NASA Announcement of Opportunity Science Team Demographics

Heidi Jensen and Lorenzo Pappas

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Introduction

The Astro2020 State of the Profession white paper, “Leadership and Participation in NASA’s Astrophysics Explorer-Class Missions”, indicated that women were underrepresented in proposing AO science teams.

The SMD Data Analytics team has expanded upon the white paper analysis to include:

- Updates to Astrophysics analysis
- Addition of Earth Science, Heliophysics, and Planetary Science division AOs
- Incorporation of incomplete 1996-2005 AO proposal data

Key Takeaways

- Astrophysics, Earth Science, and Heliophysics AO proposals have generally had few woman PIs. Planetary Science seems to have always had some woman PIs.
- While Astrophysics and Heliophysics have always had some women in AO science team roles, the transition to more women in PI roles is more recent.
- Earth Science PIs and science teams have not experienced the increases in participation by women observed in other SMD divisions.
- The fraction of women in science roles on proposal teams are not significantly different between all four divisions or between all five AO size classes.
- Academic age distributions of AO PIs are not significantly different from each other across the four SMD division or five AO size classes.

Data Sources

- AO proposal data
  - 2006-present: NSPIRES proposal reports
  - 1996-2005: legacy database from paper proposals
- Inferred Gender
  - Free, online lookup tool (API)
  - Additional research for low inferred gender accuracy values
- Career Stage
  - Final degree year from CV text in proposals or online research

Overview

Mission Size Introductory Table

AO Submitting Organizations

AO PIs: Inferred gender and academic age

AO Science Teams: Inferred gender and academic age

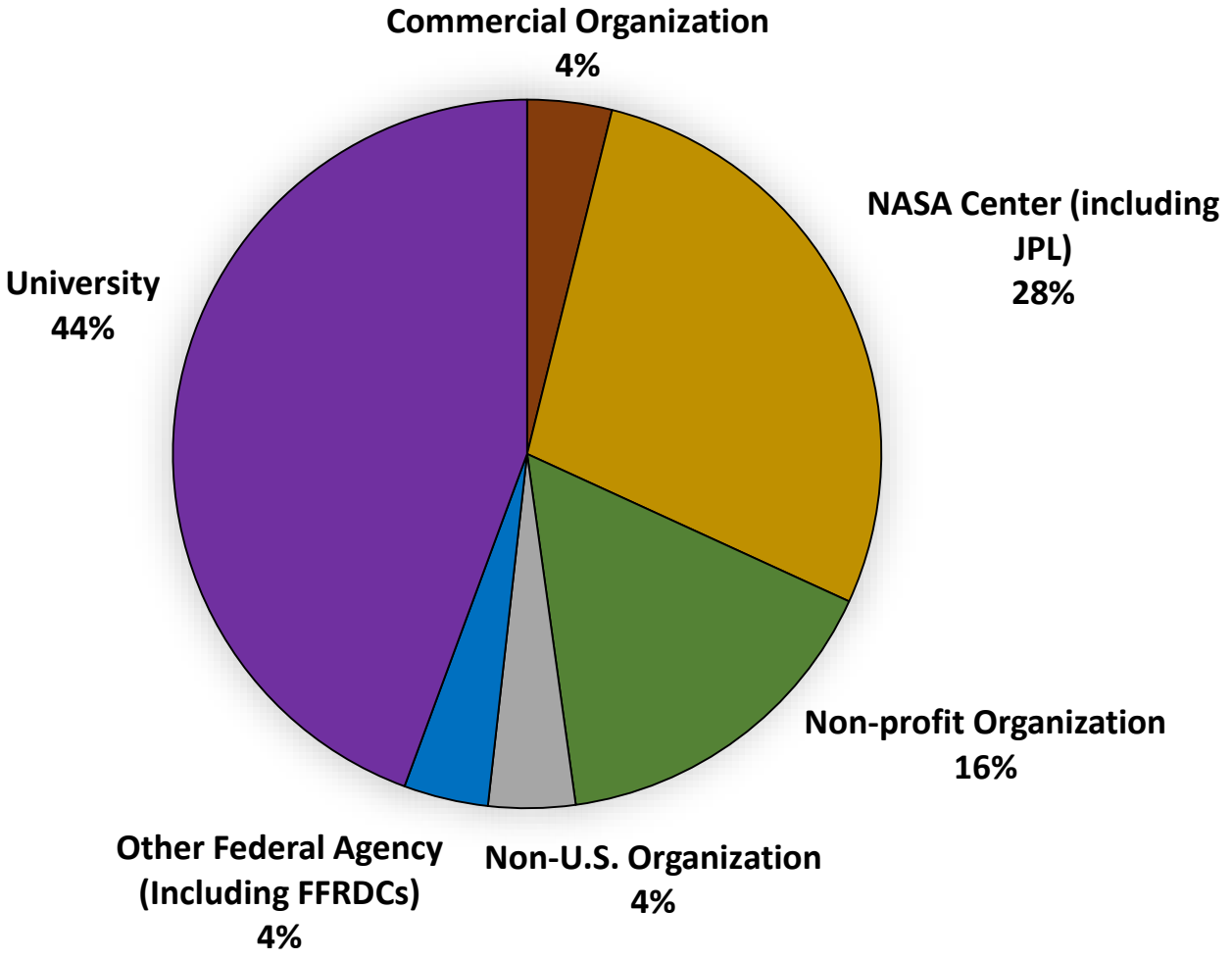
AO Science Teams: Number and proportion of women

How Many Announcement of Opportunity (AO) Proposals Are Submitted?

Mission Size	Mission Cost Cap (in millions)	Number of Calls *	Total Number of Proposals Submitted	Average Number of Proposals Submitted	Selection Rate Including Proposals Selected for Tech Dev
Instrument	<$125	11	232	21	20%
MO	<$125	18	249	14	21%
Small	<$250	9	179	20	19%
Medium	<$750	12	248	21	19%
Large	>$750	3	25	8	36%
Overall		53	933	18	20%

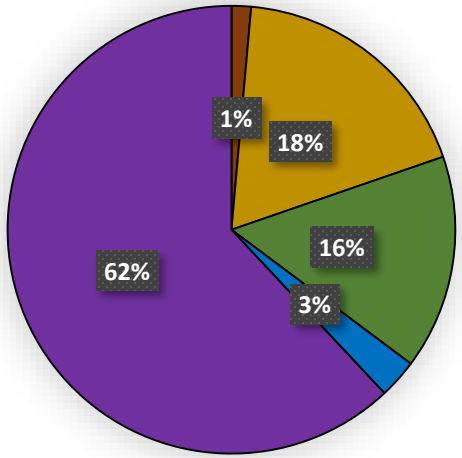
* Some Calls include more than one mission size

Submitting Organization Type: 1996-present AO proposals Across SMD

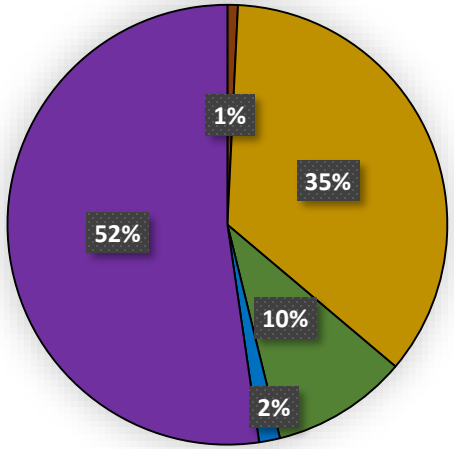


Submitting Organization Type: 1996-present AO proposals SMD Divisions

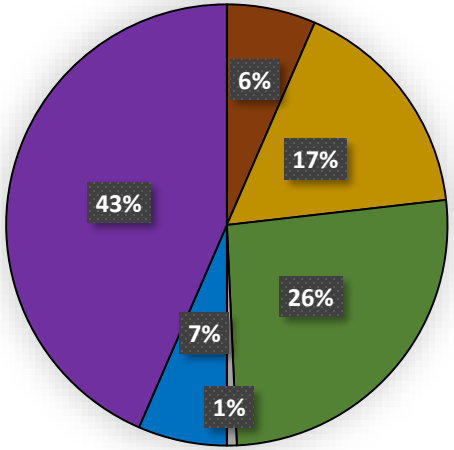
Pre-2006 Explorer



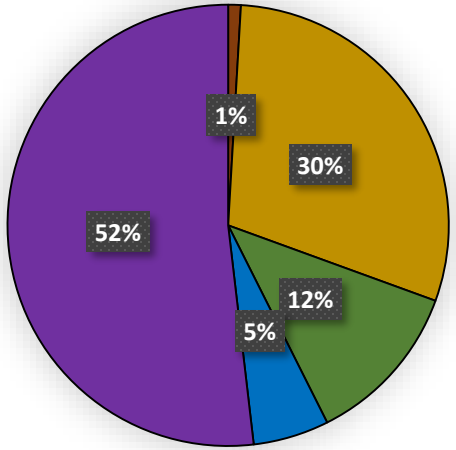
Astrophysics



Heliophysics

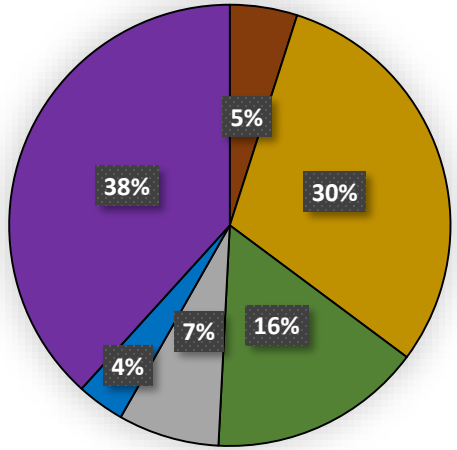


Earth Science



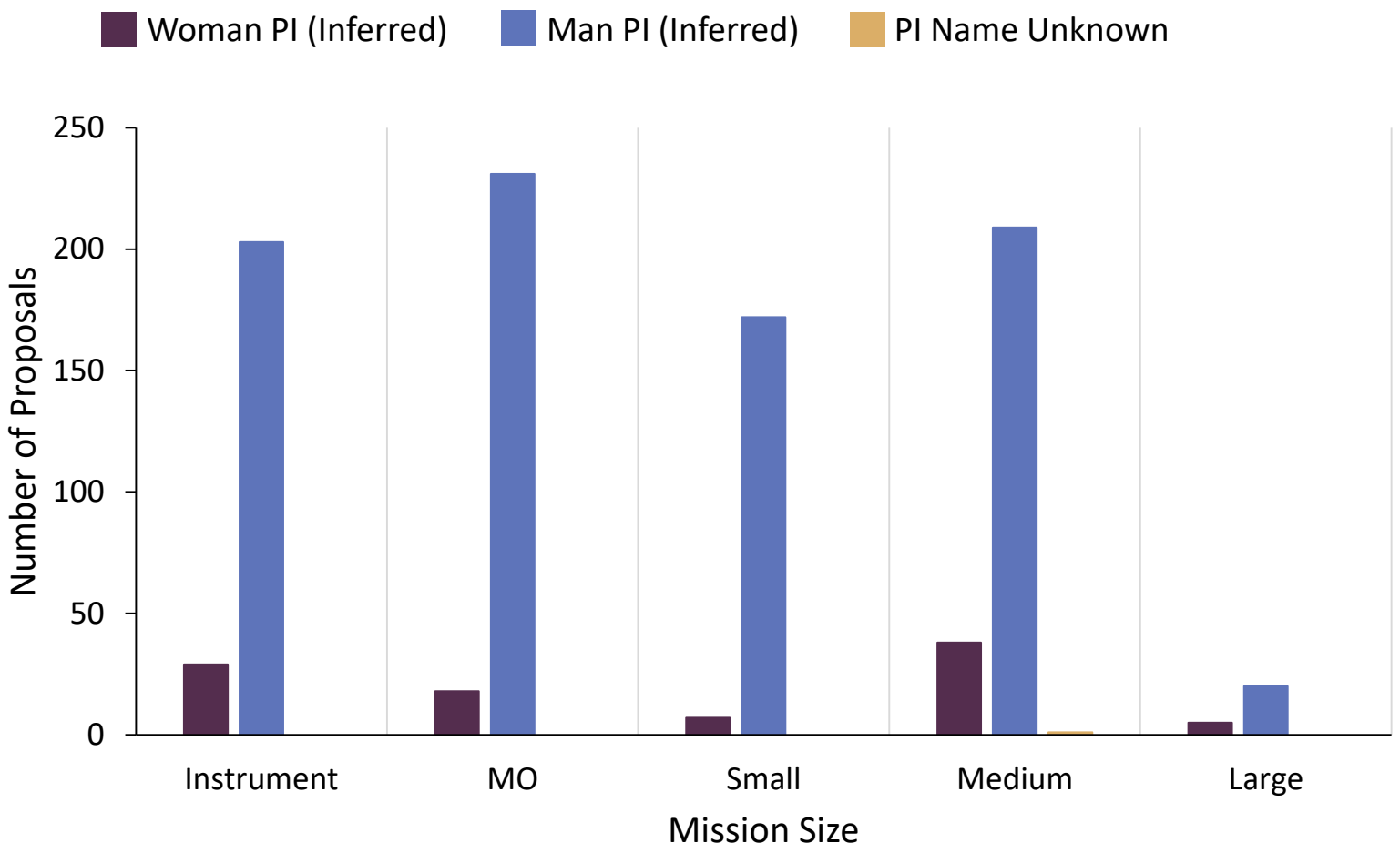
- Commercial Organization
- NASA Center (including JPL)
- Non-profit Organization
- Non-U.S. Organization
- Other Federal Agency (Including FFRDCs)
- University

