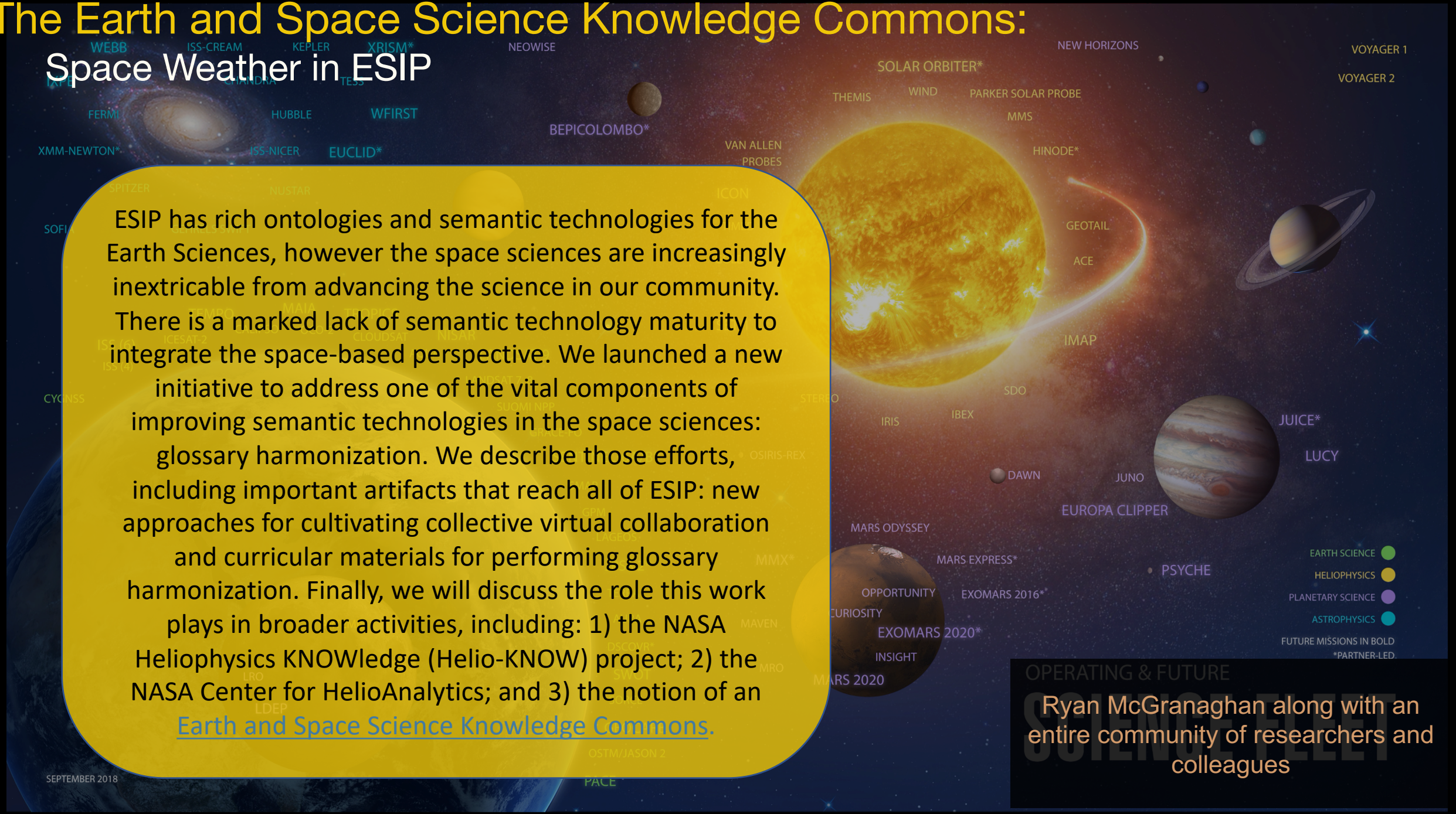
The Earth and Space Science Knowledge Commons:

Space Weather in ESIP

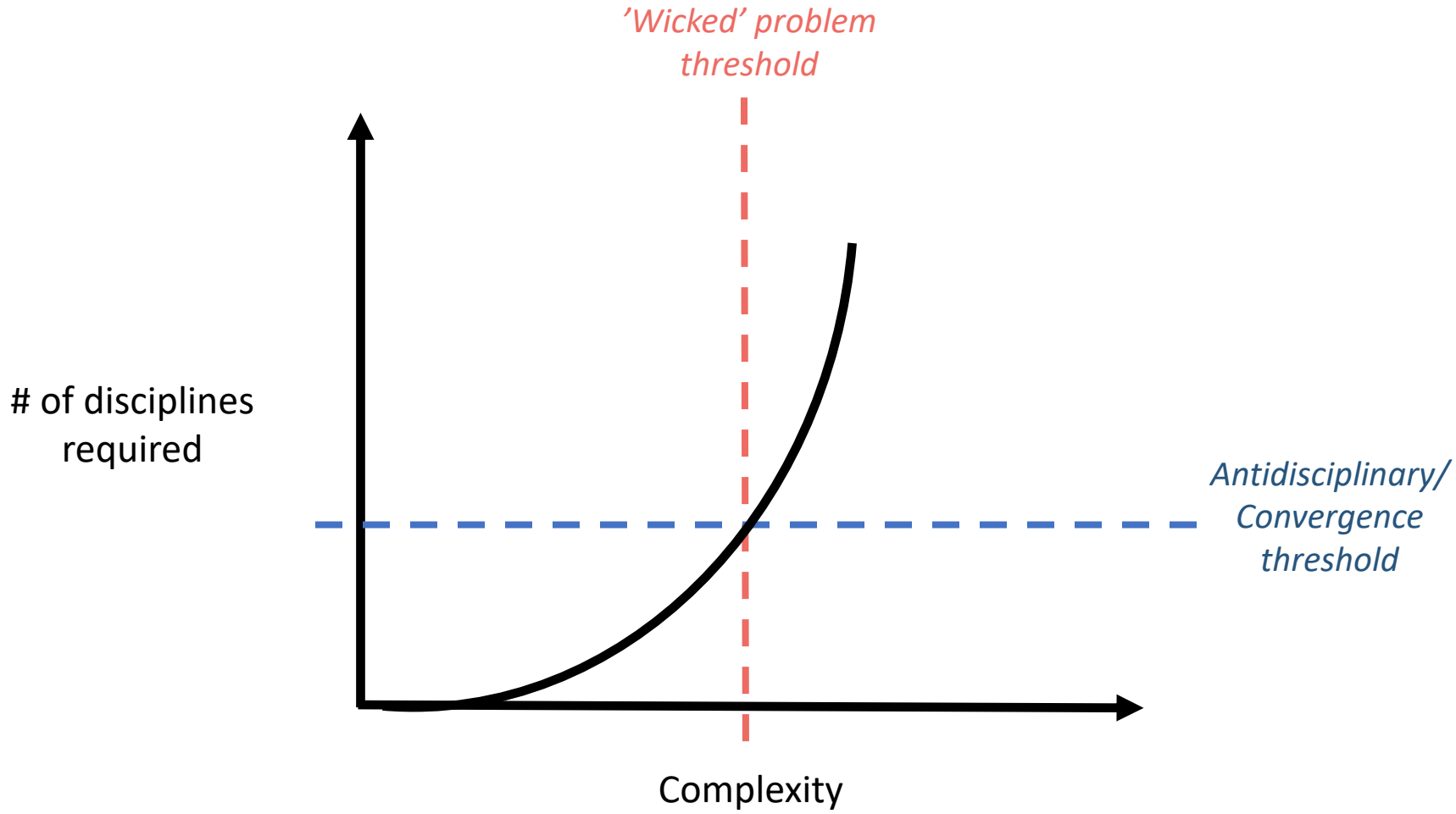


ESIP has rich ontologies and semantic technologies for the Earth Sciences, however the space sciences are increasingly inextricable from advancing the science in our community. There is a marked lack of semantic technology maturity to integrate the space-based perspective. We launched a new initiative to address one of the vital components of improving semantic technologies in the space sciences: glossary harmonization. We describe those efforts, including important artifacts that reach all of ESIP: new approaches for cultivating collective virtual collaboration and curricular materials for performing glossary harmonization. Finally, we will discuss the role this work plays in broader activities, including: 1) the NASA Heliophysics KNOWledge (Helio-KNOW) project; 2) the NASA Center for HelioAnalytics; and 3) the notion of an Earth and Space Science Knowledge Commons.

