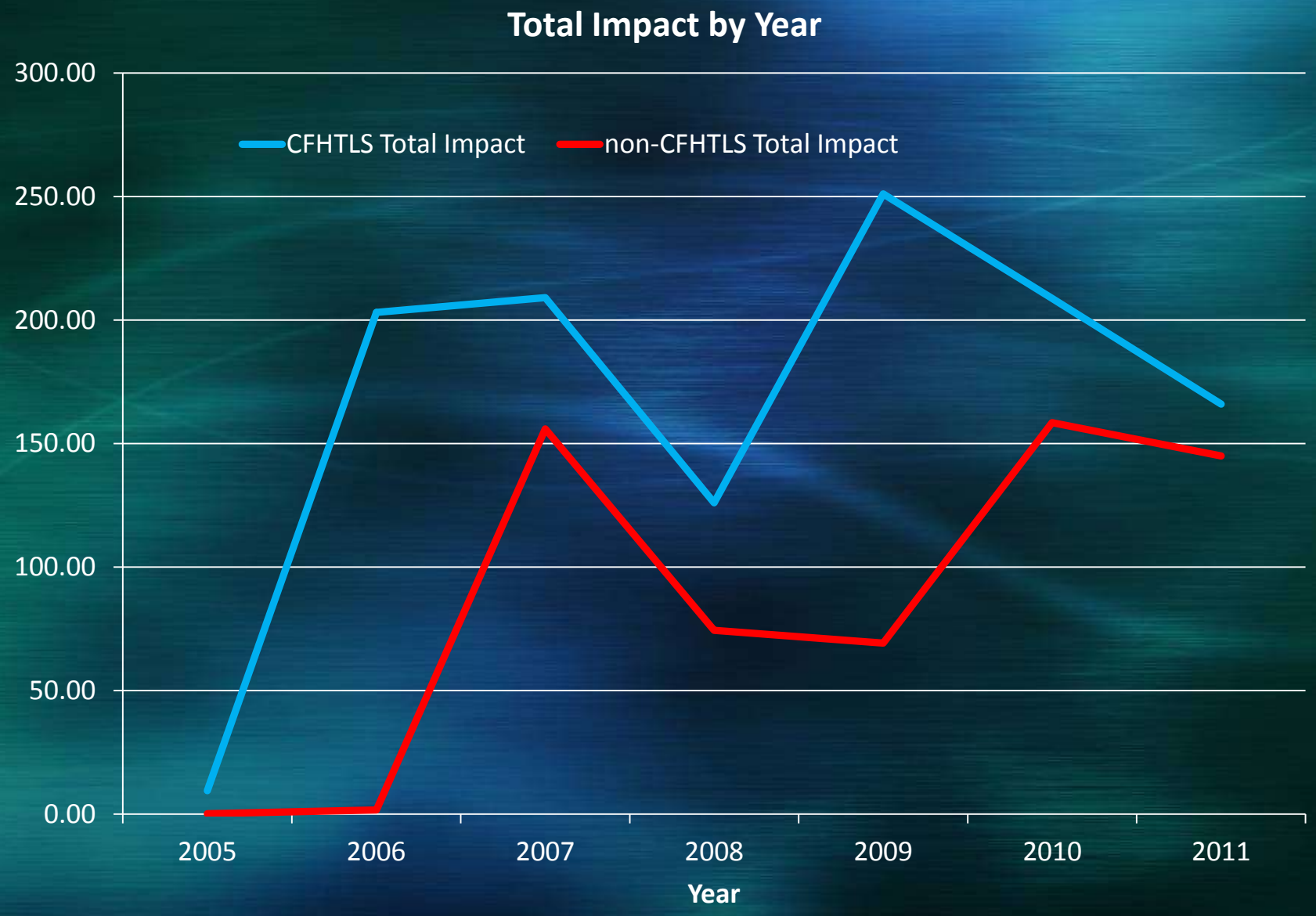

Total Impact by Instrument (1980 - 2011)
Gini Coefficient = 0.814
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Megacam
CCD
CFH12K
MOS
Coude f/8
Megacam
CCD
CFH12K
MOS
Coude f/8
ESPaDOnS
WIRCAM
Plates
FTS
PUEO
HRCAM
Coude f/4
UH8K
Herzberg
NICMOS3
UHTI
Speckle
SIS
GRENS
CFHTIR
LAPOUNE
OASIS
Redeye
TIGER
FP
MARLIN
UHAO
UHFOS
WET
EC
CIGALE
InSb
HIFI
MONICA
CIRCUS
Other
MOSFP
CAMIRAS
BEAR
RVS
PUMA
PCD
CASSHAWEC
MOCAM
PALILA
Submm
FaNTOmM
Bolometer
SILFID
MuSiCoS
GriF
ARGUS
Solar
OSIS
TRIDENT
FOCAS
UVPRIME
Garrison
SPI
ISOCAM
Genoble...
C10

Observing Hours & Papers

Hours	2006	2007	2008	2009	2010	2011
Megacam	197	176	163	166	159	119
WIRCAM	99	85	100	77	109	142
ESPaDoNS	59	77	90	116	94	82
Other	18	21	11	6	3	14

	Hours (2006-2009)	Papers (2008-2011)	Impact (2008-2011	Papers/ Hour	Impact/ Hour
Megacam	702	268	1175	0.38	1.67
WIRCAM	361	46	151	0.13	0.42
ESPaDoNS	342	51	145	0.15	0.42


CFHTLS AIPP
non-CFHTLS AIPP
CFHTLS MIPP
non-CFHTLS MIPP
# of CFHTLS Papers
# of non-CFHTLS Papers
Impact
# of Papers
Year
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
100
90
80
70
60
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
2011