Planetary Science

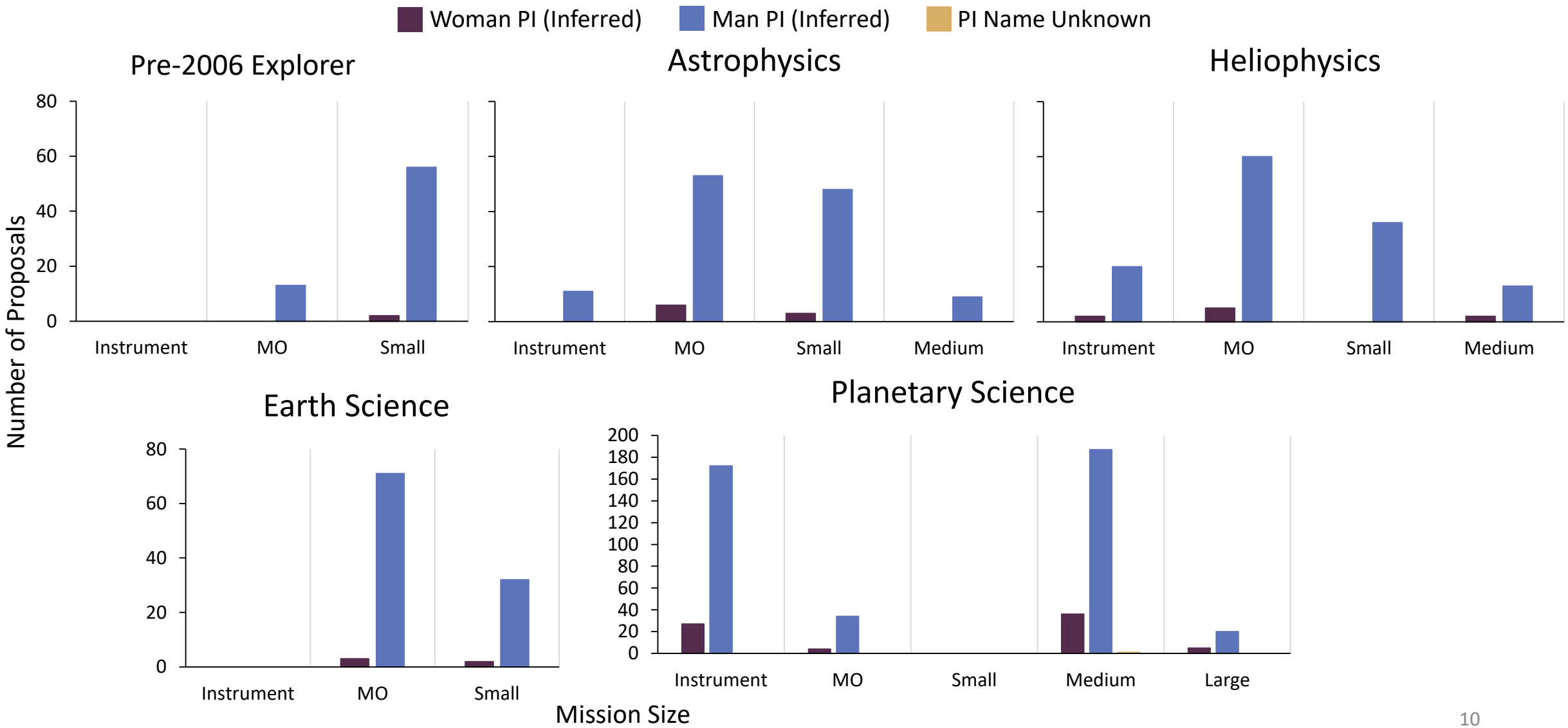


Note: Pre-2006 Explorer proposals could not be separated into Astrophysics and Heliophysics

PI Inferred Gender: 1996-present AO Submissions Across SMD by Mission Size



PI Inferred Gender: 1996-present AO Submissions
SMD Divisions by Mission Size

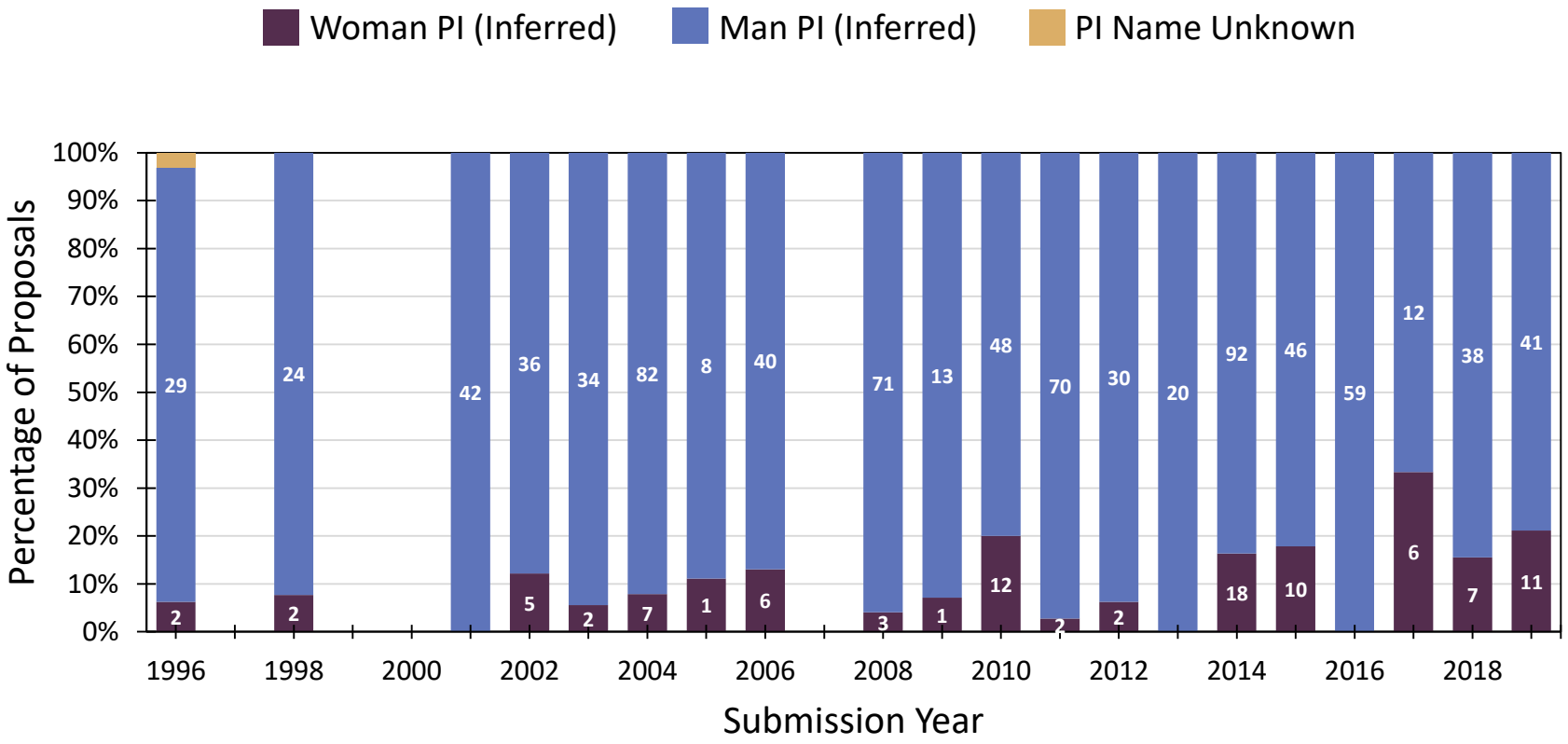


Note: Pre-2006 Explorer proposals could not be separated into Astrophysics and Heliophysics

1996-present AO Submissions: % Woman PI participation SMD Divisions by Mission Size

Division	Instrument	MO	Small	Medium	Large	Total
Pre-2006 Explorer		0%	3%			3%
Astrophysics	0%	10%	6%	0%		7%
Earth Science		4%	6%			5%
Heliophysics	9%	8%	0%	13%		7%
Planetary Science	14%	11%		16%	20%	15%
Total	13%	7%	4%	15%	20%	10%

PI Inferred Gender: 1996-present AO Submissions Across SMD by Submission Year



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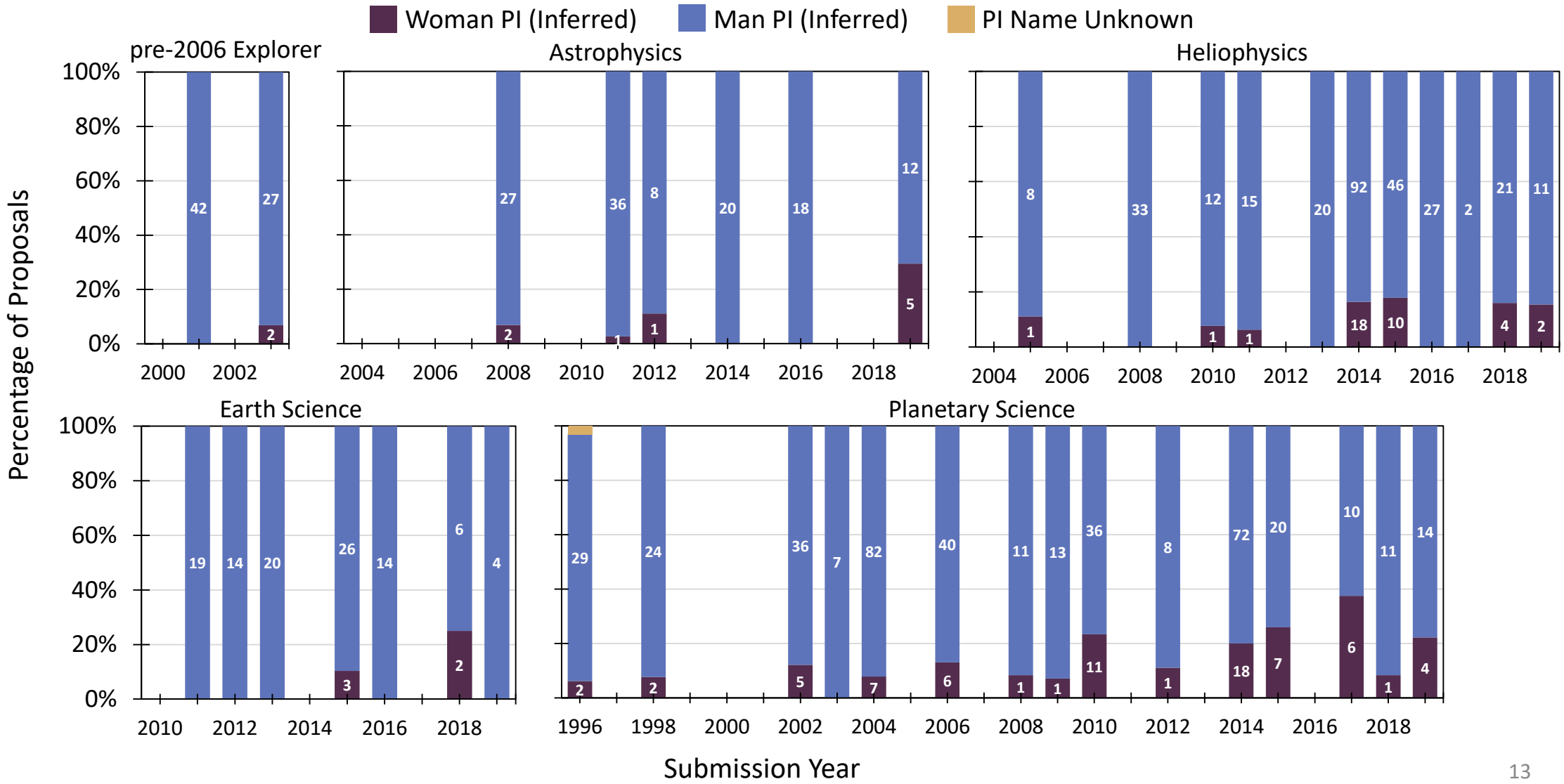
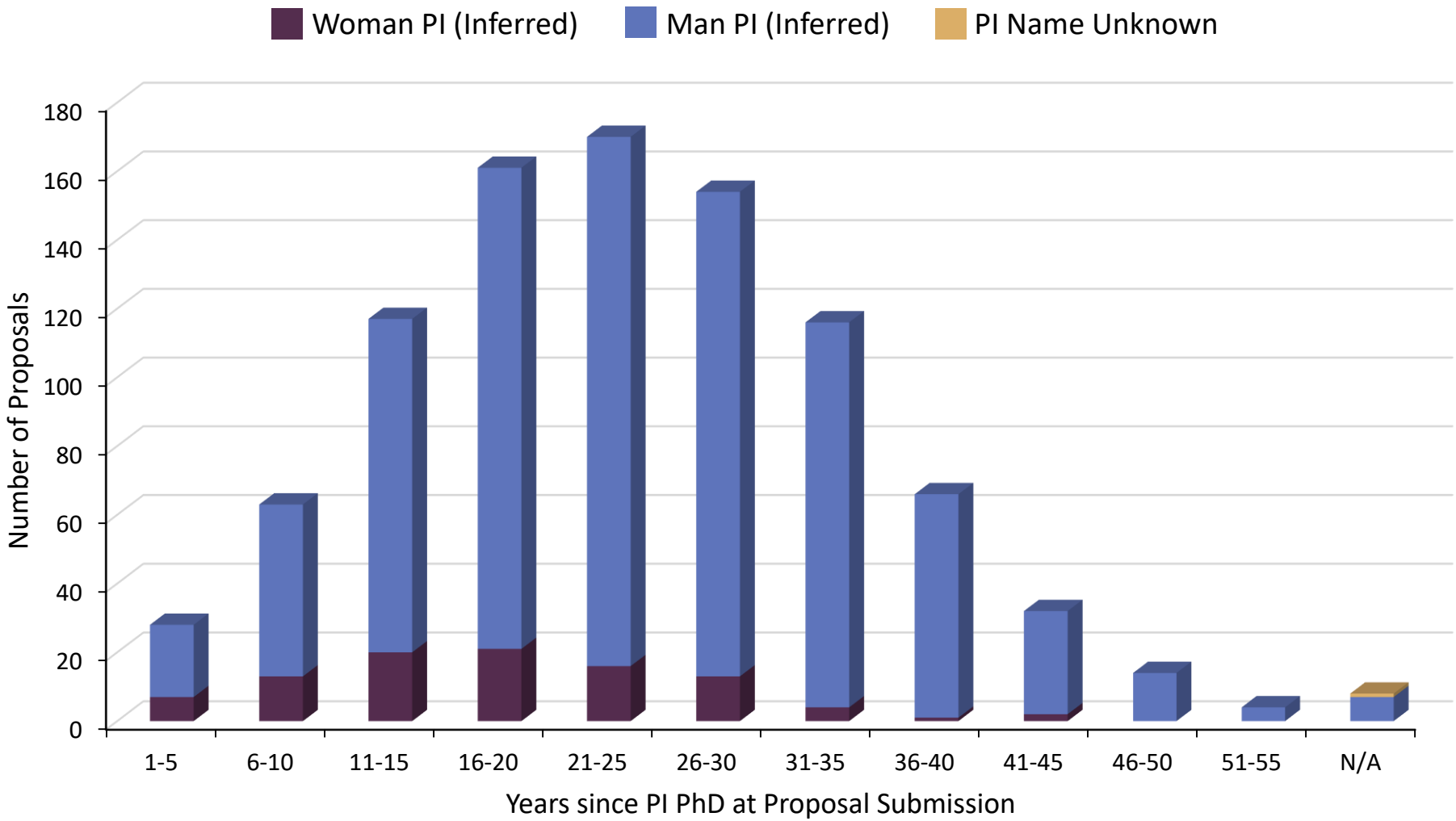


Note: Pre-2006 Explorer proposals could not be separated into Astrophysics and Heliophysics