OPERATING & FUTURE SCIENCE FLEET

Ryan McGranaghan along with an entire community of researchers and colleagues

The new 'problem-scape' for Earth and Space Sciences: increasingly interconnected and requires 'antidisciplinary' approaches (not against disciplines, but the spaces between them)

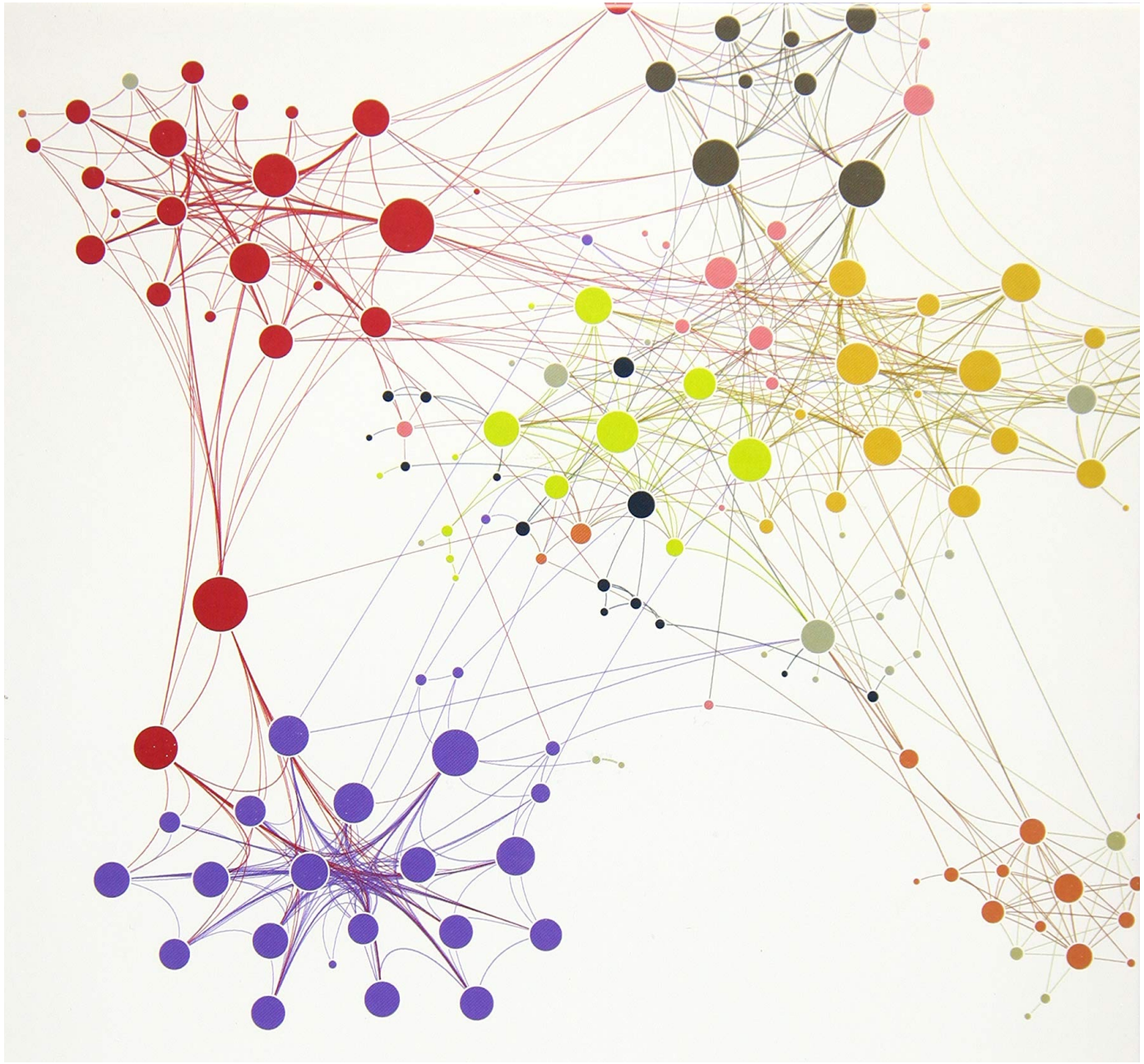


“

The most fruitful areas for the growth of the sciences were those which had been neglected as a no-man's land between the various established fields.

”

- Norbert Weiner, *Cybernetics* [1961]



Albert-László Barabási

Open Science

> *Open science is transparent and accessible knowledge that is shared and developed through collaborative networks*

\- Vicente-Saez & Martinez-Fuentes [2018]

Open Science

“

*Open science is **transparent and accessible knowledge** that is shared and developed through **collaborative networks***

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- Vicente-Saez & Martinez-Fuentes [2018]

Intelligent and accessible data infrastructure and the platform to use it

Participatory ecosystem of knowledge sharing, governance, and trust

Open Science

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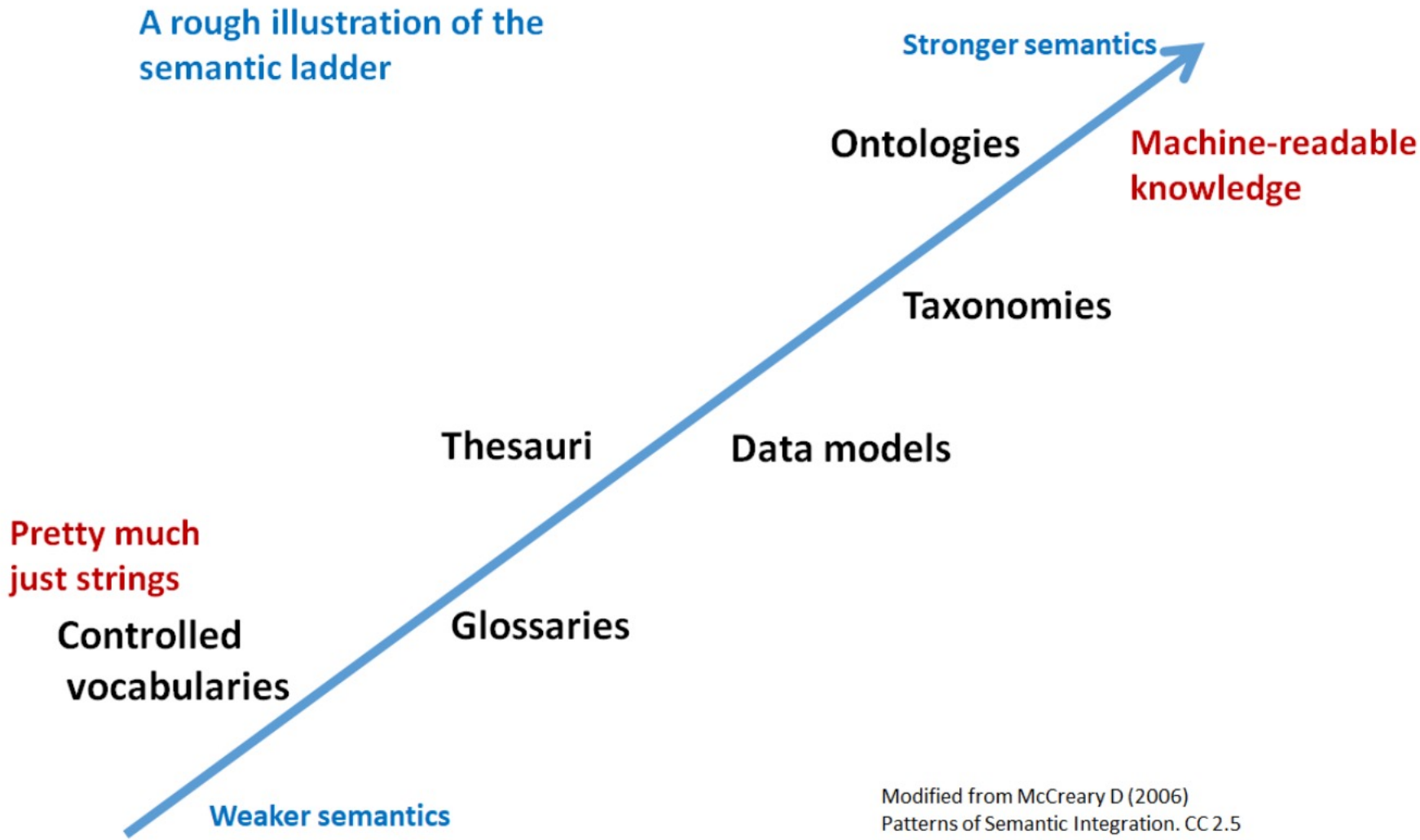
- Vicente-Saez & Martinez-Fuentes [2018]