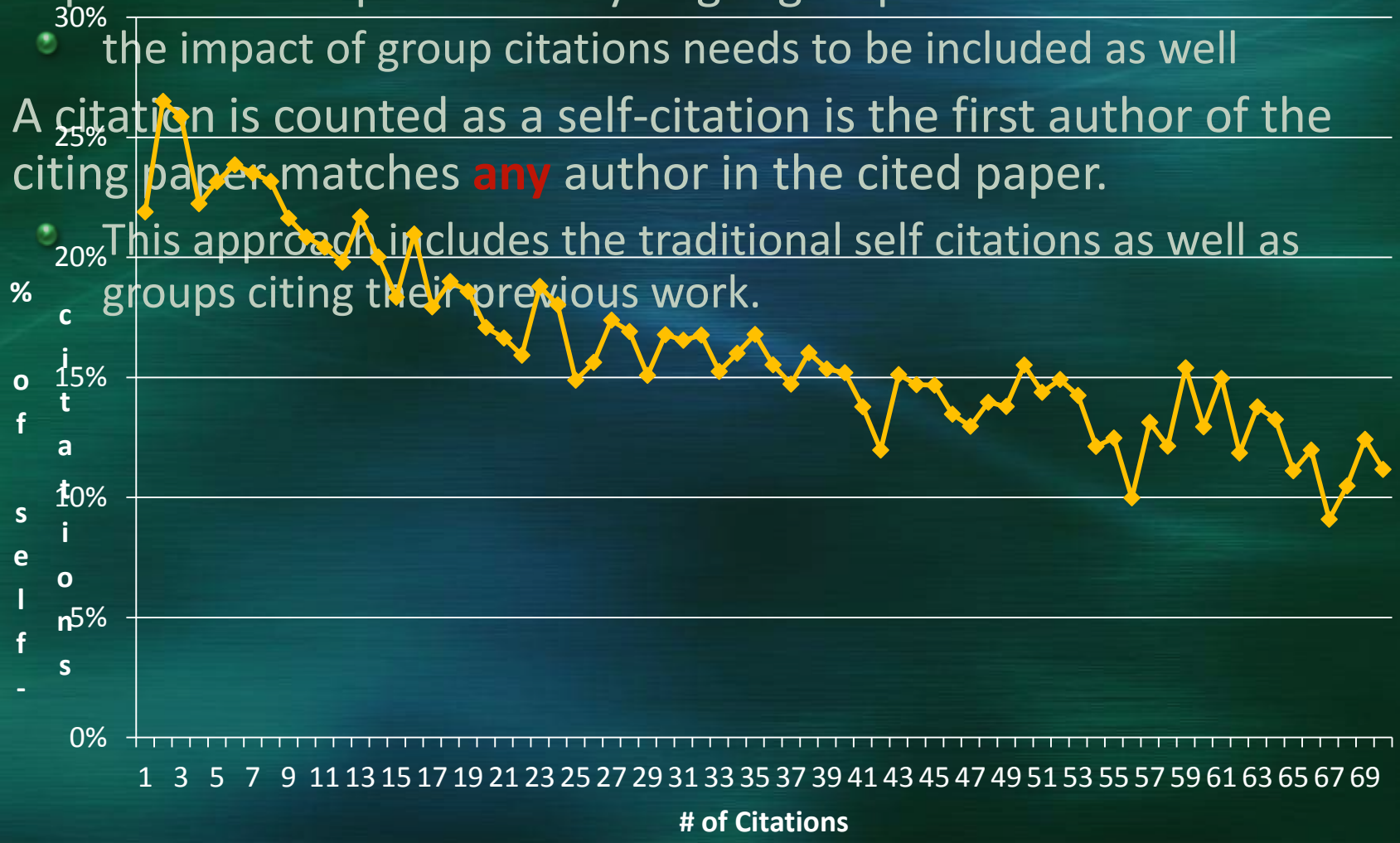

Total Impact by Year
300.00
250.00
200.00
150.00
100.00
50.00
0.00
CFHTLS Total Impact
non-CFHTLS Total Impact
2005
2006
2007
2008
2009
2010
2011
Year