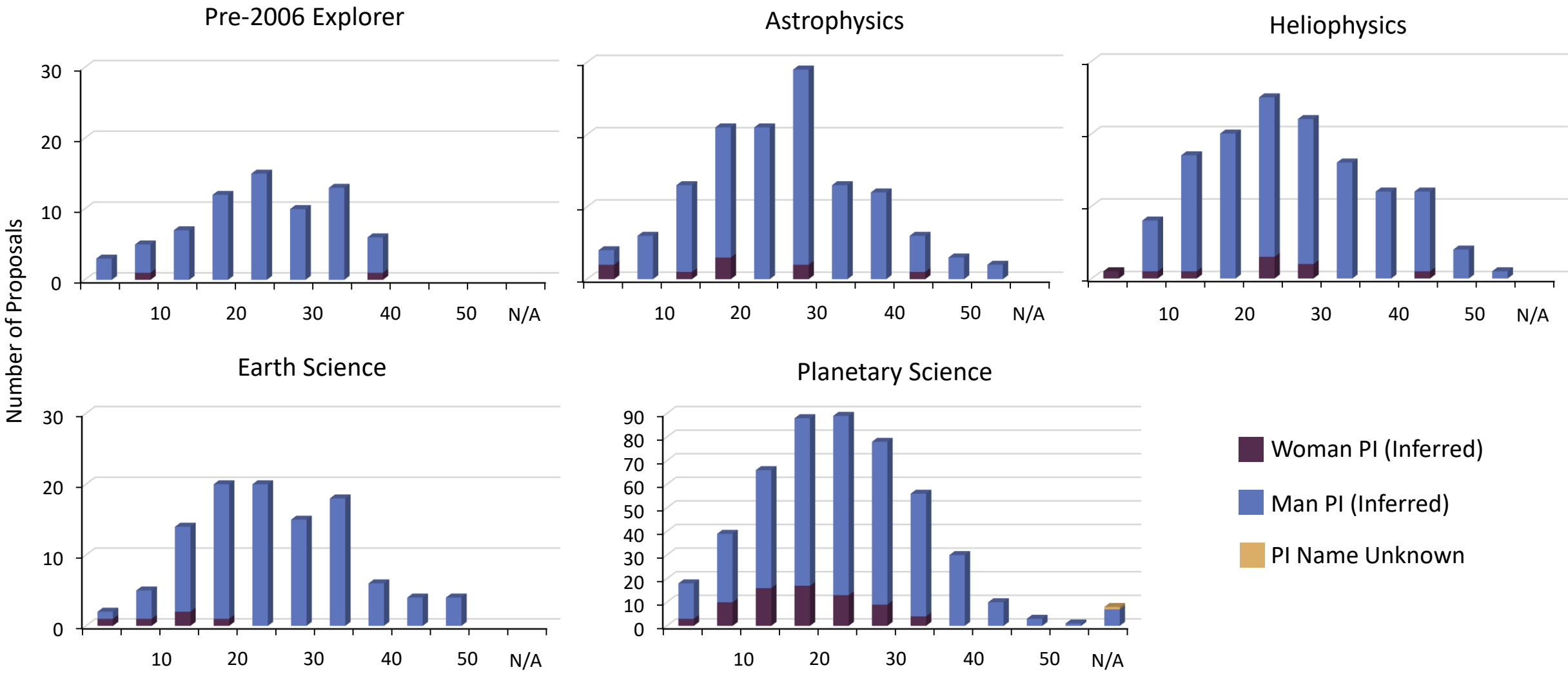
PI Inferred Gender: 1996-present AO Submissions and Selections by Mission Size Across SMD

Mission Size	Submitted			Selected		
	Total	% W PI	% M PI	Total	% W PI	% M PI
Instrument	232	13%	88%	46	13%	87%
MO	249	7%	93%	52	8%	92%
Small	179	4%	96%	34	9%	91%
Medium	248	15%	84%	48	33%	67%
Large	25	20%	80%	9	22%	78%
Total	933	10%	89%	189	16%	84%

PI Academic Age:1996-present AO Submissions Across SMD



PI Academic Age: 1996-present AO Submissions SMD Divisions



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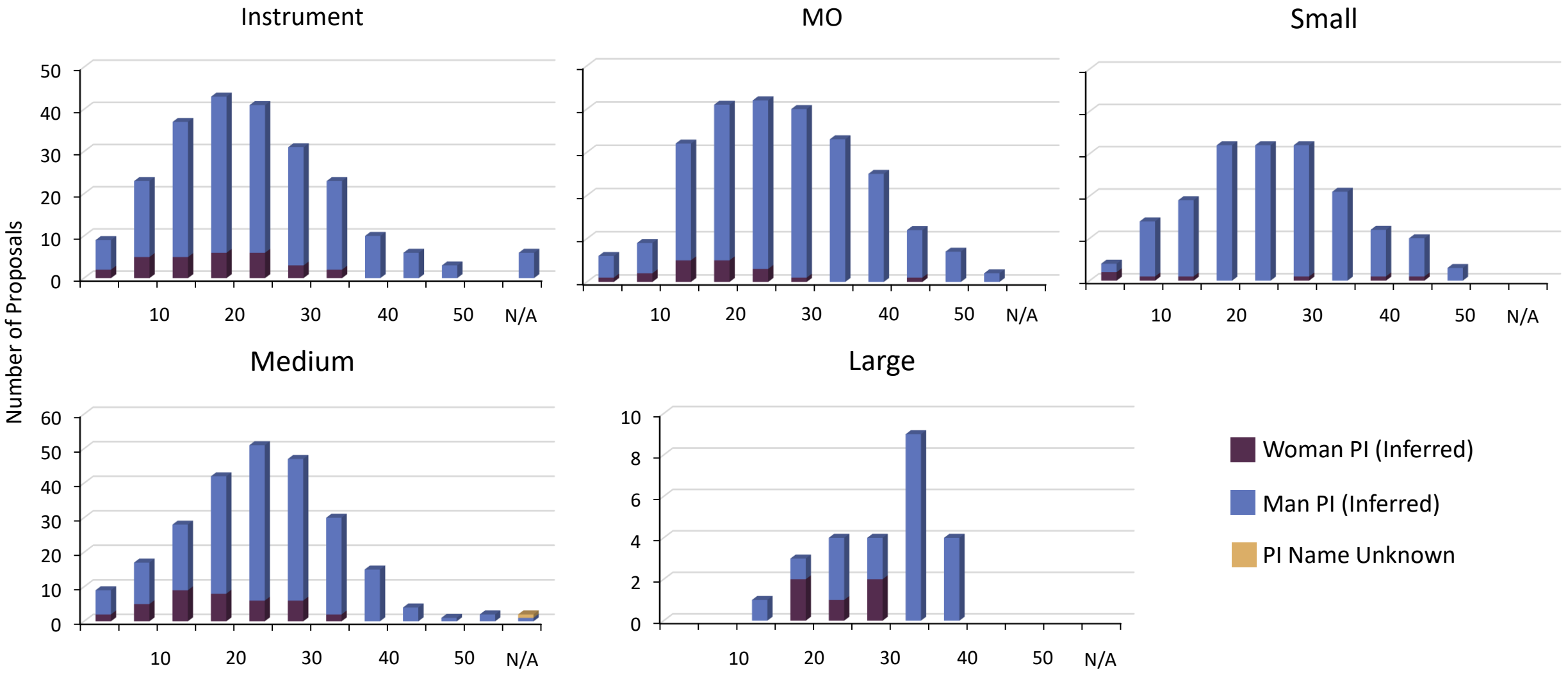

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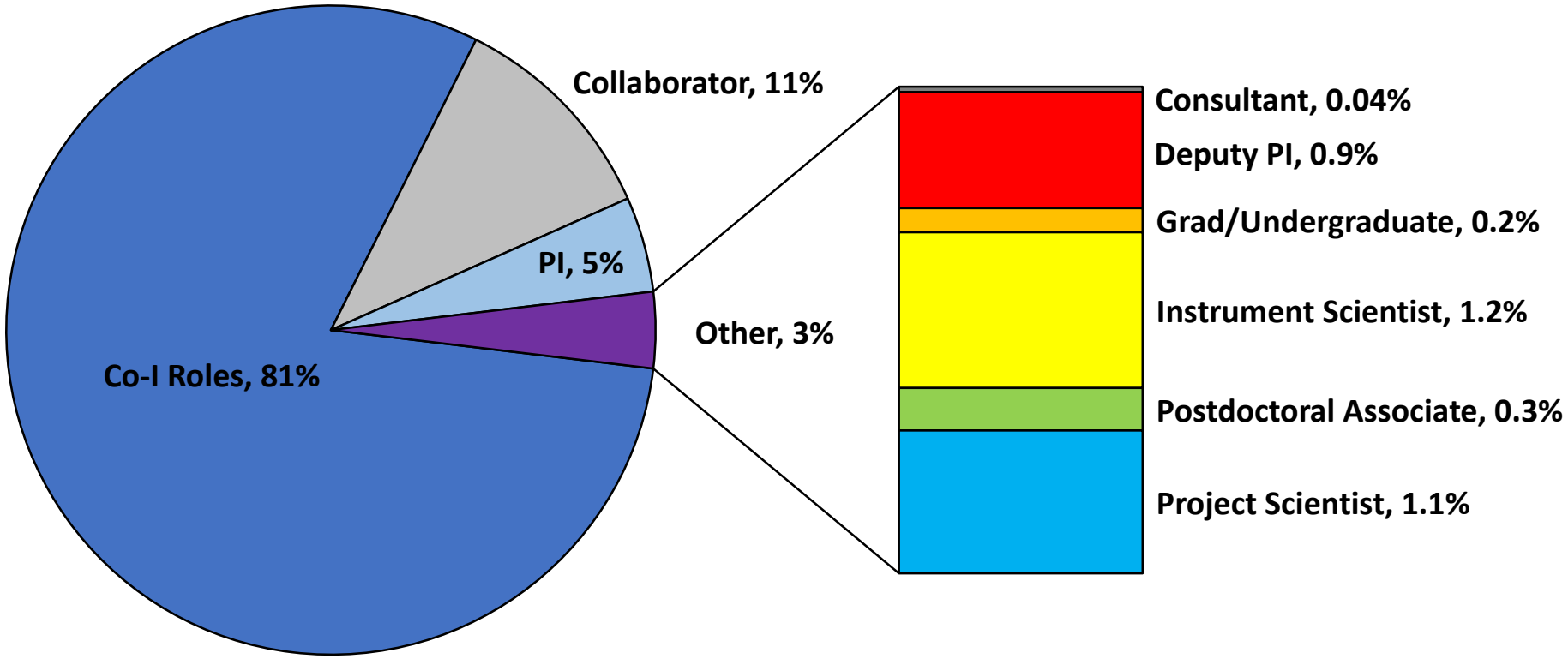
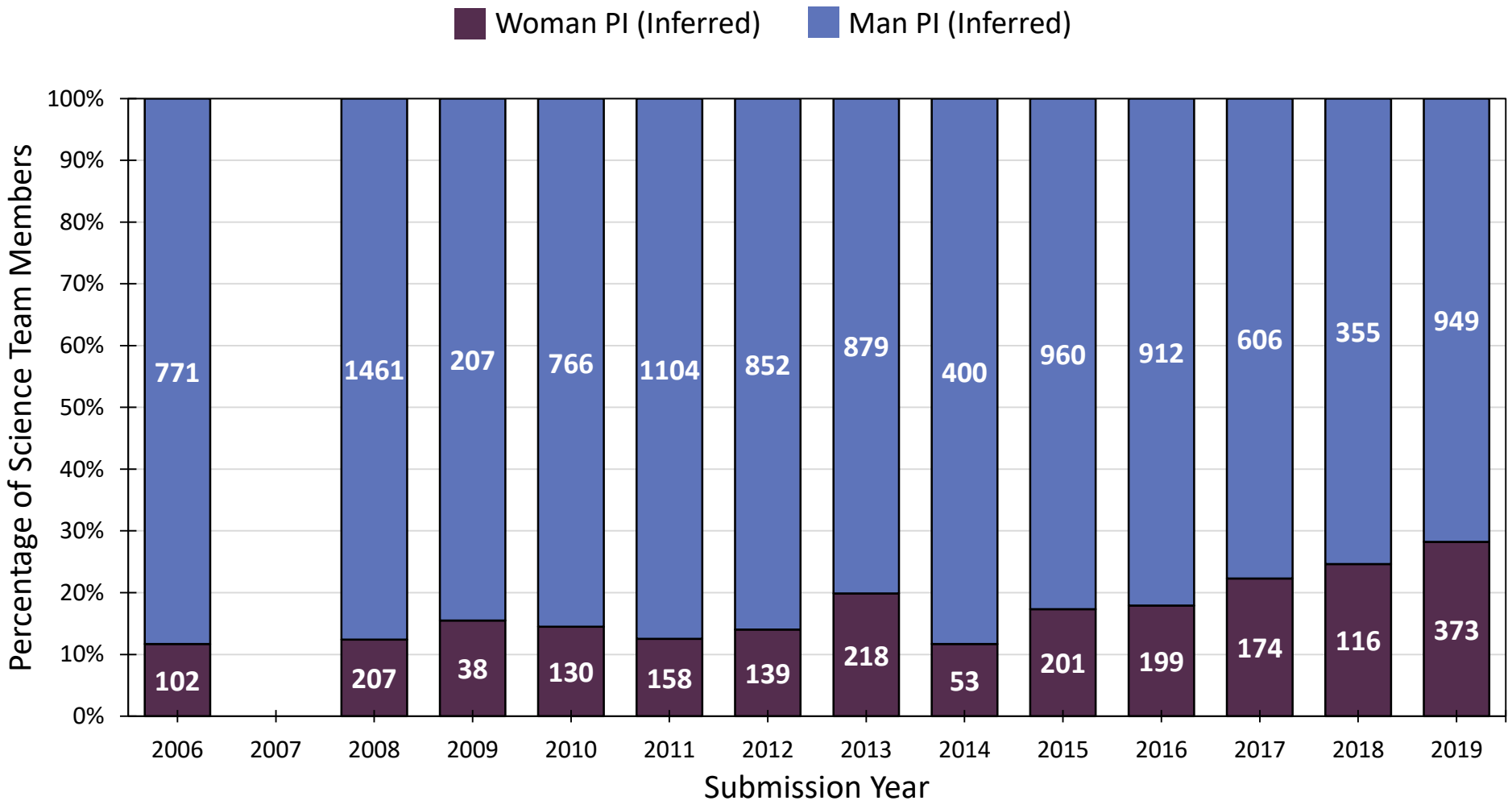
Science Team: AO Member Roles Distribution Across SMD