Intelligent and accessible data infrastructure and the platform to use it

Participatory ecosystem of knowledge sharing, governance, and trust

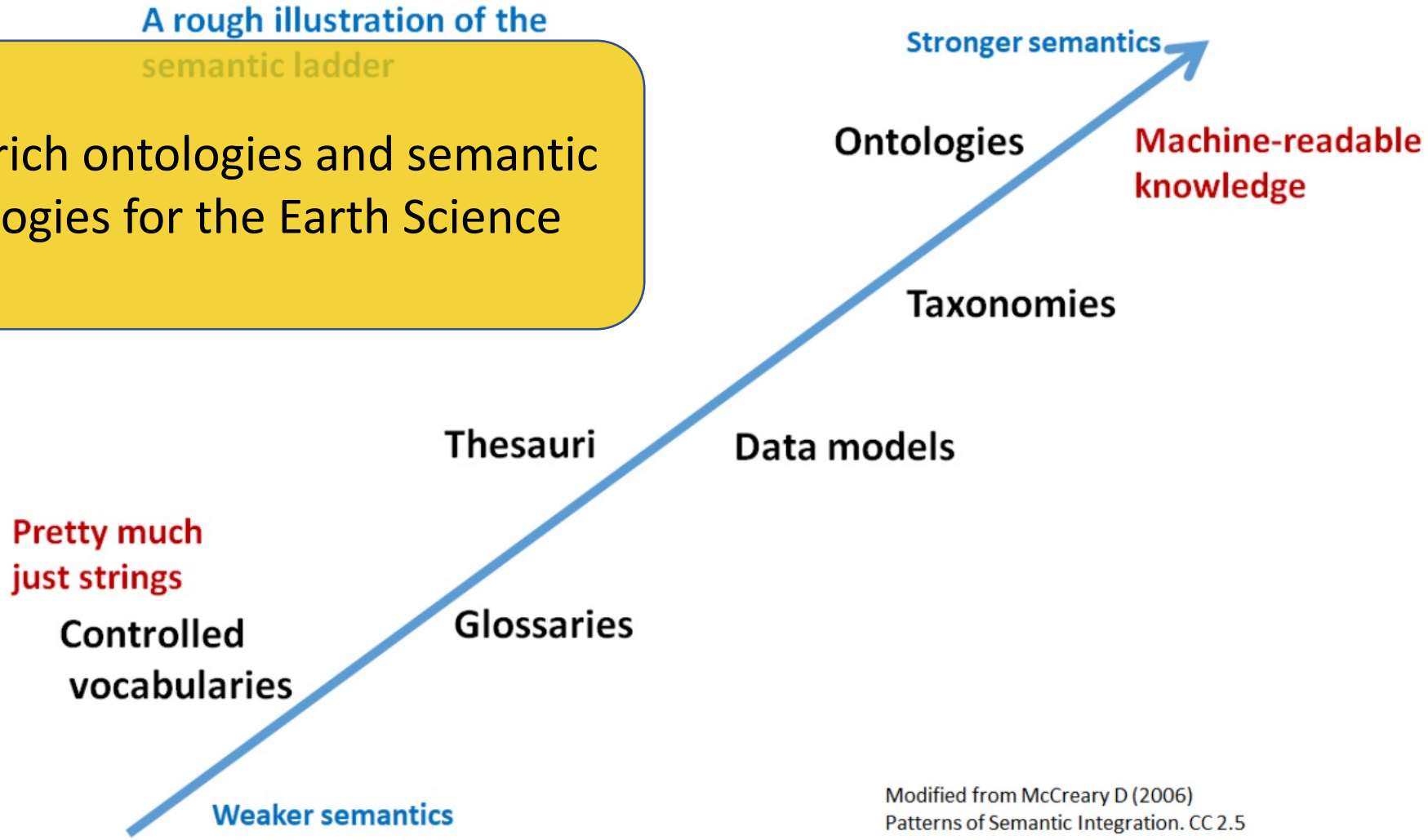
Together: A knowledge *commons*

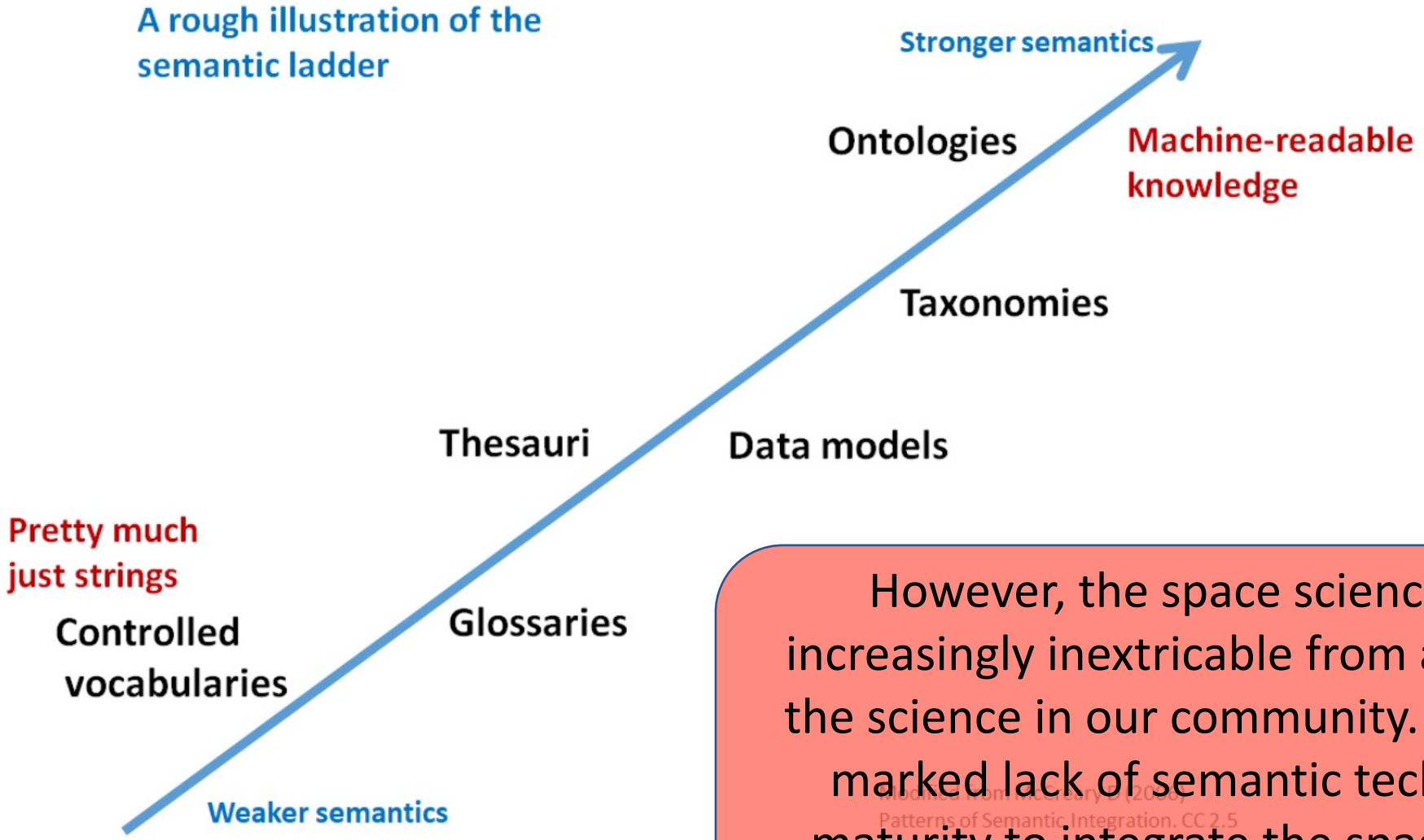
How do we get to a ***Knowledge Commons*** and ***Open Science***?