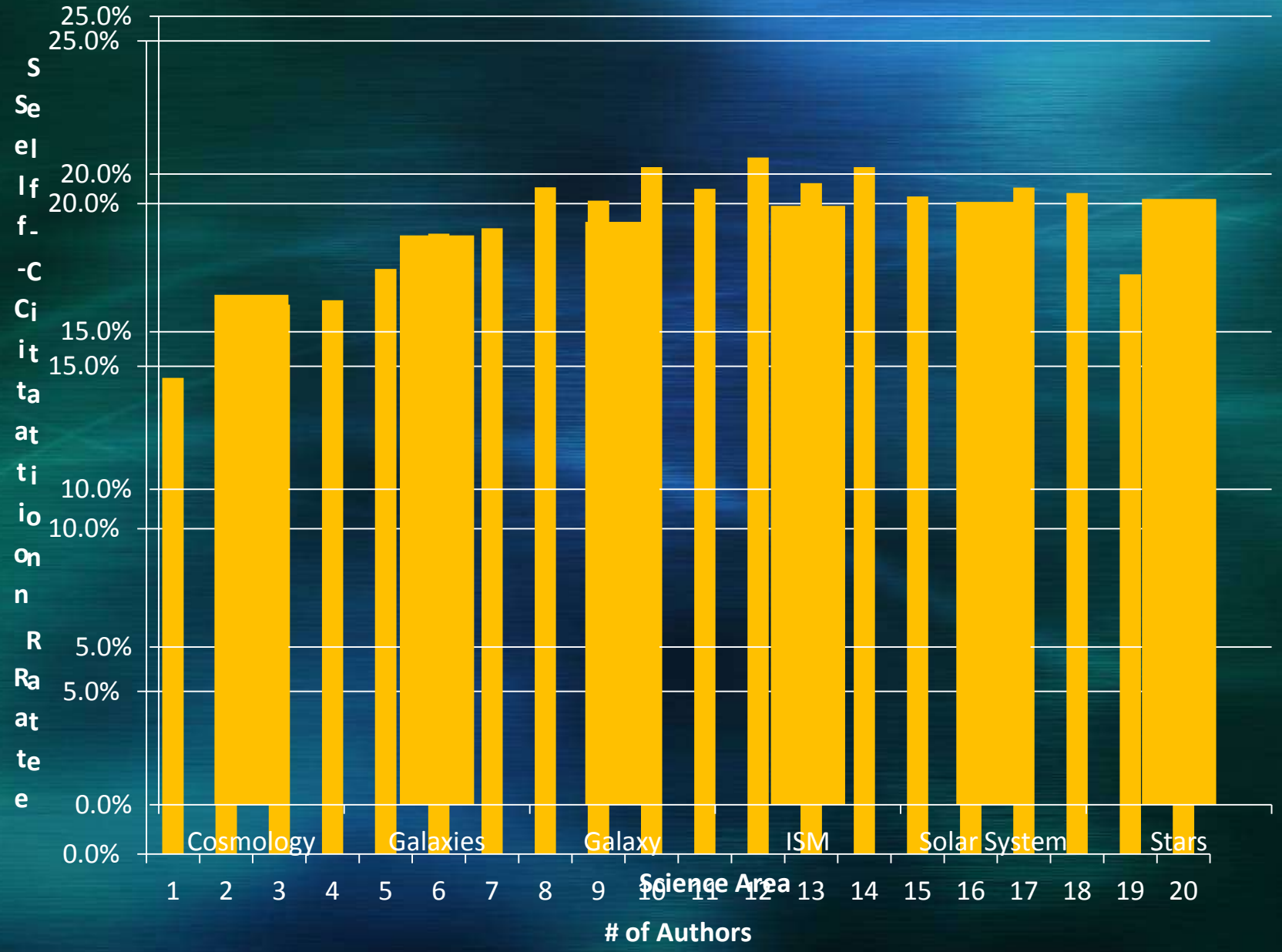
Summary

- CFHT's current productivity & impact (P&I) are at the highest level in its history and amongst the highest of any O/IR telescope
- At any given time in CFHT's history, P&I usually concentrated in a small number of instruments – recently this has been MegaCam
- Through early 1990s exploited IQ for direct imaging
- MOS dominates mid-1990s – exceptional instrument, one of the first of its kind; key was early exploitation of new capability
- Mid-1990s onward has been the domain of WF imaging – MOCAM, UH8K, CFH12K, MegaCam
  - No longer sufficient to simply rely on excellent image quality
  - First to exploit wide-field imaging; strategeic large-scale surveys;
- What about the future?
  - More powerful wide-field imaging coming on-line – DEC, HSC, LSS

Self Citations

- Papers are now published by larger groups
  - the impact of group citations needs to be included as well
- A citation is counted as a self-citation is the first author of the citing paper matches **any** author in the cited paper.
  - This approach includes the traditional self citations as well as groups citing their previous work.