Note: Science Team data is only available 2006-present

Sci Team Inferred Gender: 2006-present AO Proposals Submission Year Across SMD



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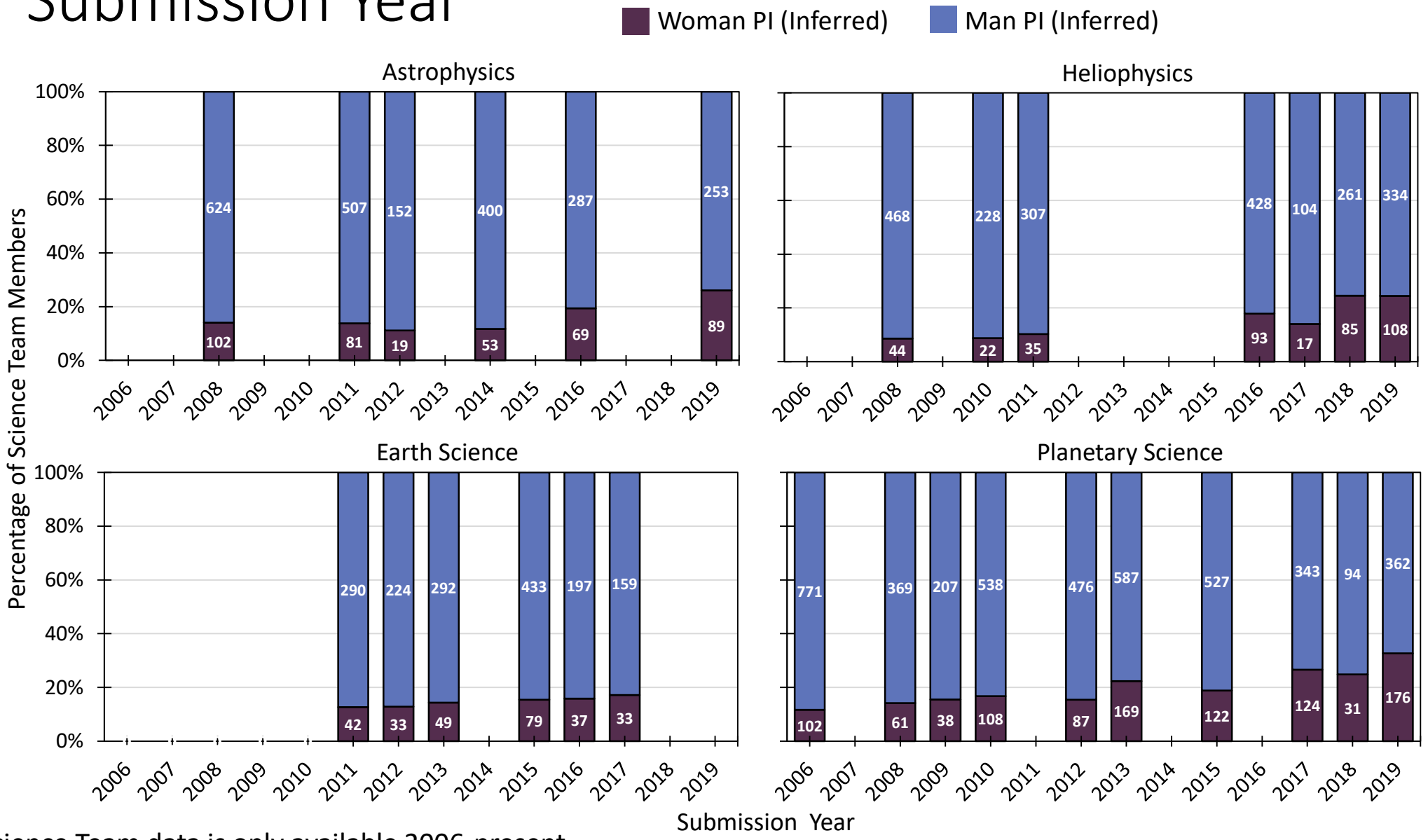
Science Team Inferred Gender: 2006-present AO Proposals Submission Year



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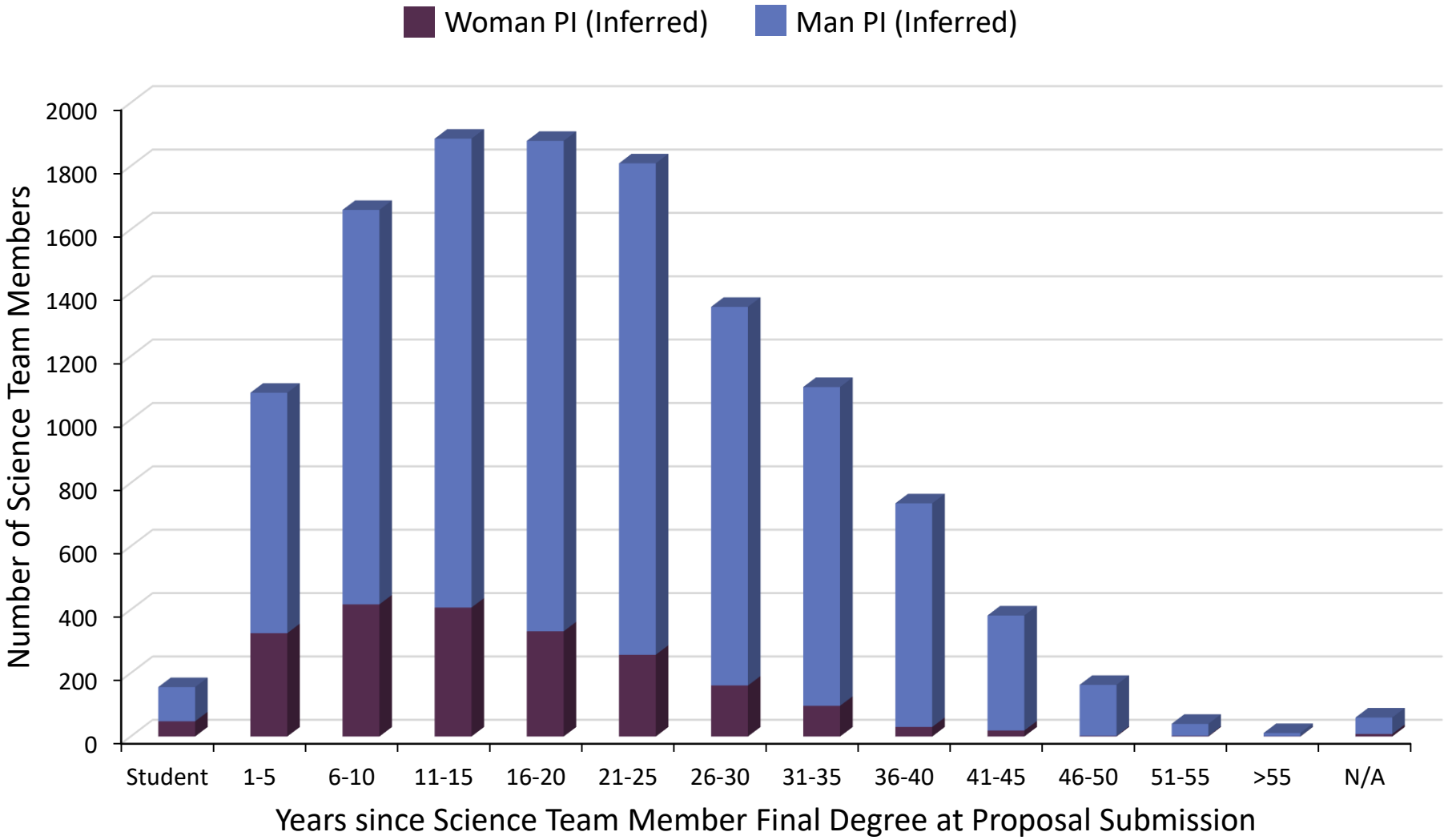
Science Team Academic Age: 2006-present AO Submissions Across SMD



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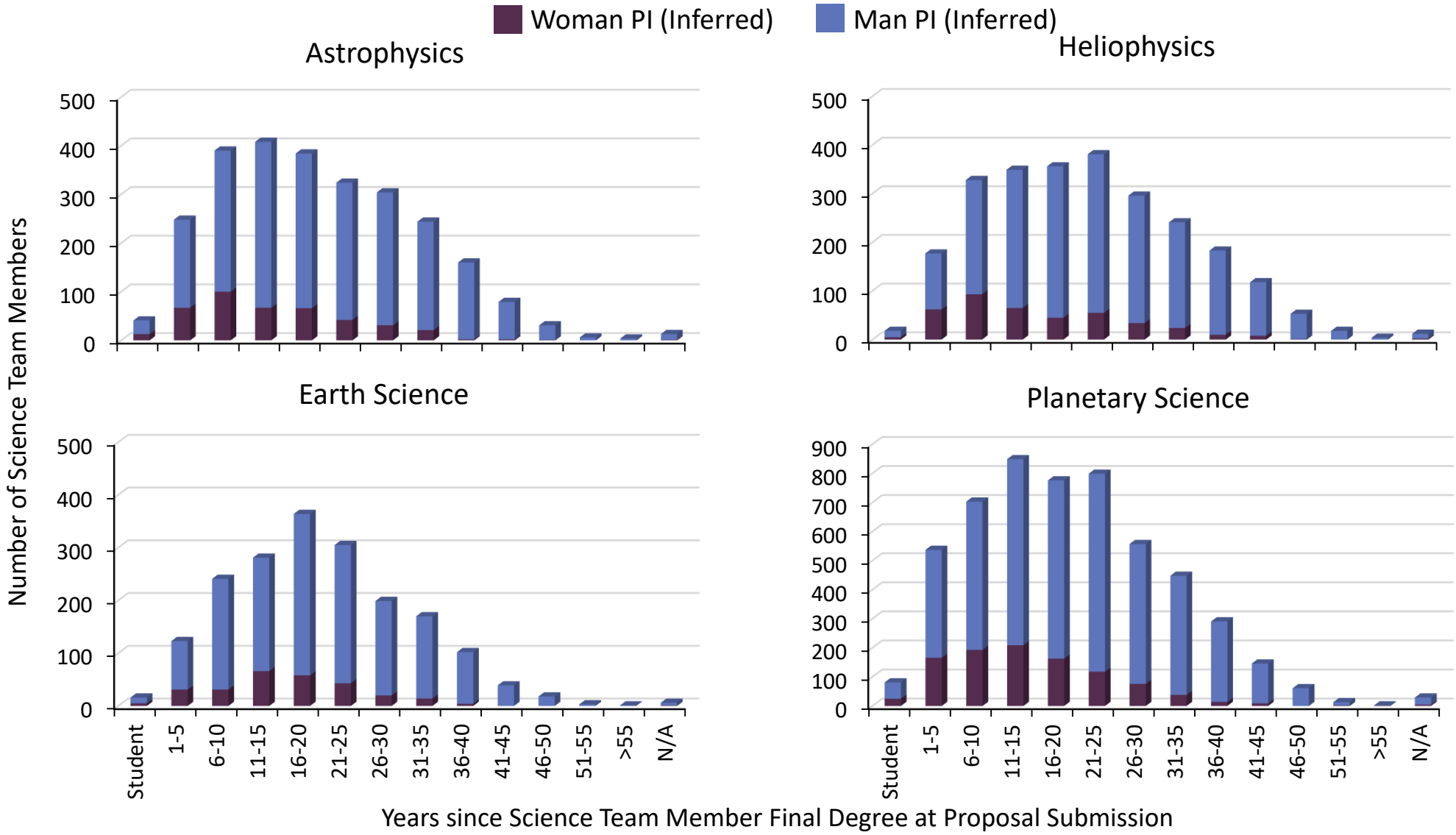
Science Team Academic Age: 2006-present AO Submissions SMD Divisions



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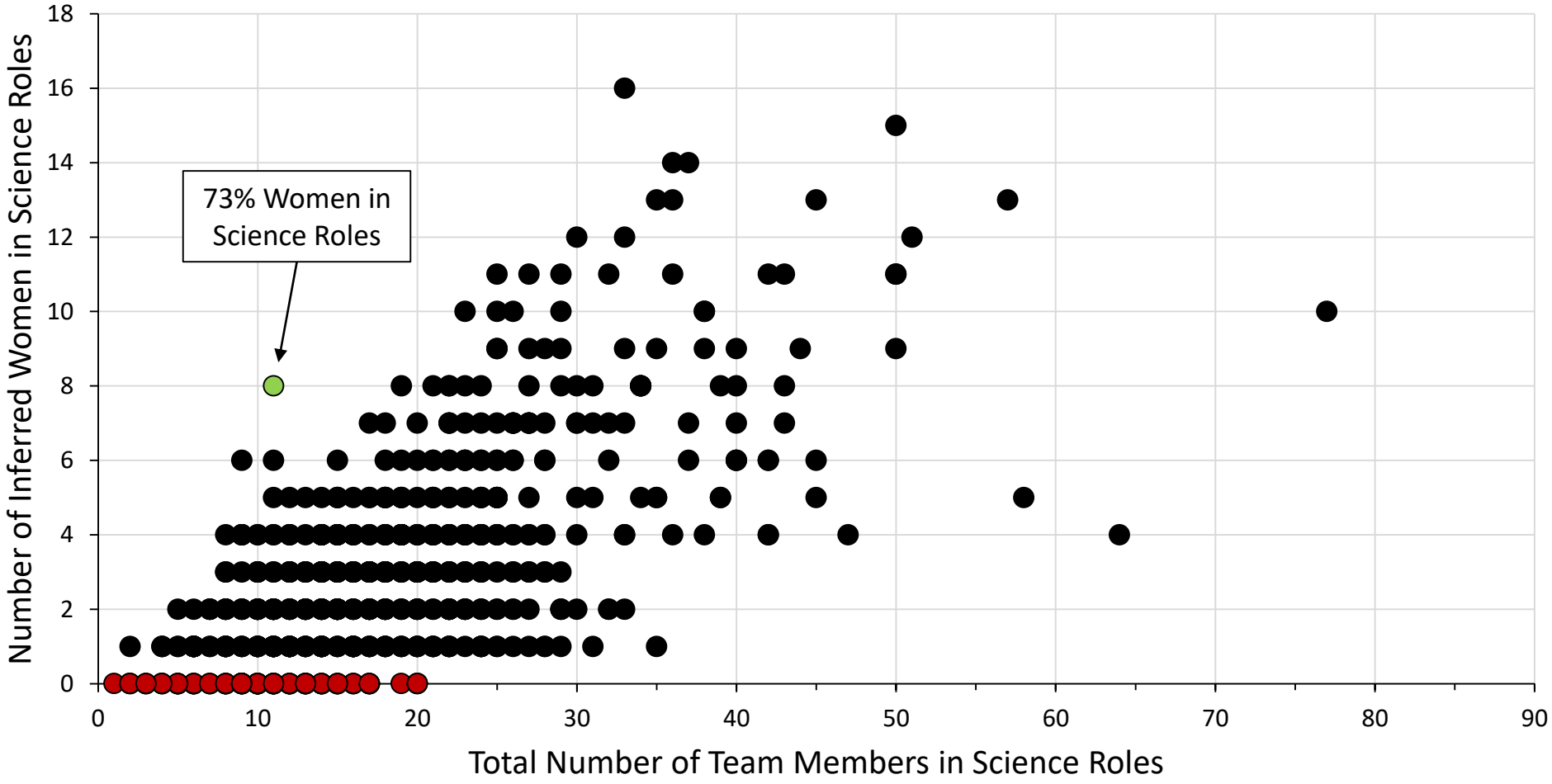
Science Teams: 2006-present AOs Participation by Women Across SMD