Modified from McCreary D (2006) Patterns of Semantic Integration. CC 2.5

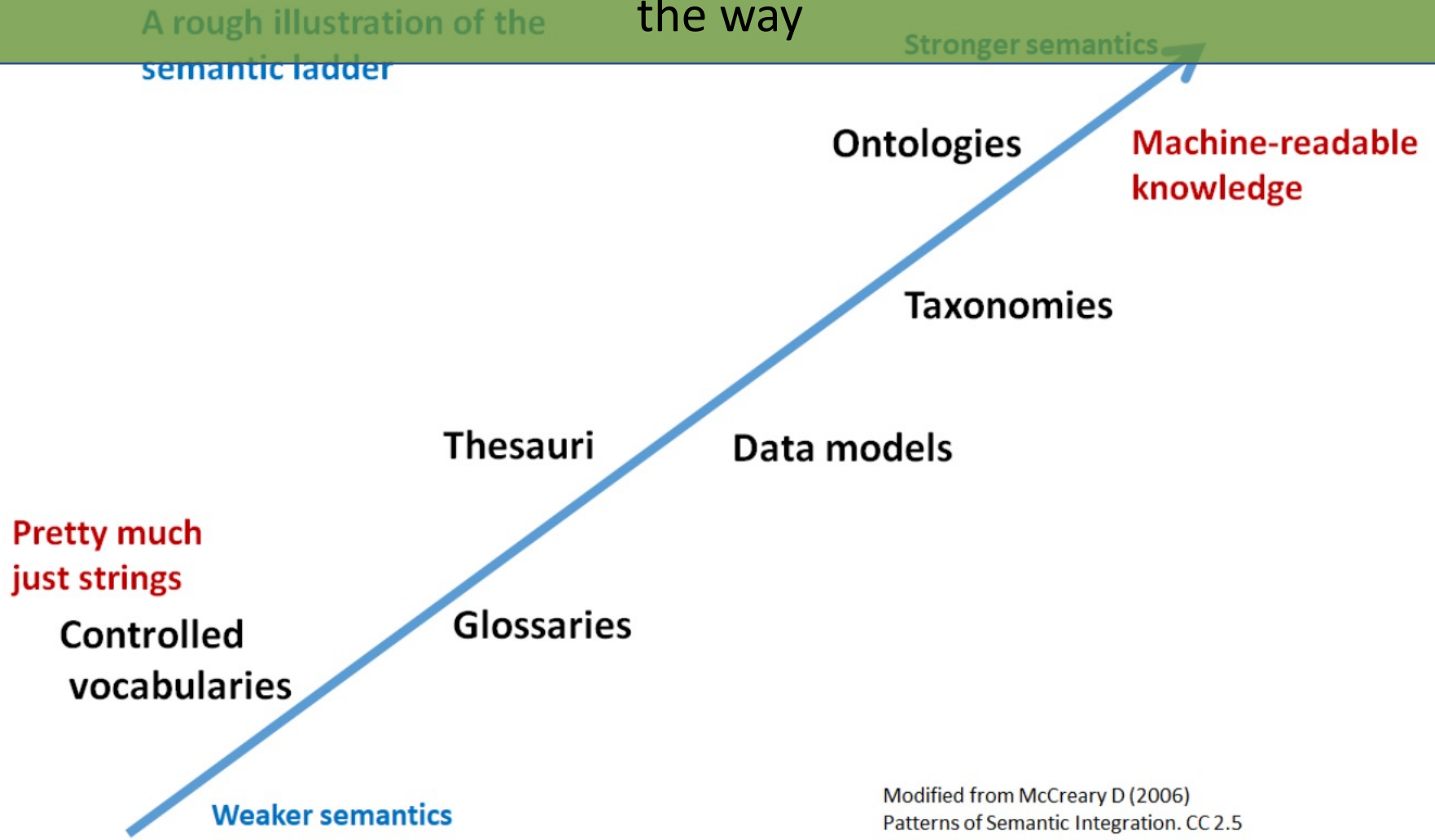
ESIP has rich ontologies and semantic technologies for the Earth Science



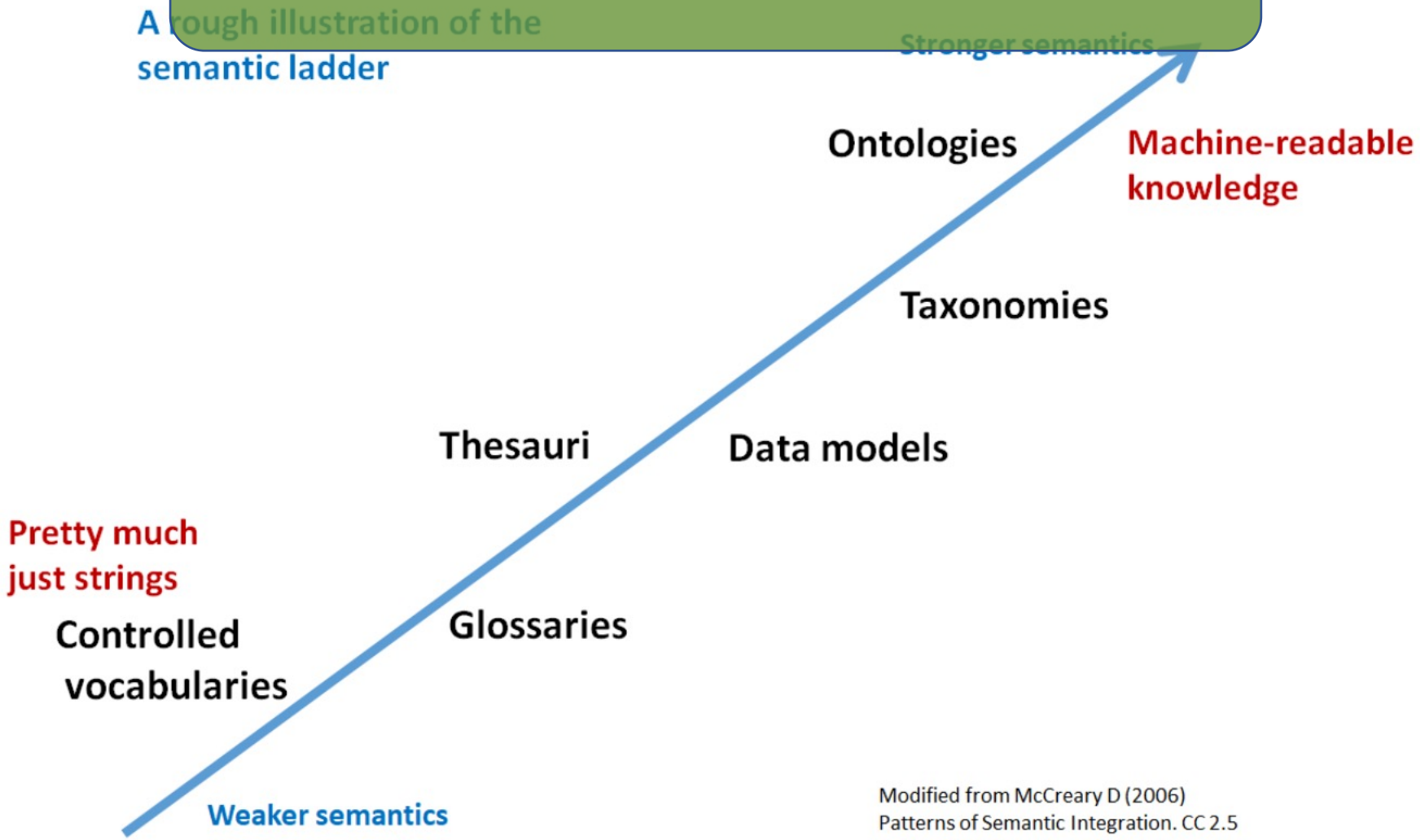


However, the space sciences are increasingly inextricable from advancing the science in our community. There is a marked lack of semantic technology maturity to integrate the space-based perspective

We are climbing the semantic ladder for the space sciences, producing ontologies, knowledge graphs, usable artifacts, and curricular materials along the way



First, why space science and space weather?