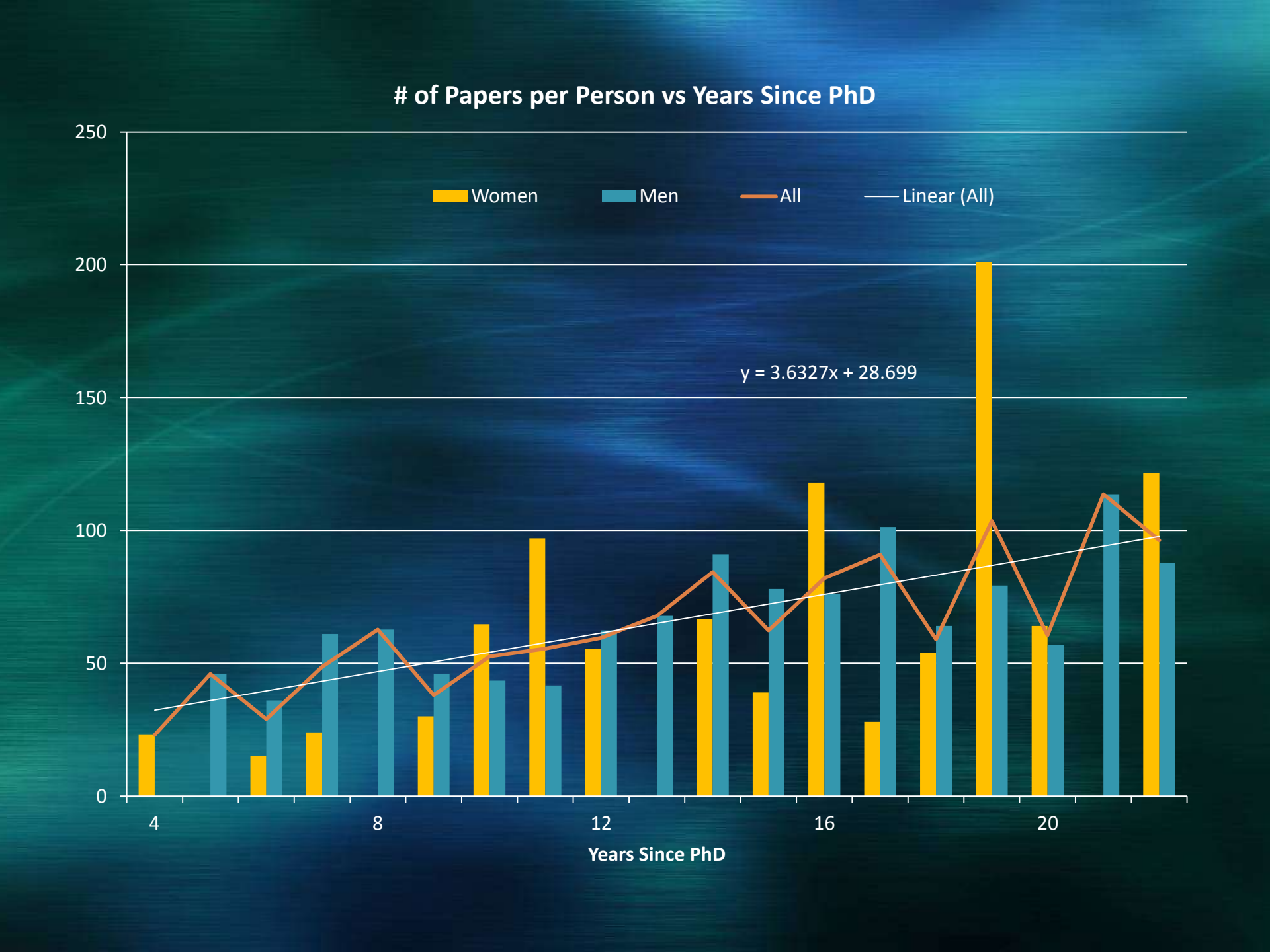


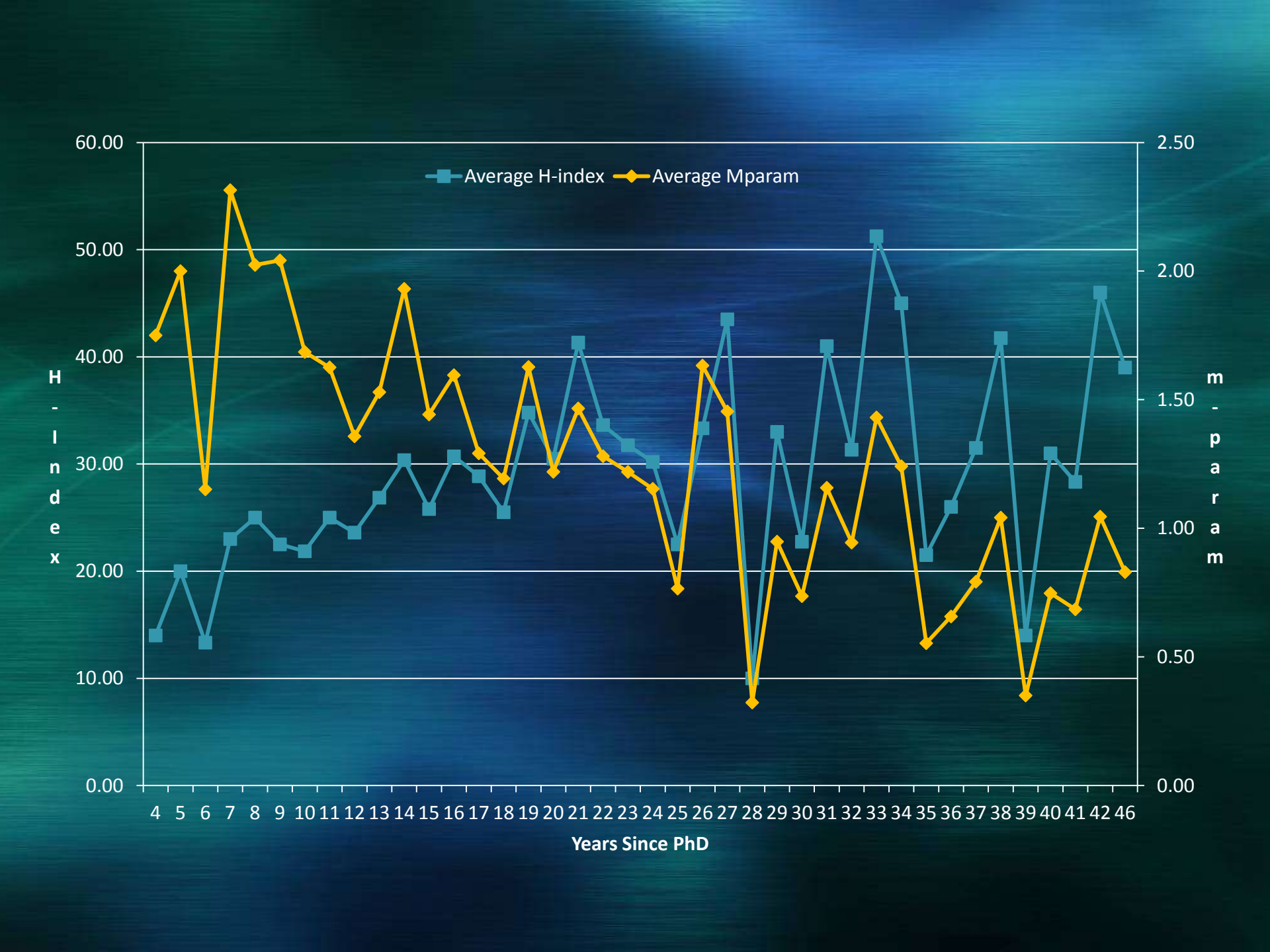

Self-Citation Rate
25.0%
25.0%
20.0%
20.0%
15.0%
15.0%
10.0%
10.0%
5.0%
5.0%
0.0%
0.0%
Cosmology
Galaxies
Galaxy
ISM
Solar System
Stars
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
# of Authors
Science Area