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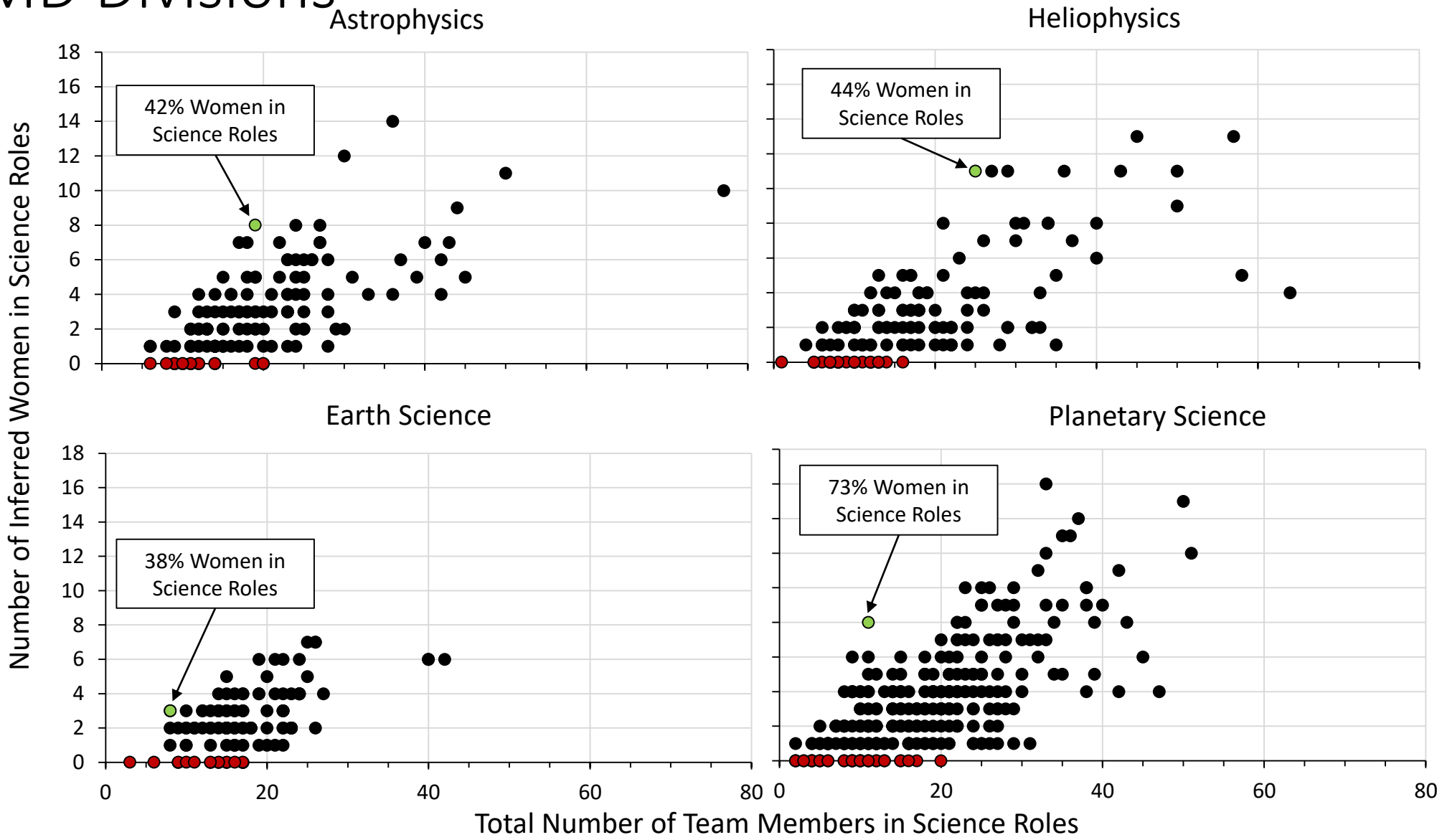
Science Teams: 2006-present AO Participation by Women SMD Divisions



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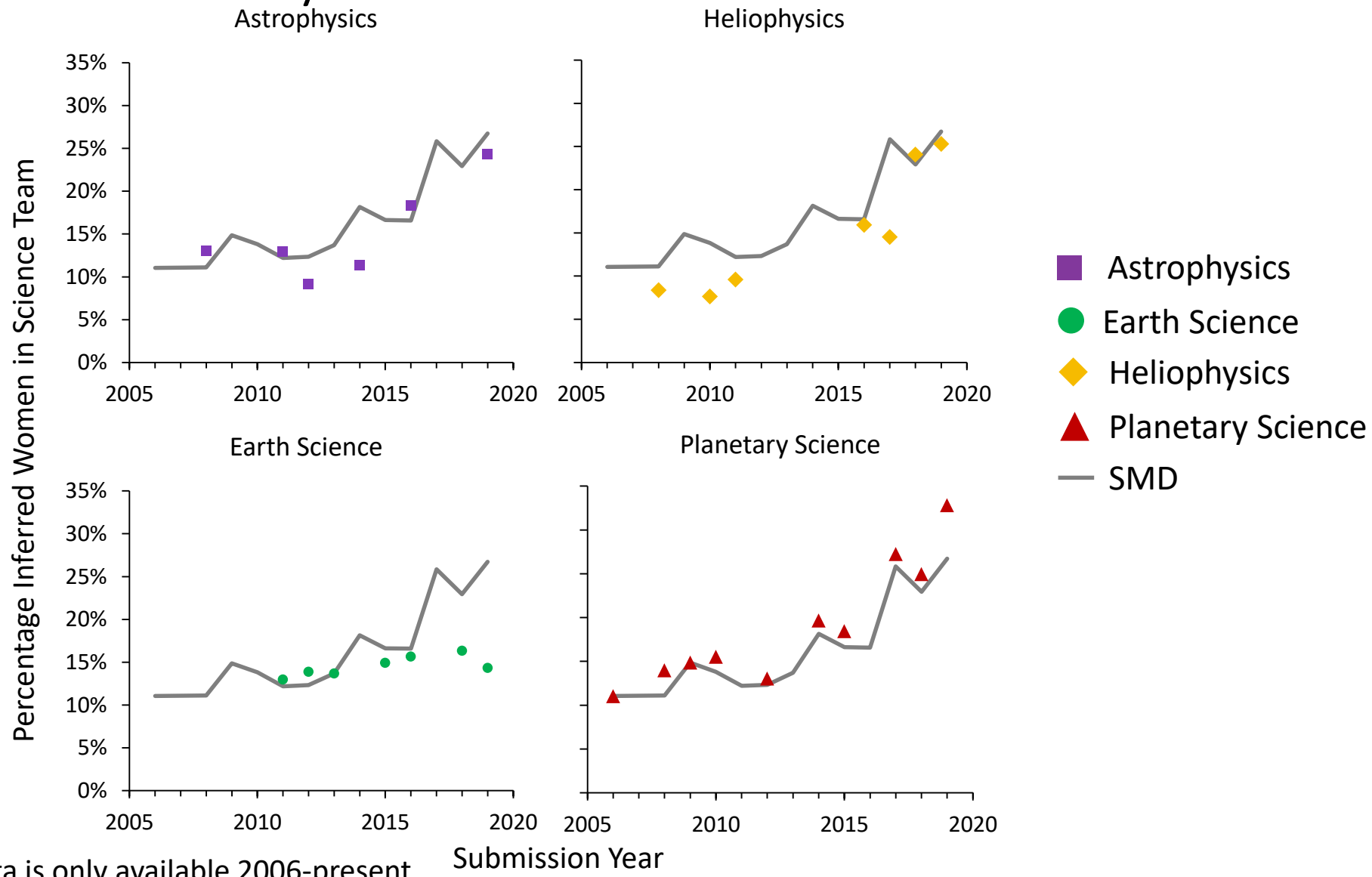
Science Teams: 2006-present AO Participation by Women SMD Divisions by Submission Year



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Summary

- Astrophysics, Earth Science, and Heliophysics AO proposals have generally had few woman PIs. Planetary Science seems to have always had some woman PIs.
  - Excluding Earth Science, the number of PIs that are women have increased since 2016.
  - There are no obvious reasons for the difference between PSD and the other divisions.
- While Astrophysics and Heliophysics have always had some women in AO science team roles, transition to more women in PI roles is more recent and seems to have slightly led the increase in the number of woman PIs
  - All divisions have 16 or more proposals without any inferred women in science roles.
  - No obvious correlation between the size of a science team and the number of women.
- Earth Science PIs and science teams have not experienced the increases in participation by women observed in other SMD divisions.
- The fraction of women in science roles on proposal teams are not significantly different between the four SMD divisions or the five AO size classes.
- Academic age distributions of AO PIs are not significantly different from each other between the four SMD divisions or five AO size classes.
- What's happens next?
  - Compare these data with division ROSES Elements
  - Track AO PI experience to see what prepares a scientist to be an AO PI

Thank You!
Comments? Questions?

Back Up Slides

1996 – present Announcements of Opportunity

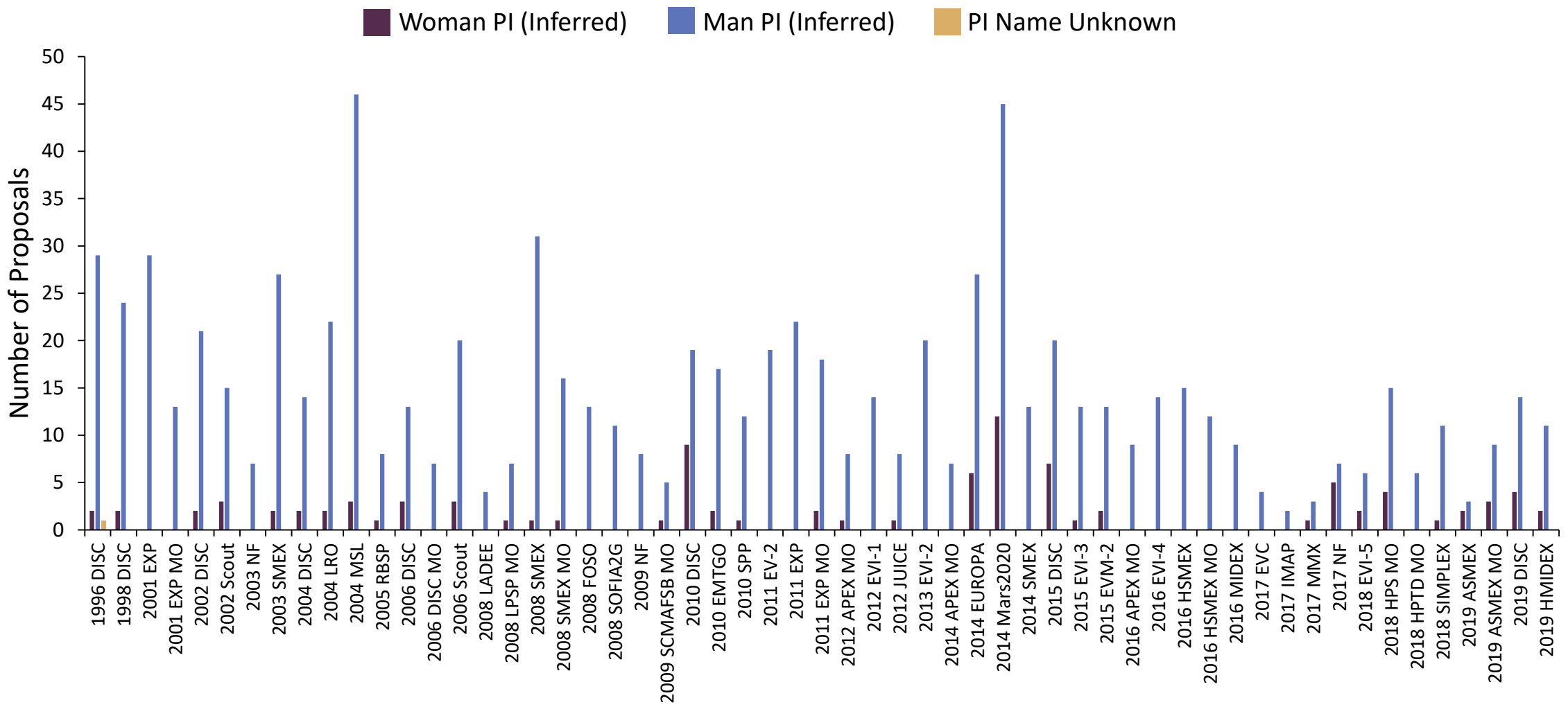
Division	Mission size	Submission year	AO Name
Planetary Science	Medium	1996	1996 Discovery
Planetary Science	Medium	1998	1998 Discovery
Astro/Heliophysics	Small	2001	Explorer 2001
Astro/Heliophysics	MO	2001	2001 Explorer Missions of Opportunity
Planetary Science	Medium	2002	2002 Discovery
Planetary Science	Medium	2002	2002 Scout
Astro/Heliophysics	Small	2003	2003 SMEX
Planetary Science	Large	2003	2003 New Frontiers
Planetary Science	Medium	2004	2004 Discovery
Planetary Science	Instrument	2004	2004 Lunar Reconnaissance Orbiter
Planetary Science	Instrument	2004	2004 Mars Science Laboratory
Heliophysics	Instrument	2005	Radiation Belt Storm Probes
Planetary Science	Medium and MO	2006	Discovery Program 2006 and MO
Planetary Science	Medium and MO	2006	Mars Scout 2006 and MOs
Astrophysics	Instrument	2008	SOFIA Second Generation Instruments Investigations
Astro/Heliophysics	Small and MO	2008	2008 Small Explorer (SMEX), MO, and FOSO
Planetary Science	Instrument	2008	LADEE Dust Instrument
Planetary Science	MO	2008	Lunar and Planetary Science Partner MO
Planetary Science	MO	2008	Small Complete MO in Astrobiology and Fundamental Space Biology
Planetary Science	Large	2009	New Frontiers Announcement of Opportunity 2009
Heliophysics	Instrument	2010	Solar Probe Plus Announcement of Opportunity
Planetary Science	Instrument	2010	ExoMars Trace Gas Orbiter Instruments Investigations
Planetary Science	Medium	2010	Discovery 2010 Announcement of Opportunity
Astro/Heliophysics	Small	2011	Explorer 2011
Astro/Heliophysics	MO	2011	Explorer 2011 Science MO
Earth Science	Small	2011	Earth Venture -2
Astrophysics	MO	2012	2012 Astrophysics Explorer MO
Earth Science	MO	2012	Earth Venture Instrument - 1
Planetary Science	Instrument	2012	Jupiter Icy Moons Explorer Instrument
Earth Science	MO	2013	Earth Venture Instrument - 2
Astrophysics	MO	2014	2014 Astrophysics Explorer MO
Astrophysics	Small	2014	Astrophysics Explorers Program 2014 Small Explorer (SMEX)
Planetary Science	Instrument	2014	Europa Instrument Investigation
Planetary Science	Instrument	2014	Mars 2020 Investigations
Earth Science	Small	2015	Earth Venture Mission - 2 (EVM-2)
Earth Science	MO	2015	Earth Venture Instrument - 3
Planetary Science	Medium	2015	Discovery 2014 Announcement of Opportunity
Astrophysics	MO	2016	2016 Astrophysics Explorers MO
Astrophysics	Medium	2016	Astrophysics Explorers Program 2016 Medium Explorer (MIDEX)
Heliophysics	MO	2016	2016 Heliophysics Explorer MO
Heliophysics	Small	2016	2016 Heliophysics Small Explorer (SMEX) AO
Earth Science	MO	2016	Earth Venture Instrument - 4
Earth Science	MO	2017	Earth Venture Continuity -1 (EVC1)
Planetary Science	Instrument	2017	MMX Neutron and Gamma-Ray Spectrometer Investigation
Planetary Science	Large	2017	New Frontiers 4
Heliophysics	MO	2018	2018 Heliophysics Science MO
Heliophysics	MO	2018	2018 Heliophysics Technology Demonstration MO
Earth Science	MO	2018	Earth Venture Instrument - 5
Planetary Science	MO	2018	Small Innovative Missions for Planetary Exploration
Astrophysics	MO	2019	2019 Astrophysics Explorers MO
Astrophysics	Small	2019	2019 Astrophysics Small Explorer (SMEX) AO
Heliophysics	Medium	2019	Heliophysics Explorers Program 2019 MIDEX AO
Planetary Science	Medium	2019	2019 Discovery Program AO

How Many Proposals Submitted?