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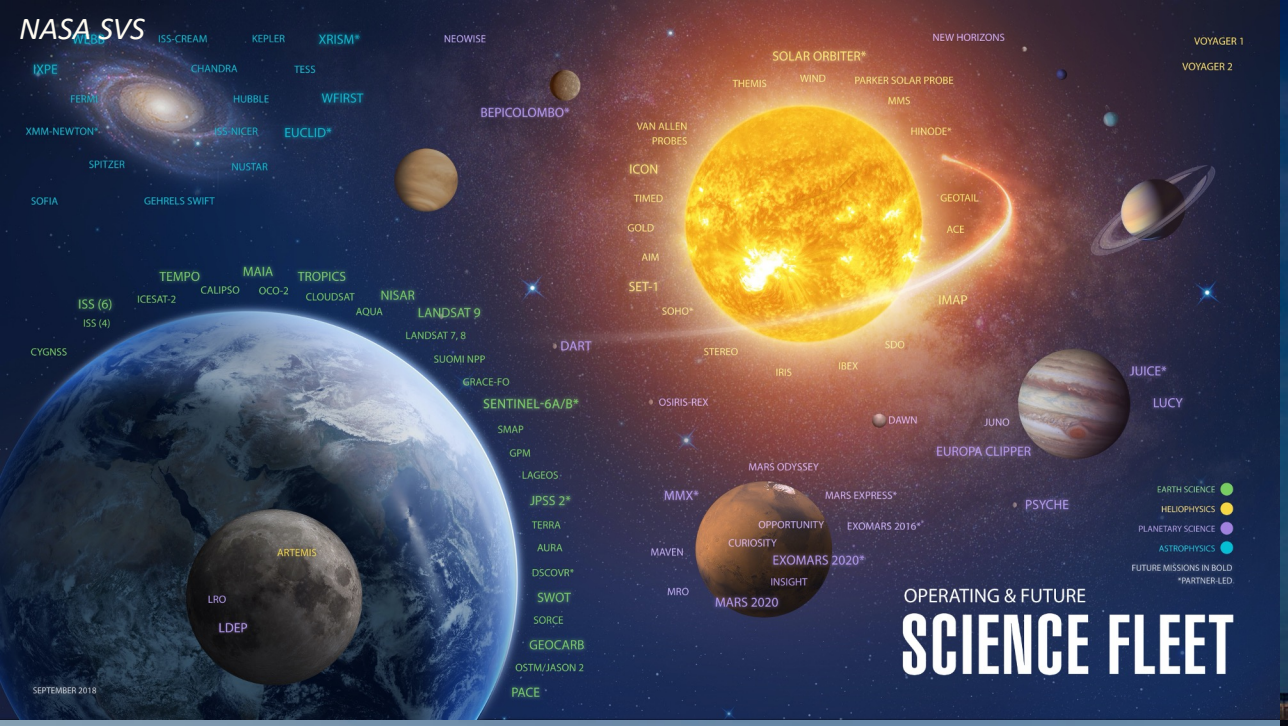
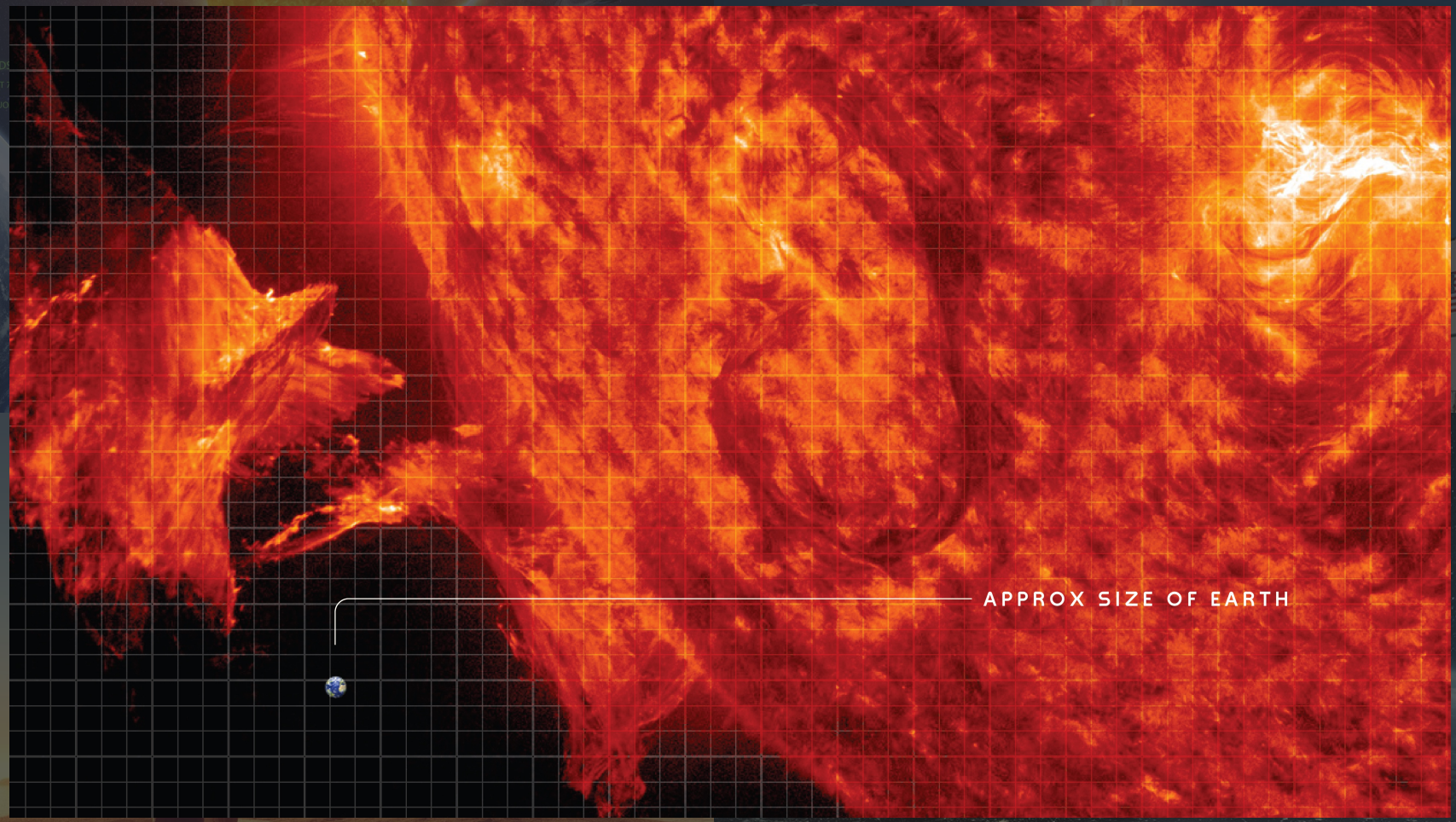


Space data have become entangled in every facet of our lives.

NASA SVS

SpaceX



We live with a star and the complex interactions of the solar energy and variability with our space environment inextricably link our daily lives to the space environment

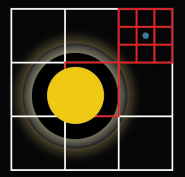
SETI Institute

Geographical Magazine

The potential hazards of a space weather storm are sobering

"SOLAR "SUPERSTORM" JUST MISSED EARTH IN 2012"

CBS NEWS



"NASA: WORLD WAS ALMOST PLUNGED INTO DARKNESS AFTER NEAR MISS WITH HUGE SOLAR STORM IN 2012"

INTERNATIONAL BUSINESS TIMES

"SOLAR FLARE ALMOST SENT EARTH BACK TO THE DARK AGES IN 2012"