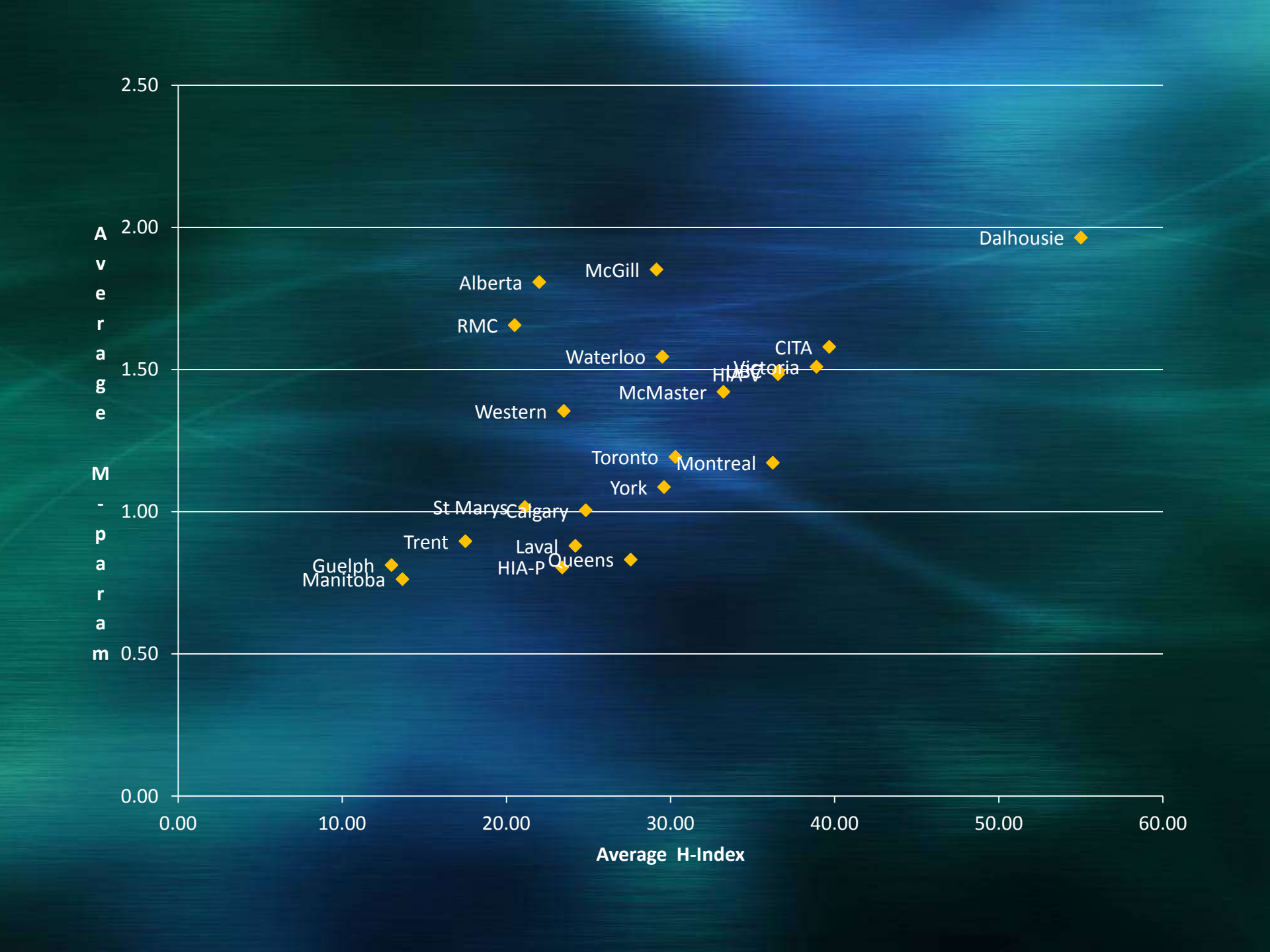
Canadian Astro Faculty

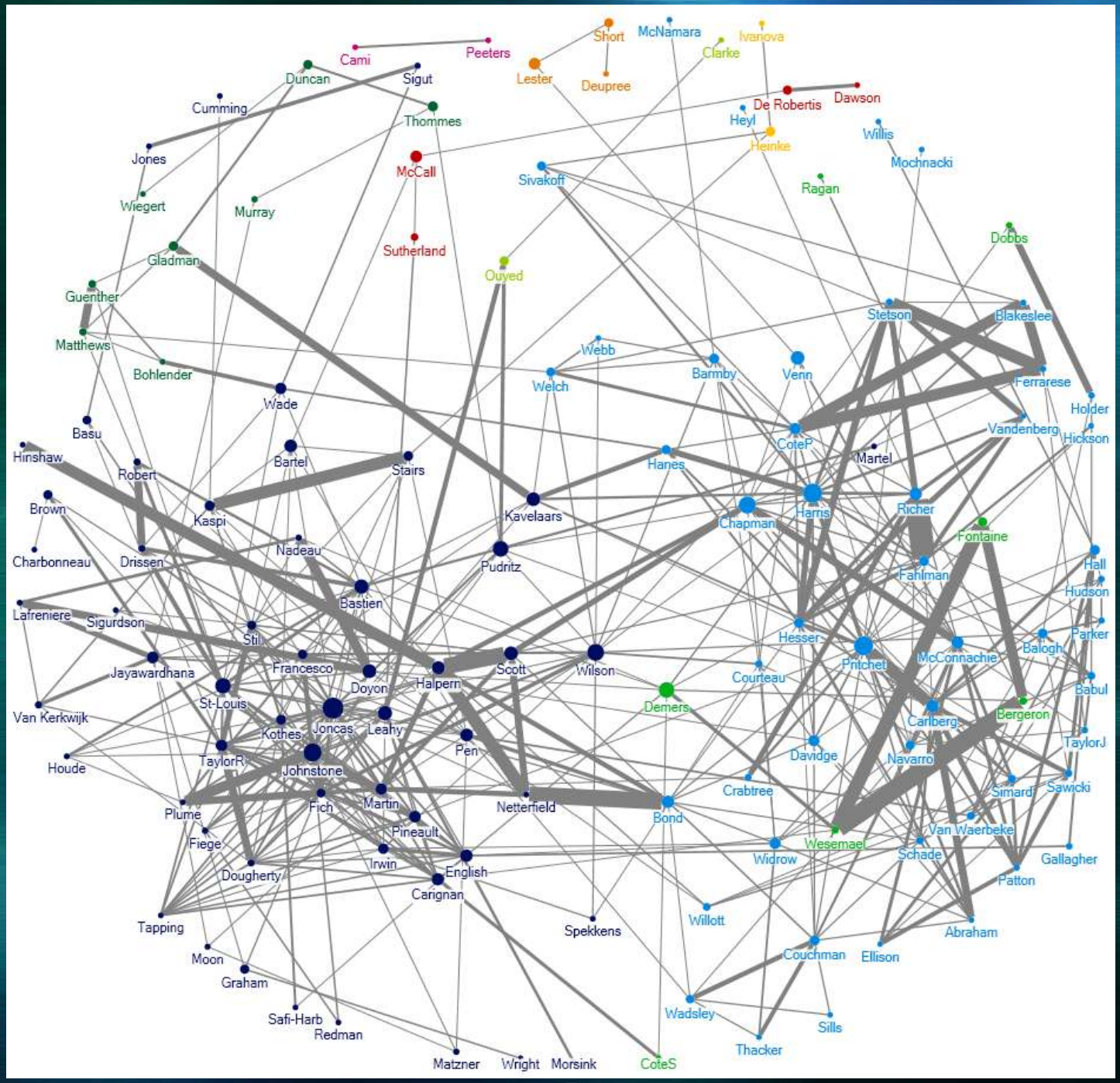
Data

- Database of Canadian faculty and permanent researchers
- Ancillary data such as gender, year of PhD, country and institute of PhD
- Retrieve papers and citations counts from ADS
- Calculate metrics such as h-index and g-index


# of Papers per Person vs Years Since PhD
250
200
150
100
50
0
Women
Men
All
Linear (All)
y = 3.6327x + 28.699
4
8
12
16
20
Years Since PhD


Average H-index
Average Mparam
60.00
50.00
40.00
30.00
20.00
10.00
0.00
H-Index
2.50
2.00
1.50
1.00
0.50
0.00
m-param
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 46