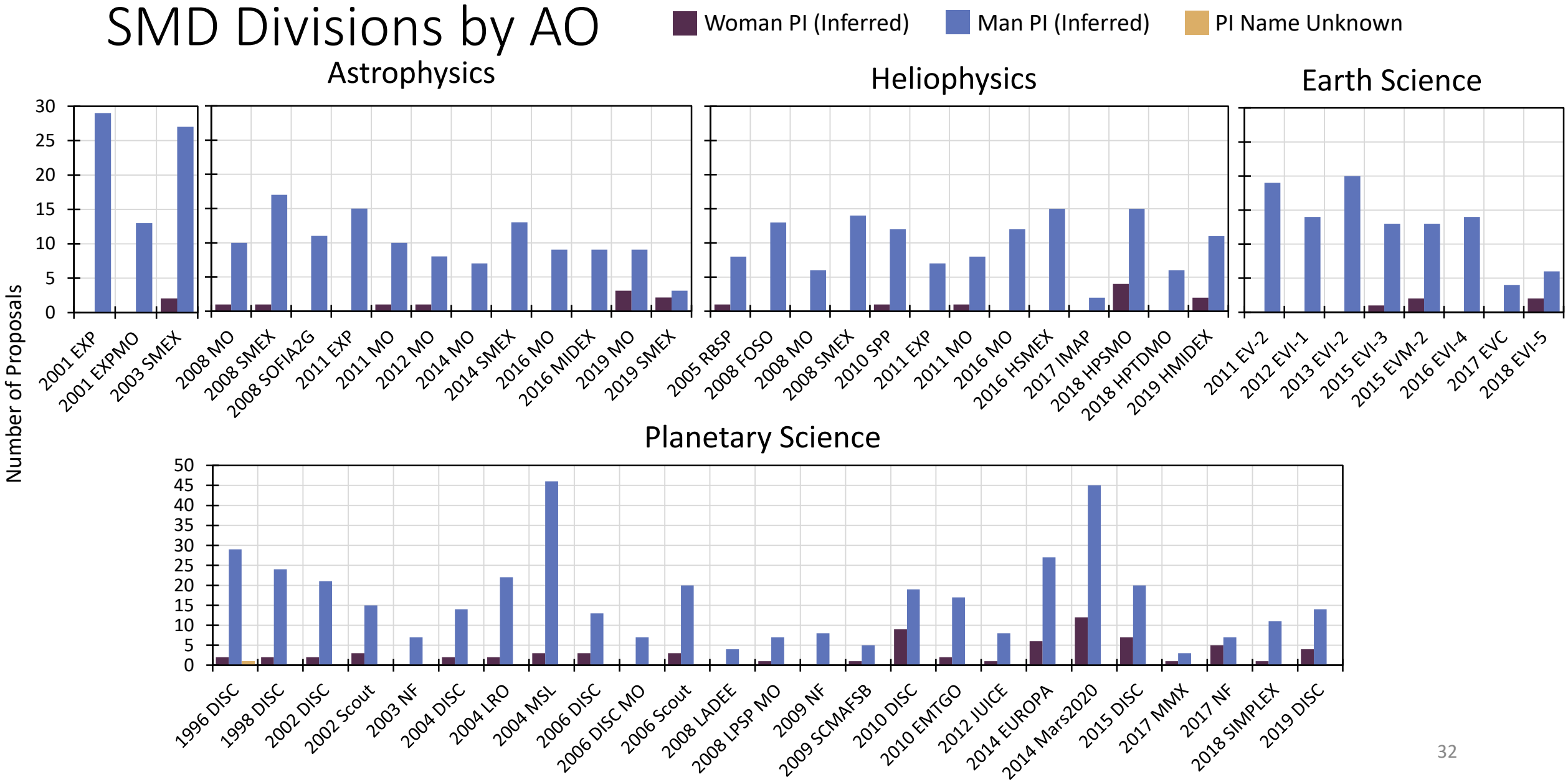
Mission Size	Number of Calls *	Total Number of Proposals Submitted	Average Number of Proposals Submitted	Selection Rate with Tech Development	Selection Rate without Tech Development
Instrument	11	232	21	20%	20%
MO	18	249	14	21%	19%
Small	9	179	20	19%	18%
Medium	12	248	21	19%	18%
Large	3	25	8	36%	28%
Overall	53	933	18	20%	19%

* Some Calls include more than one mission size

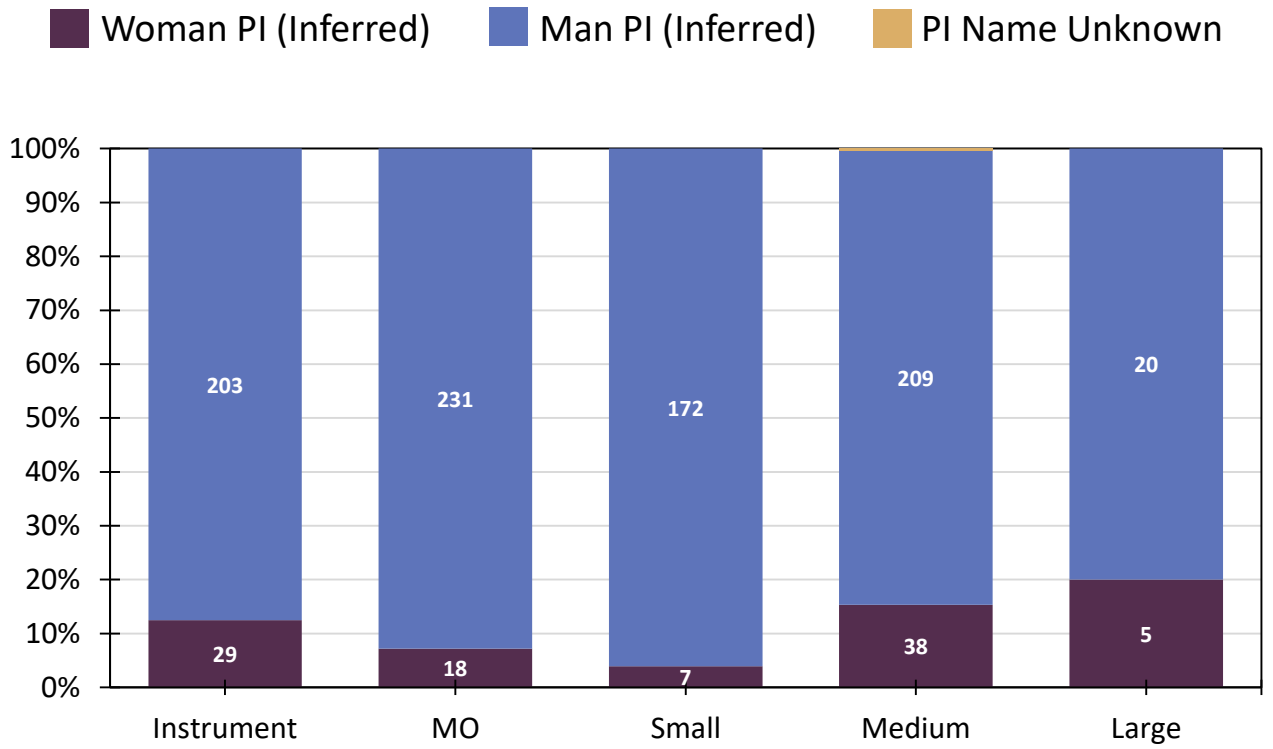
PI Inferred Gender: 1996-present AO Submissions Across SMD by AO



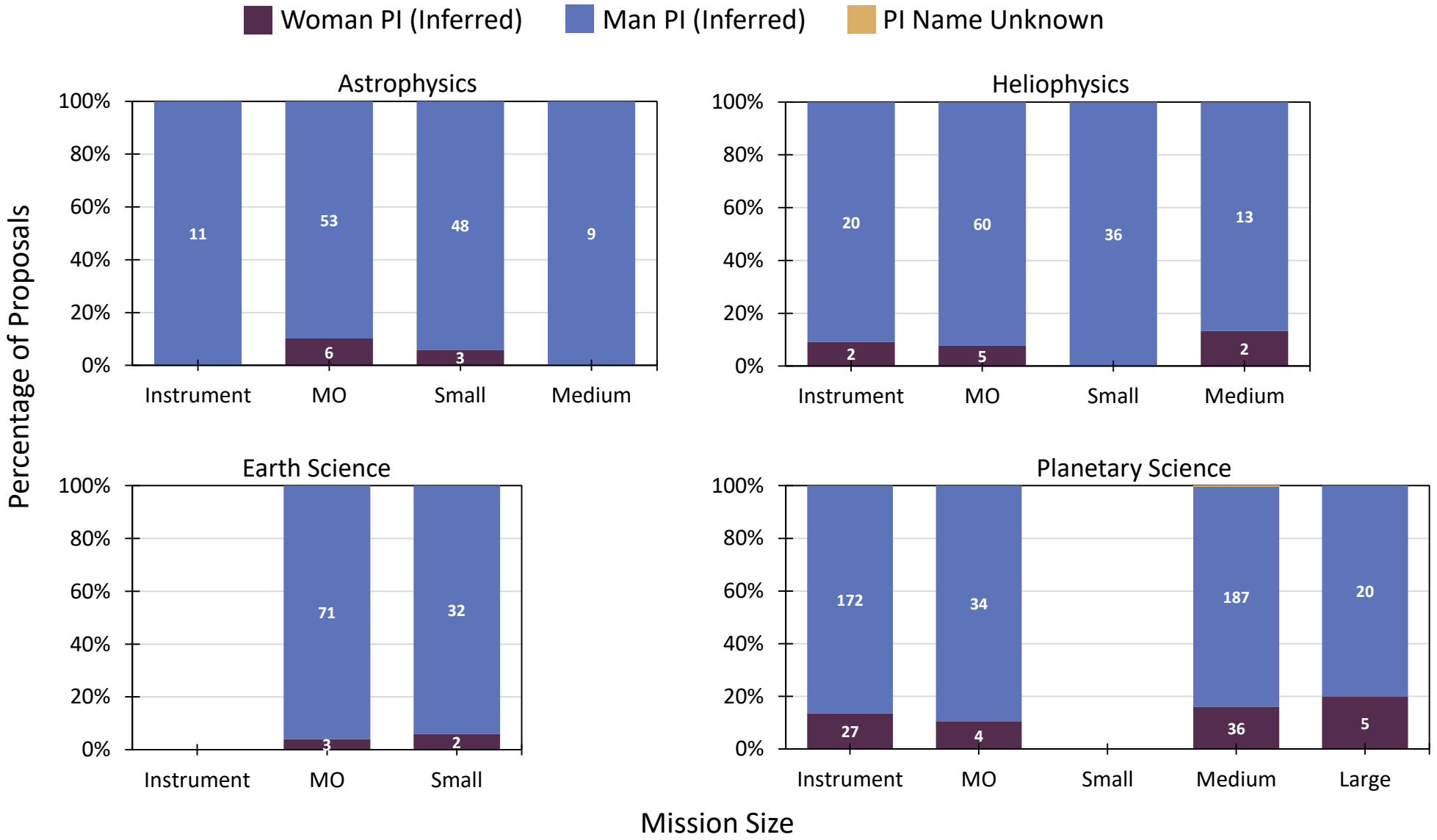
PI Inferred Gender: 1996-present AO Submissions SMD Divisions by AO



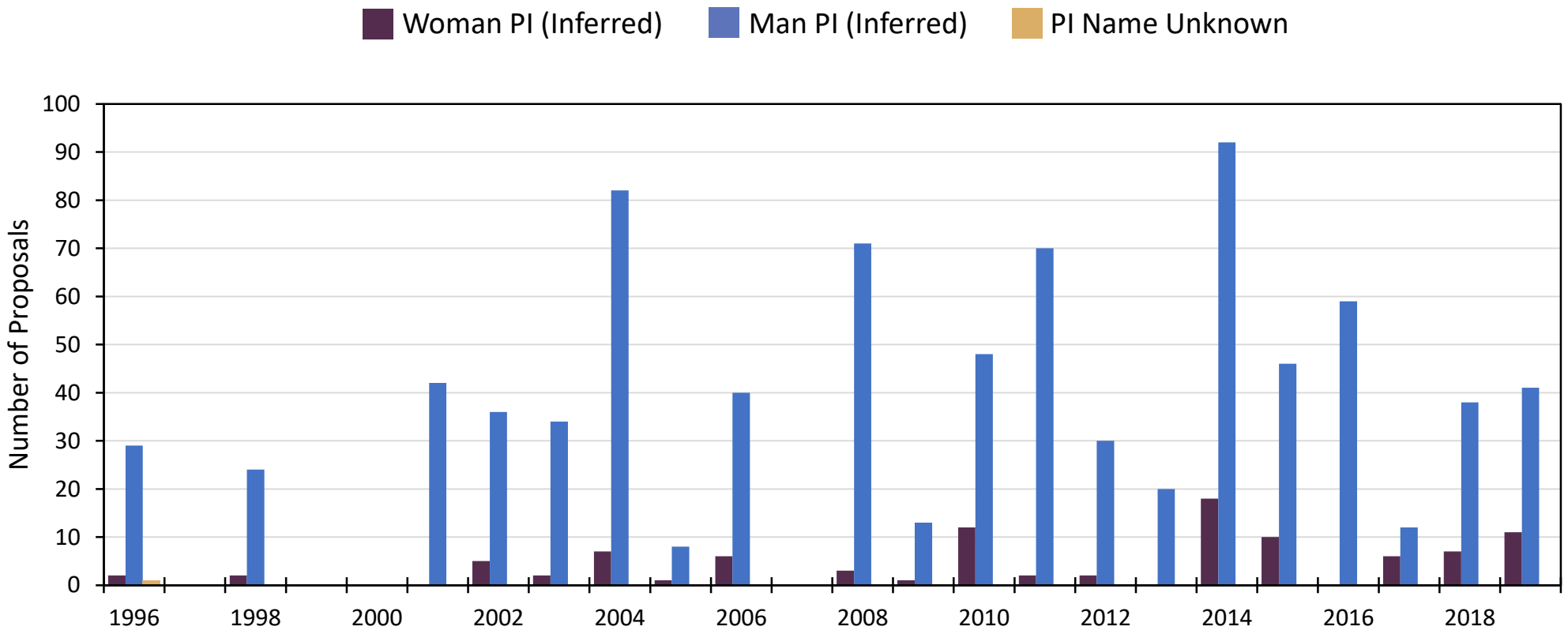
PI Inferred Gender: 1996-present AO Submissions Across SMD by Mission Size