NBC NEWS

NASA SVS

SpaceX

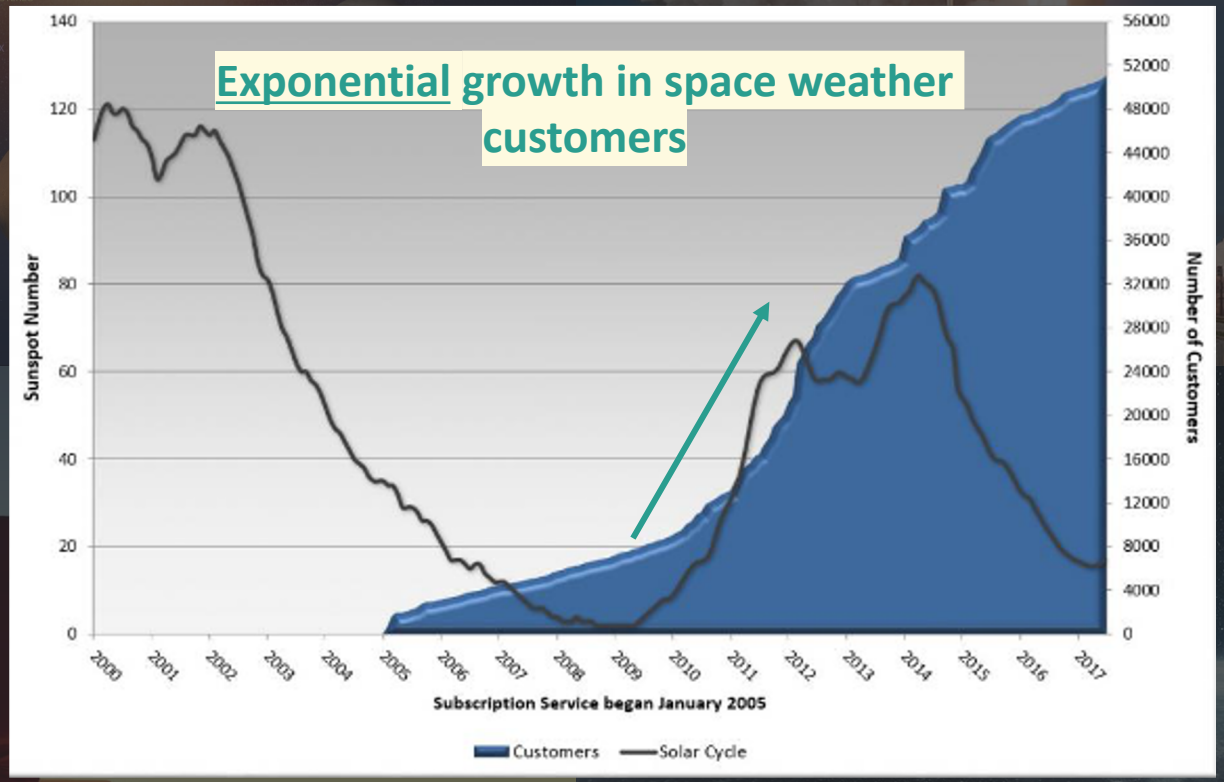
SETI Institute

Geographical Magazine

NASA SVS

SpaceX

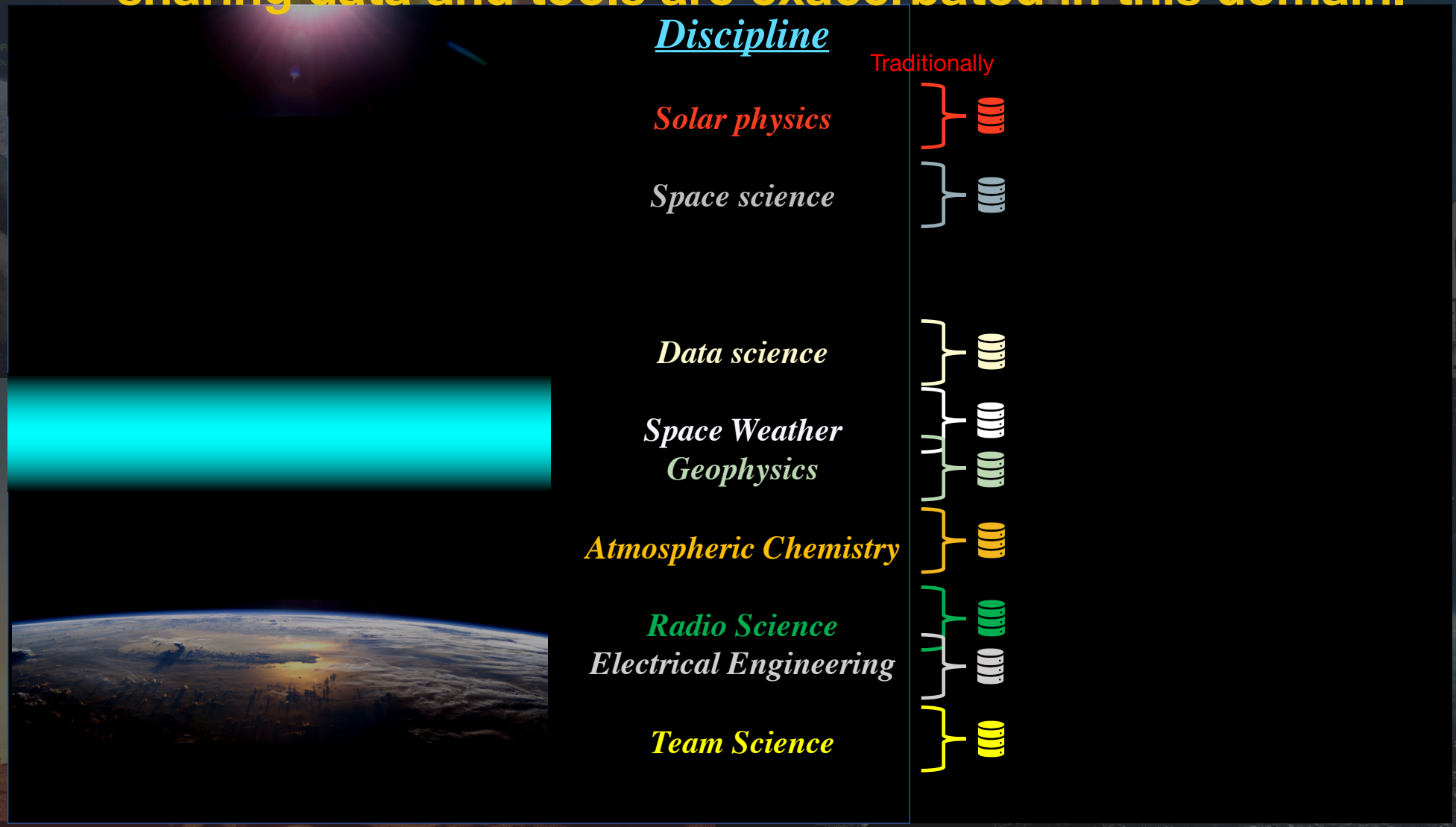
From space weather near misses and many events that have not missed us, more industries, groups, and individuals are realizing that their well-being is affected by space weather



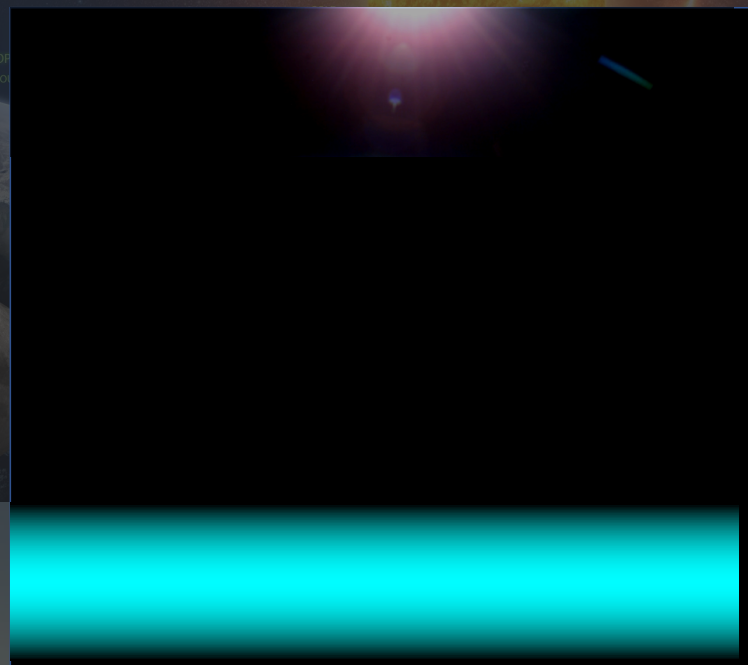
SETI Institute

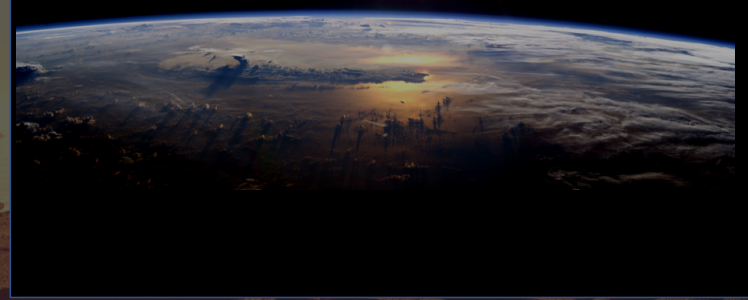
Geographical Magazine

Space Weather is inherently multidisciplinary. What that means is that all the traditional problems in collaborating across communities and in sharing data and tools are exacerbated in this domain.