Years Since PhD


2.50
2.00
1.50
1.00
0.50
0.00
Average M-param
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Average H-Index
Dalhousie
McGill
Alberta
RMC
CITA
Waterloo
Victoria
HIA-V
McMaster
Western
Toronto
Montreal
York
St Marys
Calgary
Trent
Laval
Queens
HIA-P
Guelph
Manitoba


Short
McNamara
Ivanova
Clarke
Cami
Peeters
Lester
Deupree
Duncan
Sigut
Cumming
Thommes
De Robertis
Dawson
Heyl
Heinke
Willis
Jones
McCall
Sivakoff
Mochnacki
Ragan
Wiegert
Murray
Sutherland
Dobbs
Gladman
Ouyed
Guenther
Stetson
Blakeslee
Matthews
Webb
Barmby
Venn
Bohlender
Welch
Ferrarese
Wade
Holder
Basu
Vandenberg
Hickson
CoteP
Hinshaw
Bartel
Stairs
Hanes
Martel
Robert
Richer
Brown
Kaspi
Kavelaars
Chapman
Harris
Fontaine
Charbonneau
Drissen
Nadeau
Pudritz
Fahlman
Hall
Hudson
Bastien
Lafreniere
Sigurdson
Hesser
Parker
Stil
Balogh
Jayawardhana
Francesco
Scott
Wilson
Pritchet
McConnachie
Courteau
Babul
Doyon
Halpern
St-Louis
Demers
Van Kerkwijk
Carlberg
Bergeron
Joncas
Kothes
Leahy
TaylorJ
Pen
Davidge
Houde
TaylorR
Navarro
Johnstone
Crabtree
Simard
Sawicki
Fich
Martin
Netterfield
Bond
Plume
Van Waerbeke
Pineault
Wesemael
Fiege
Schade
Irwin
Widrow
Gallagher
English
Dougherty
Patton
Carignan
Willott
Tapping
Spekkens
Abraham
Couchman
Ellison
Moon
Graham
Wadsley
Safi-Harb
Sills
Redman
Thacker
Matzner
Wright
Morsink
CoteS