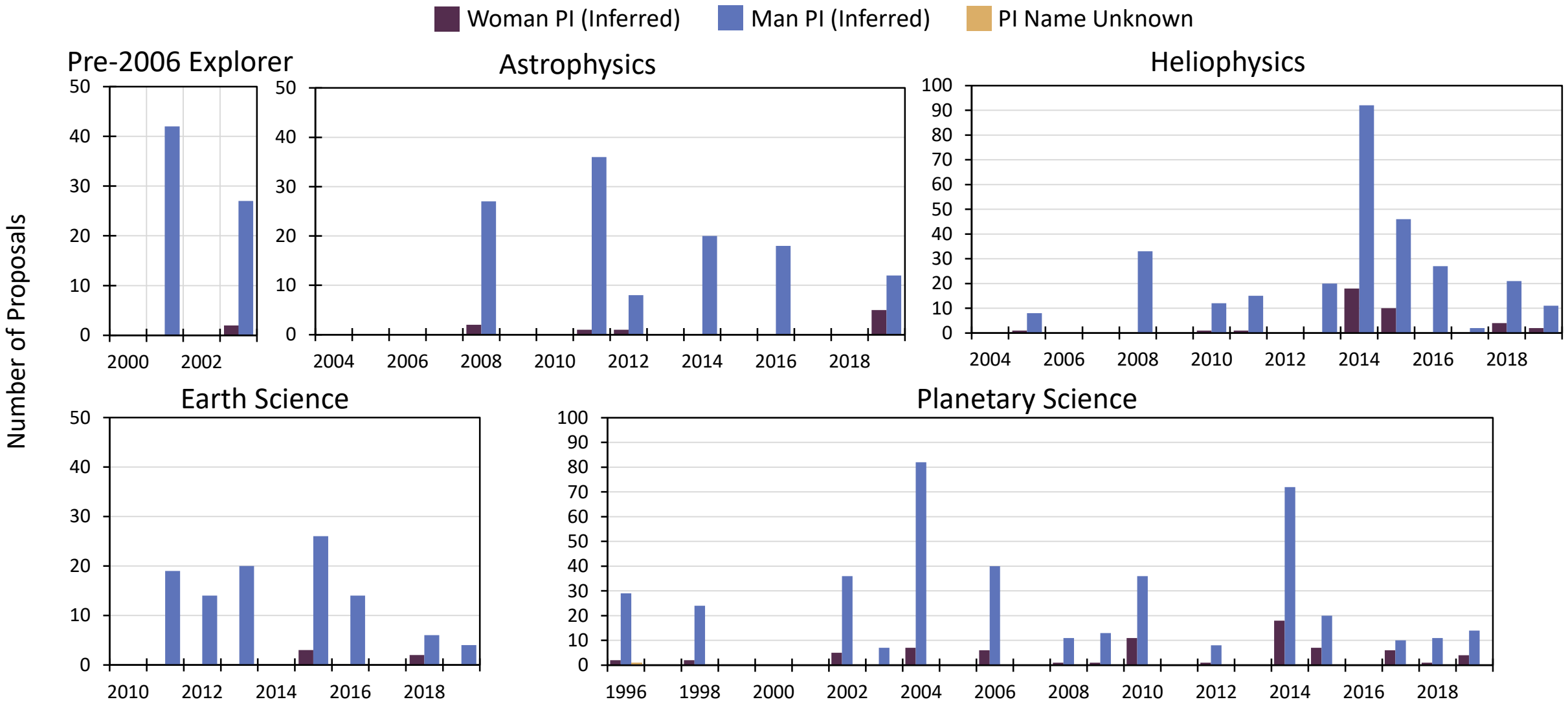
PI Inferred Gender: 1996-present AO Submissions
SMD Divisions by Mission Size



PI Inferred Gender: 1996-present AO Submissions Submission Year Across SMD



PI Inferred Gender: 1996-present AO Submissions Submission Year by SMD Division



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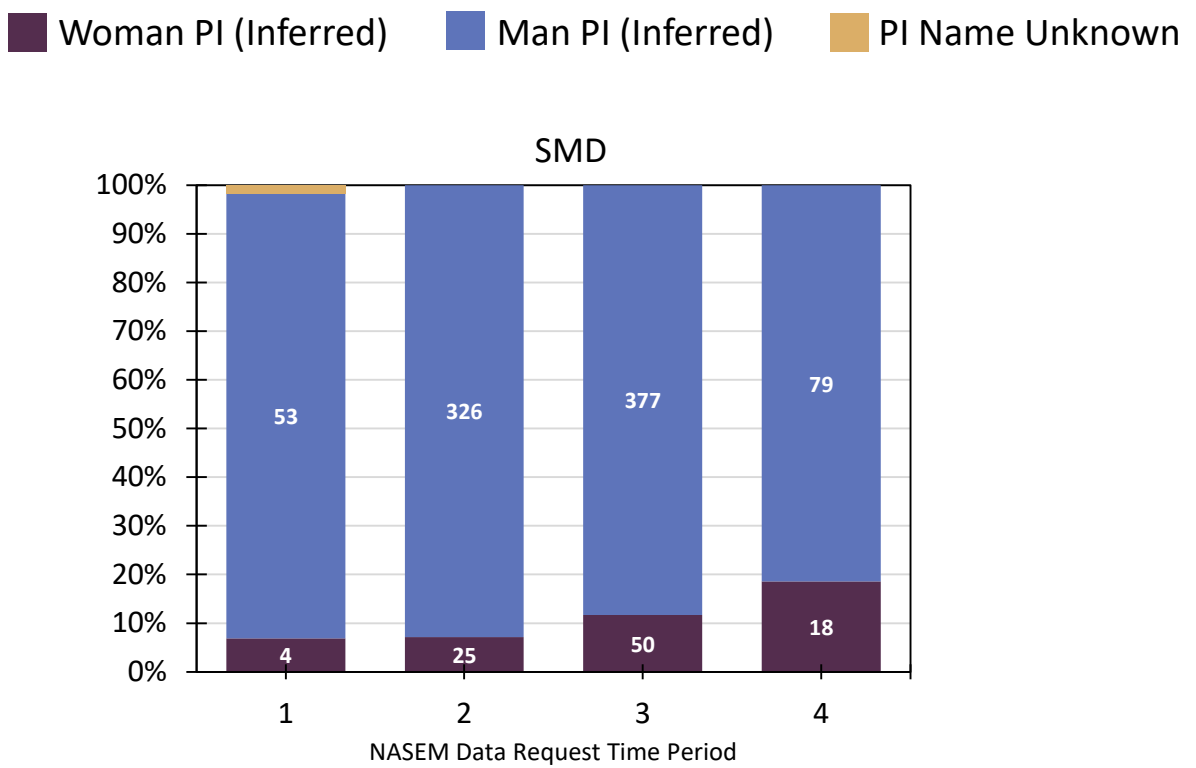
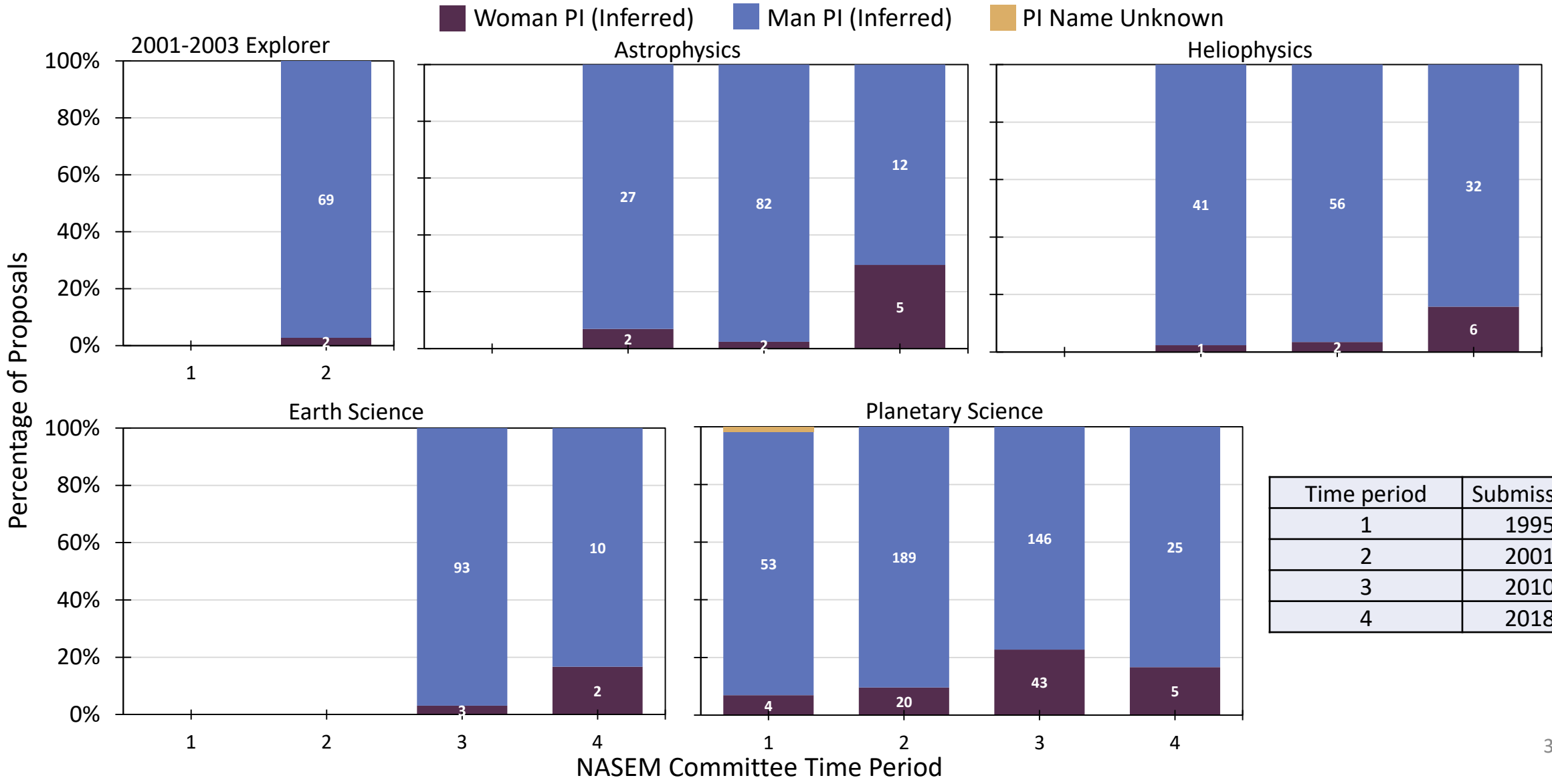
PI Inferred Gender: 1996-present AO Submissions Time Period Across SMD



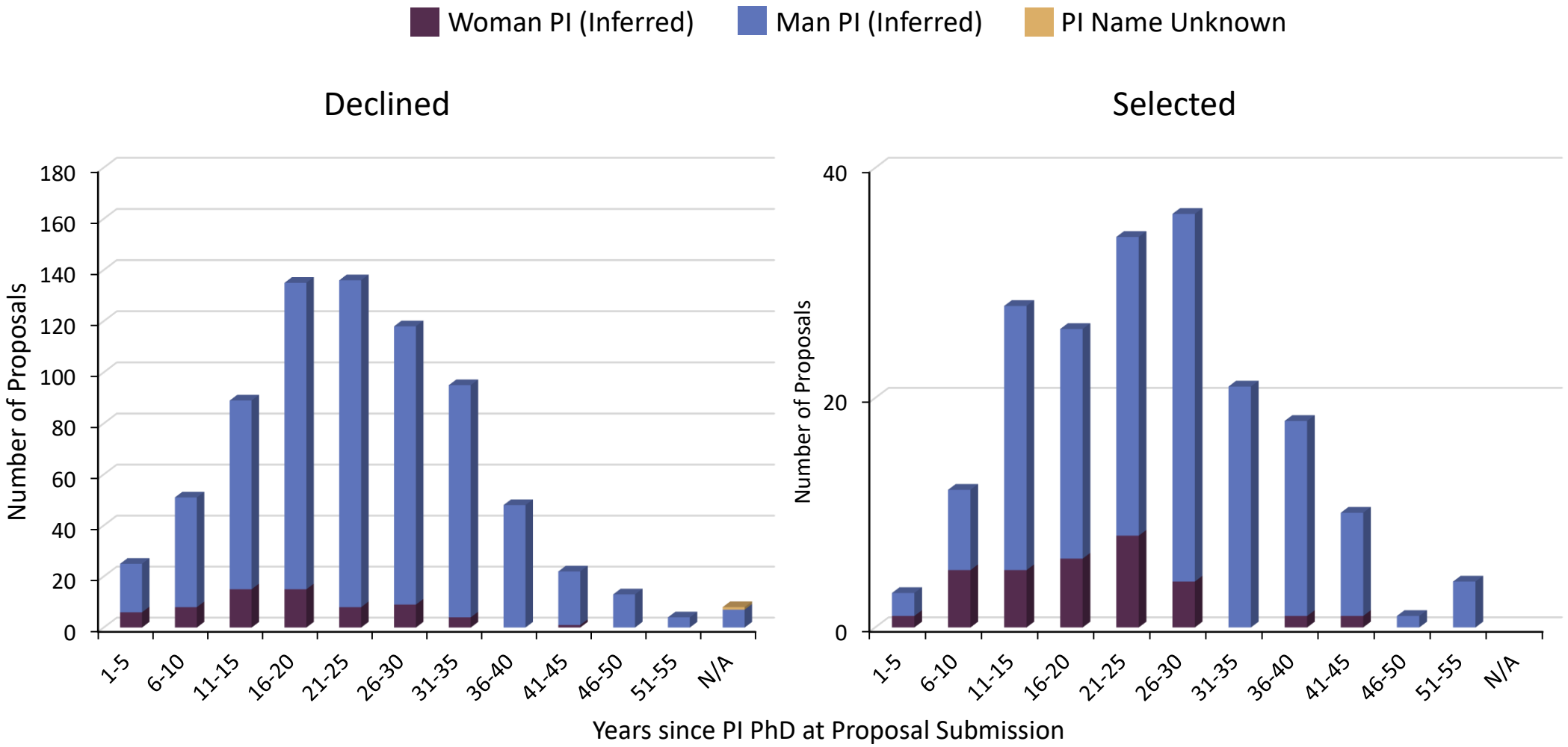
Time period	Submission Years
1	1995-2000
2	2001-2009
3	2010-2017
4	2018-2019