We need to network the pockets of progress across space weather and integrate them with the Earth Sciences → semantic technologies





Discipline

Traditionally

Solar physics

Space science

Data science

Space Weather
Geophysics

Atmospheric Chemistry

Radio Science
Electrical Engineering

Team Science

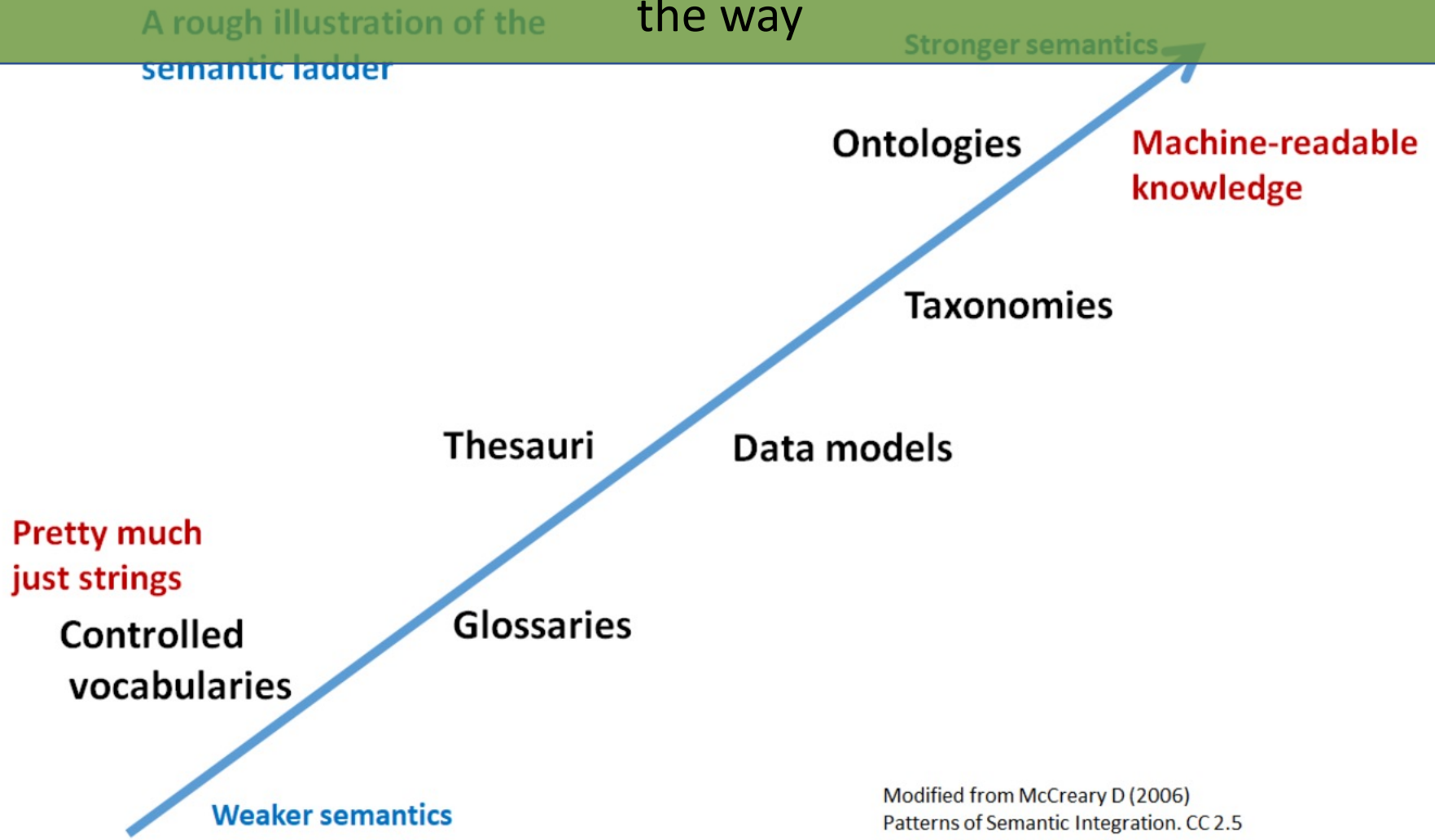
Knowledge networked across disciplines

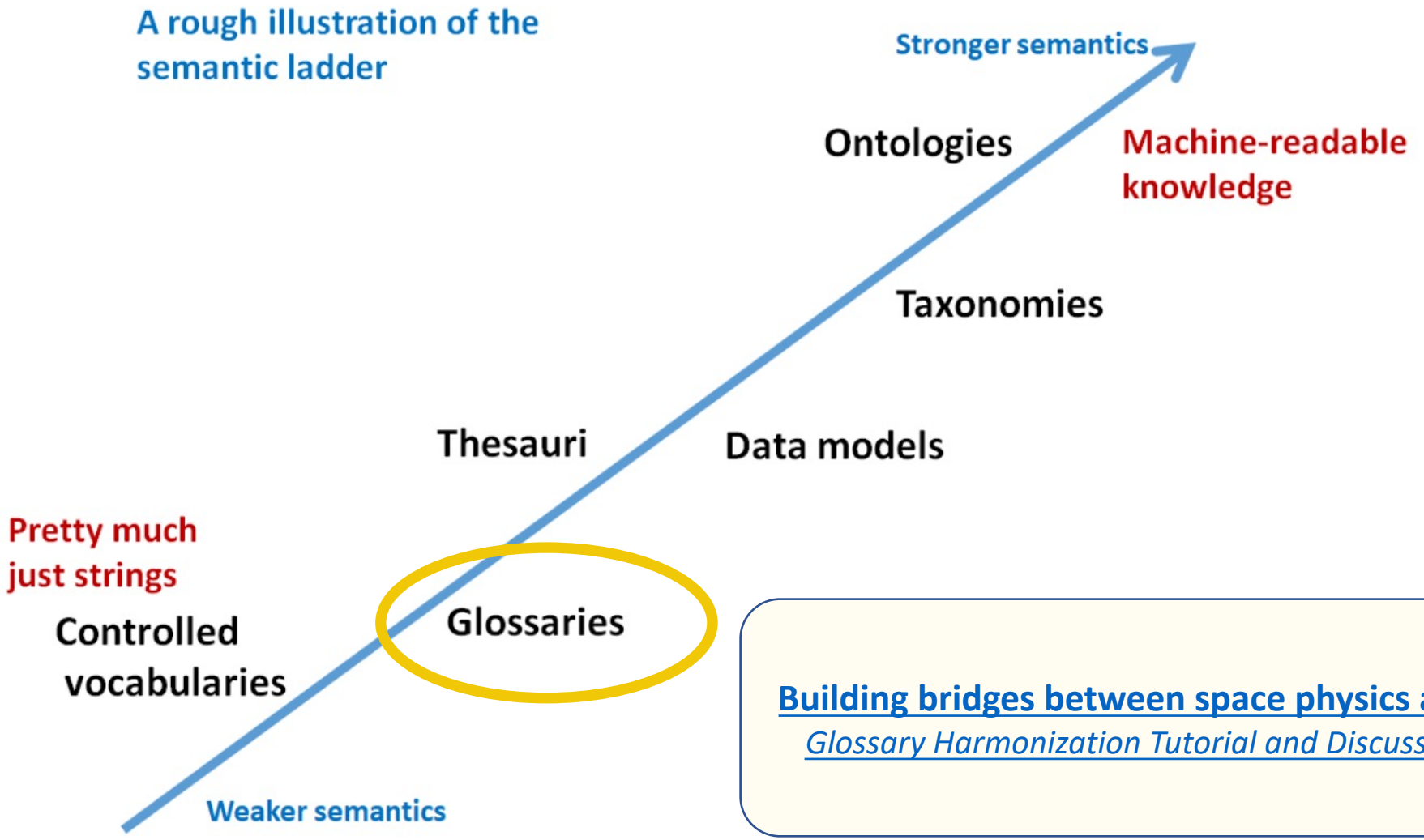
Diverse data made 'analysis ready'