PI Inferred Gender: 1996-present AO Submissions Time Period for SMD Divisions

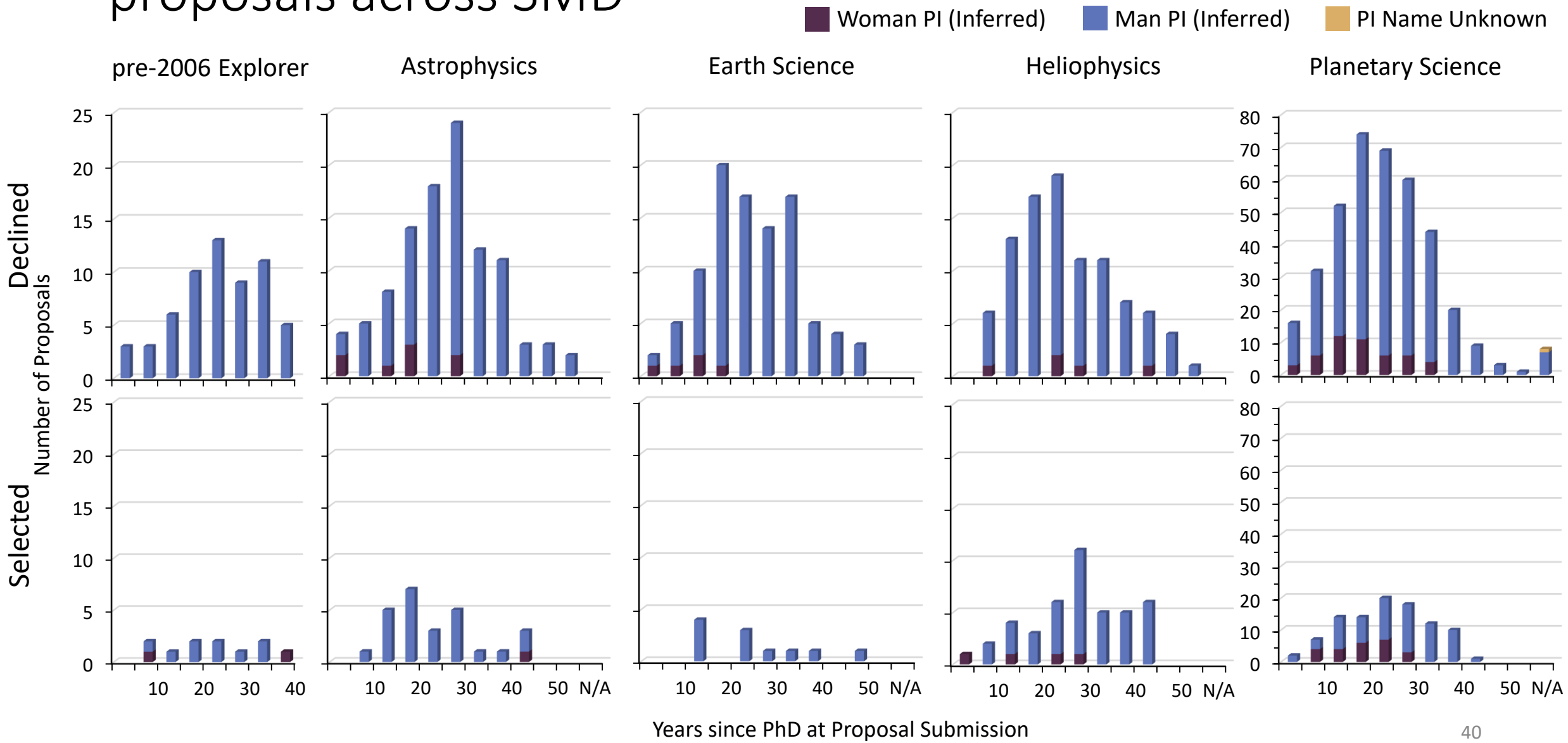


Time period	Submission Years
1	1995-2000
2	2001-2009
3	2010-2017
4	2018-2019

PI Academic Age:1996-present AO Selected/Declined Across SMD



PI Academic Age: 1996-present Declined and Selected AO proposals across SMD



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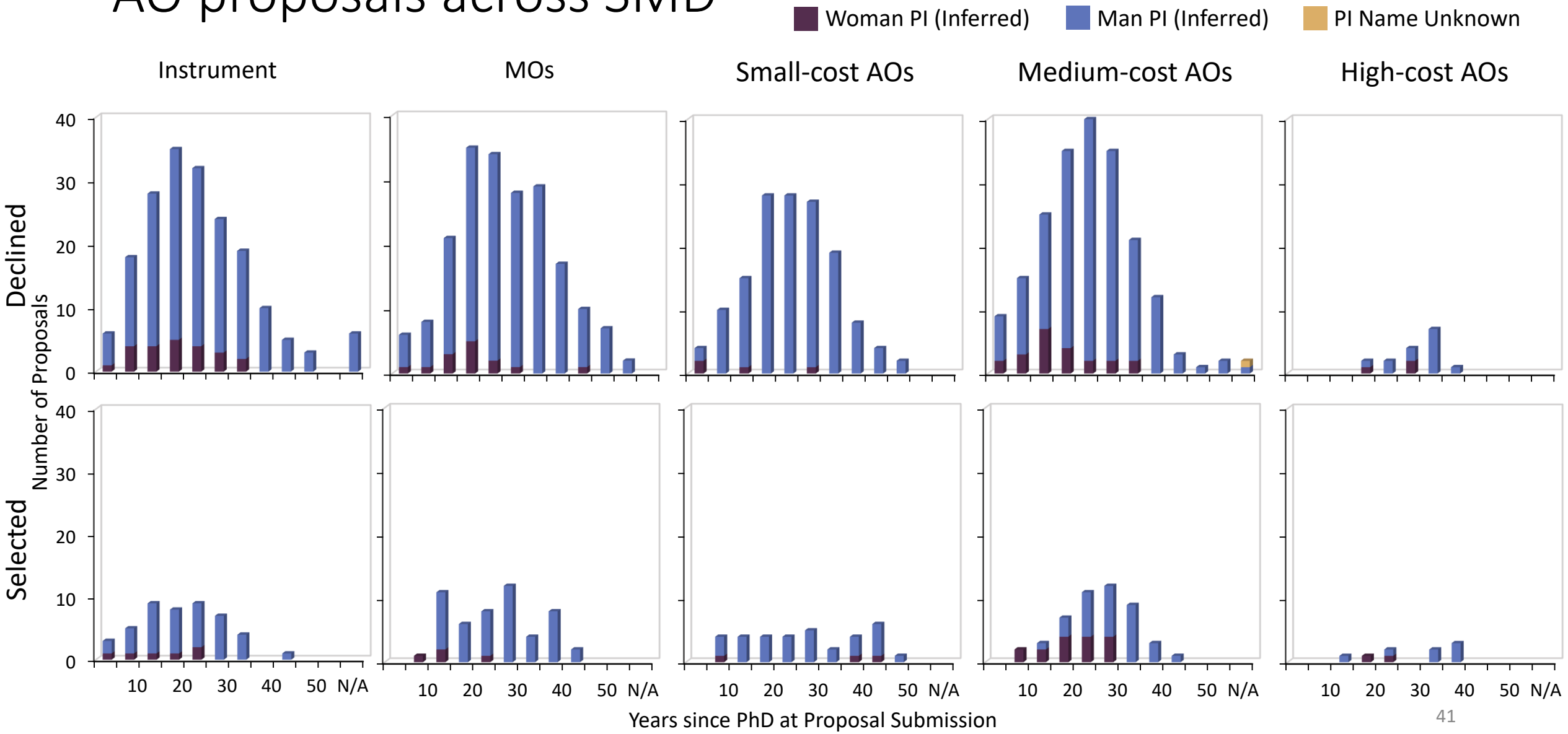
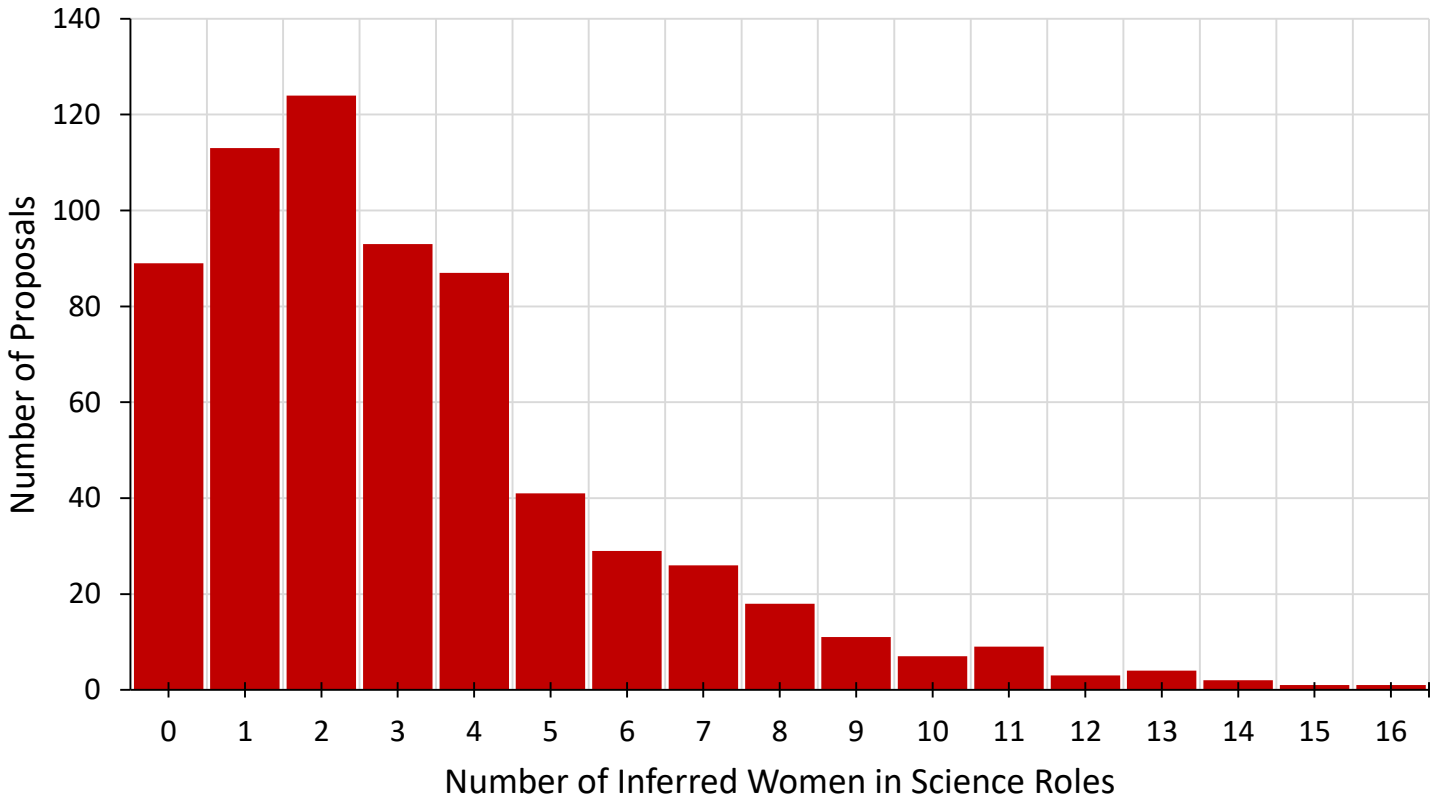


Science Teams: 2006-present AO Participation by Women Across SMD



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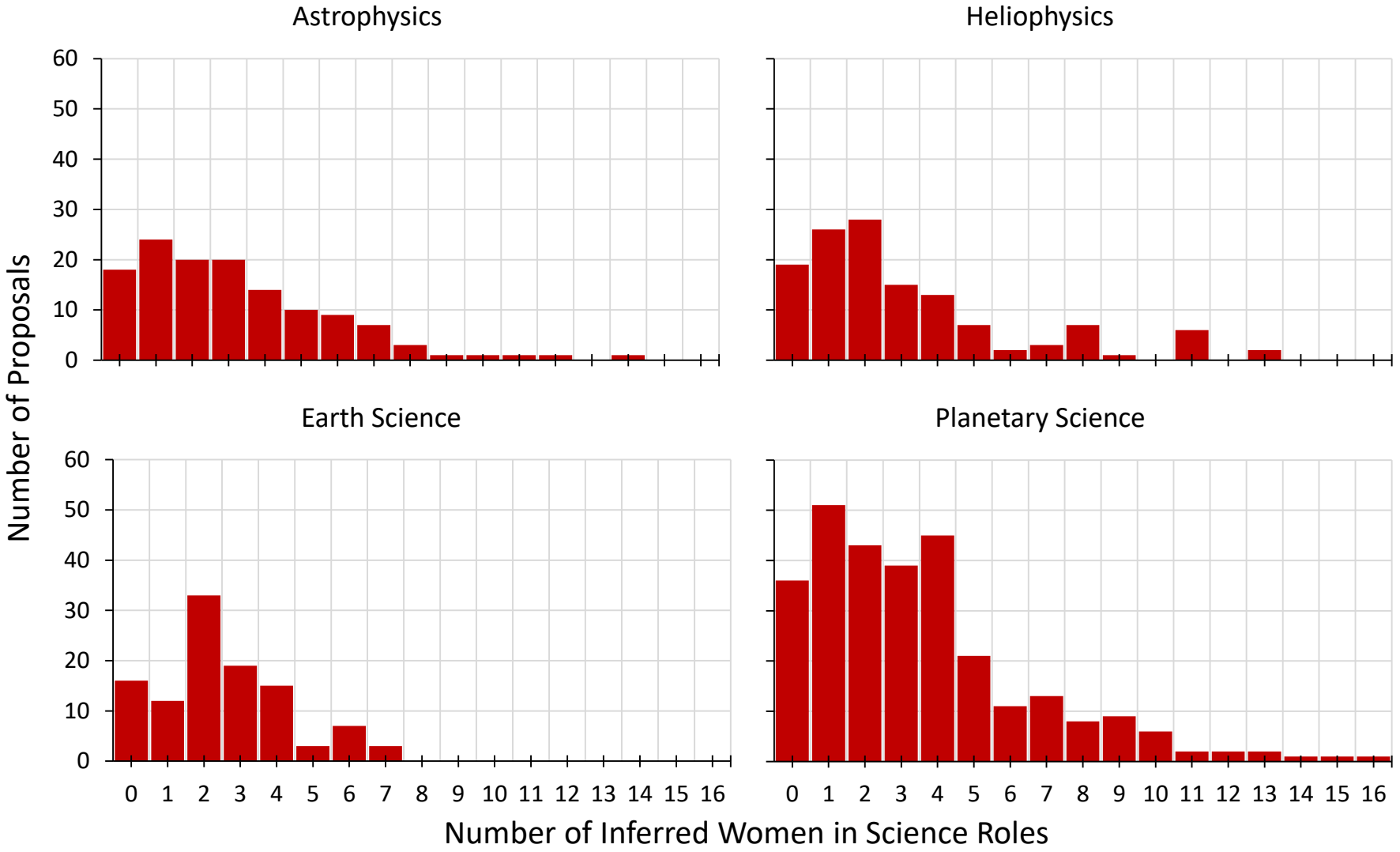

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