Statistical and Machine Learning analyses

Searchable knowledge network

We are climbing the semantic ladder for the space sciences, producing ontologies, knowledge graphs, usable artifacts, and curricular materials along the way





Building bridges between space physics and the Earth:

Glossary Harmonization Tutorial and Discussion Workshop

edits warmly welcome -- please comment + edit with suggestions on

Glossary Harmonization Tutorial and Discussion Workshop

Purpose: To teach and compile curricular materials for glossary harmonization and to identify fruitful paths forward for the space weather use case

When

October 15, 2021
2-3:30 PM EDT
Complement to these notes: The Miro board for today

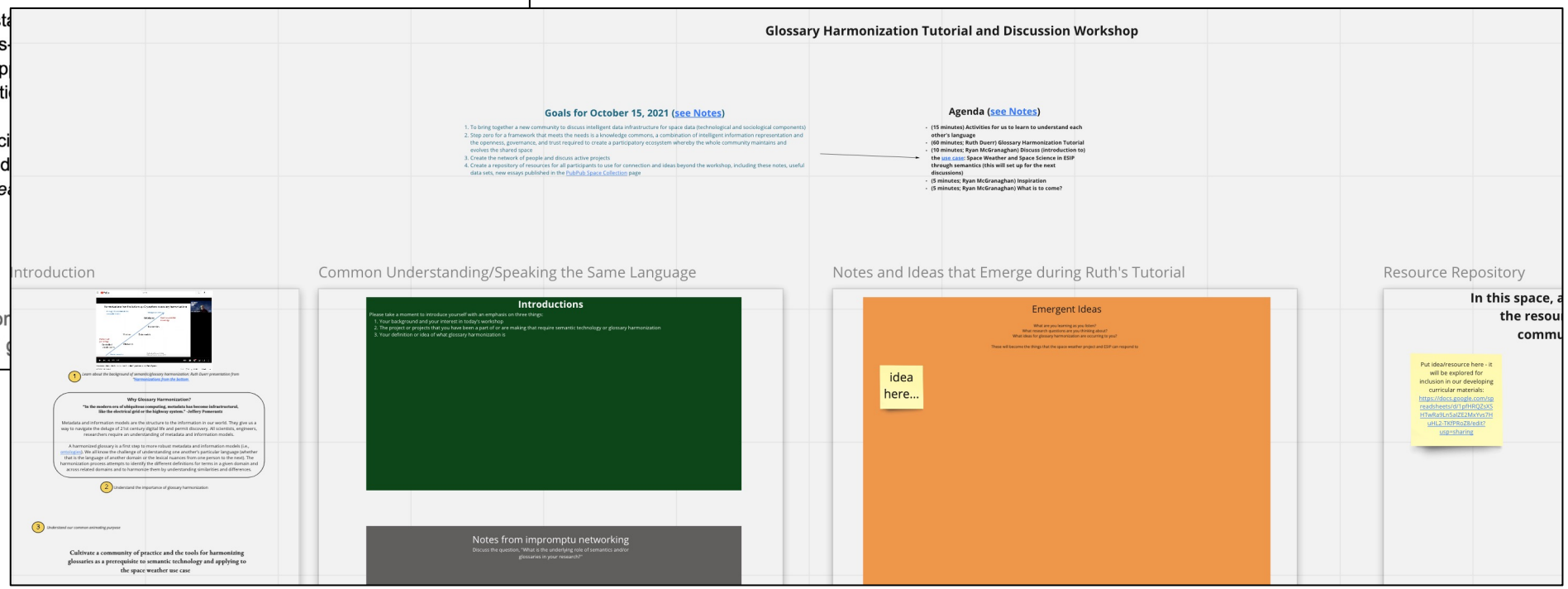
Description

A participatory learning event to understa
to cross-disciplinary/cross-dataset/cross-
a tutorial, a brainstorm of the existing ap
space weather. It will help build connecti

This event is sponsored by the Earth Sci
by Ryan McGranaghan, Ruth Duerr, and
space physics and the Earth: Space Wea

Why Glossary Harmonization?

"In the modern era of ubiquitous cor
the electrical g



Outcomes

Immediate

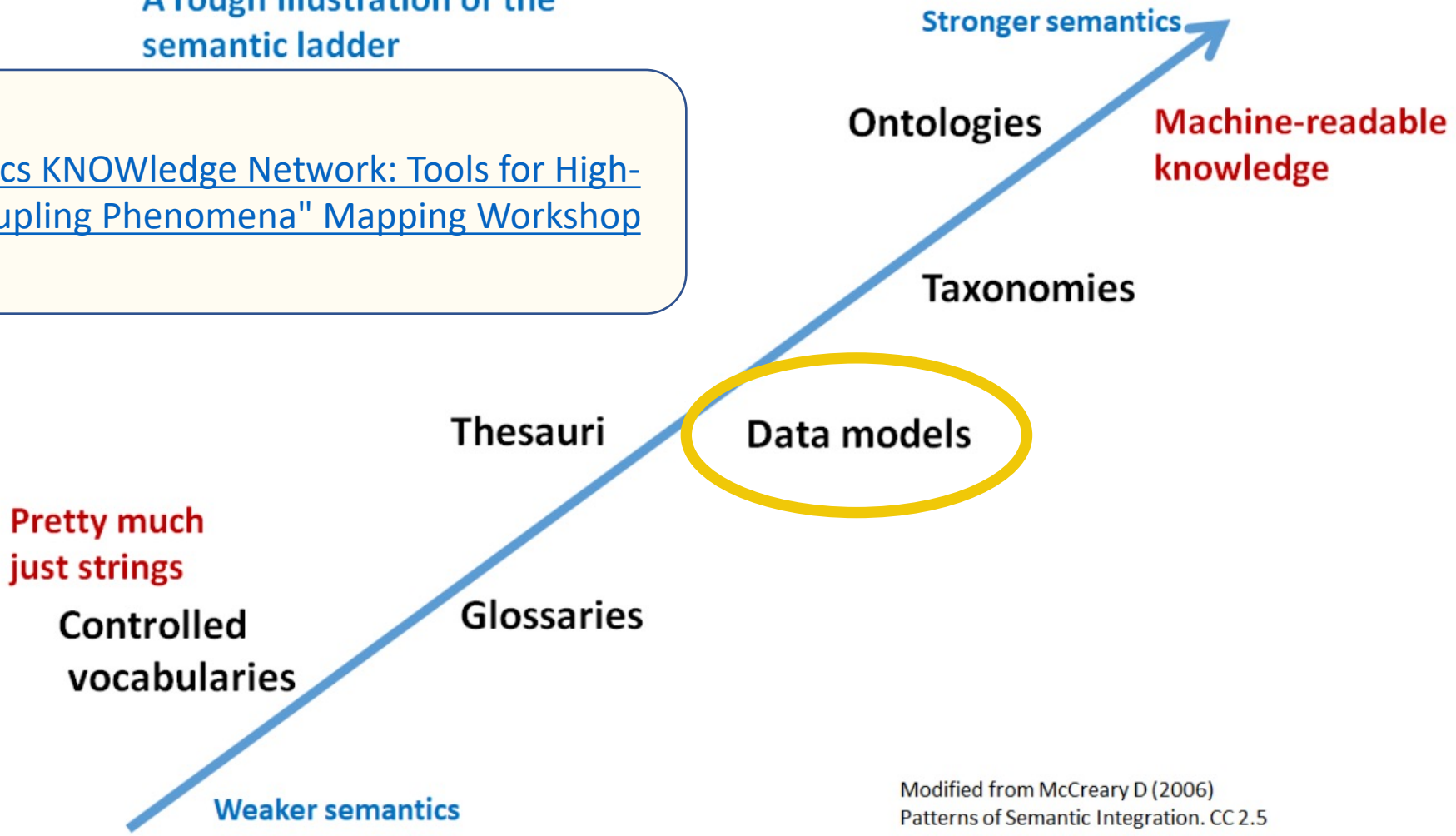
- Engaged in a participatory learning process for glossary harmonization
- Identified the various approaches to glossary harmonization
- Grew the Living list of curricular materials and tools for glossary harmonization

Longer term

- Established a set of usable and discoverable curricular materials and tools for glossary harmonization to serve the broad communities involved
- Identified and learned about the other use cases in the Earth and Space Sciences for glossary harmonization
- Better converged the Space Weather/space sciences and participating communities

A rough illustration of the semantic ladder

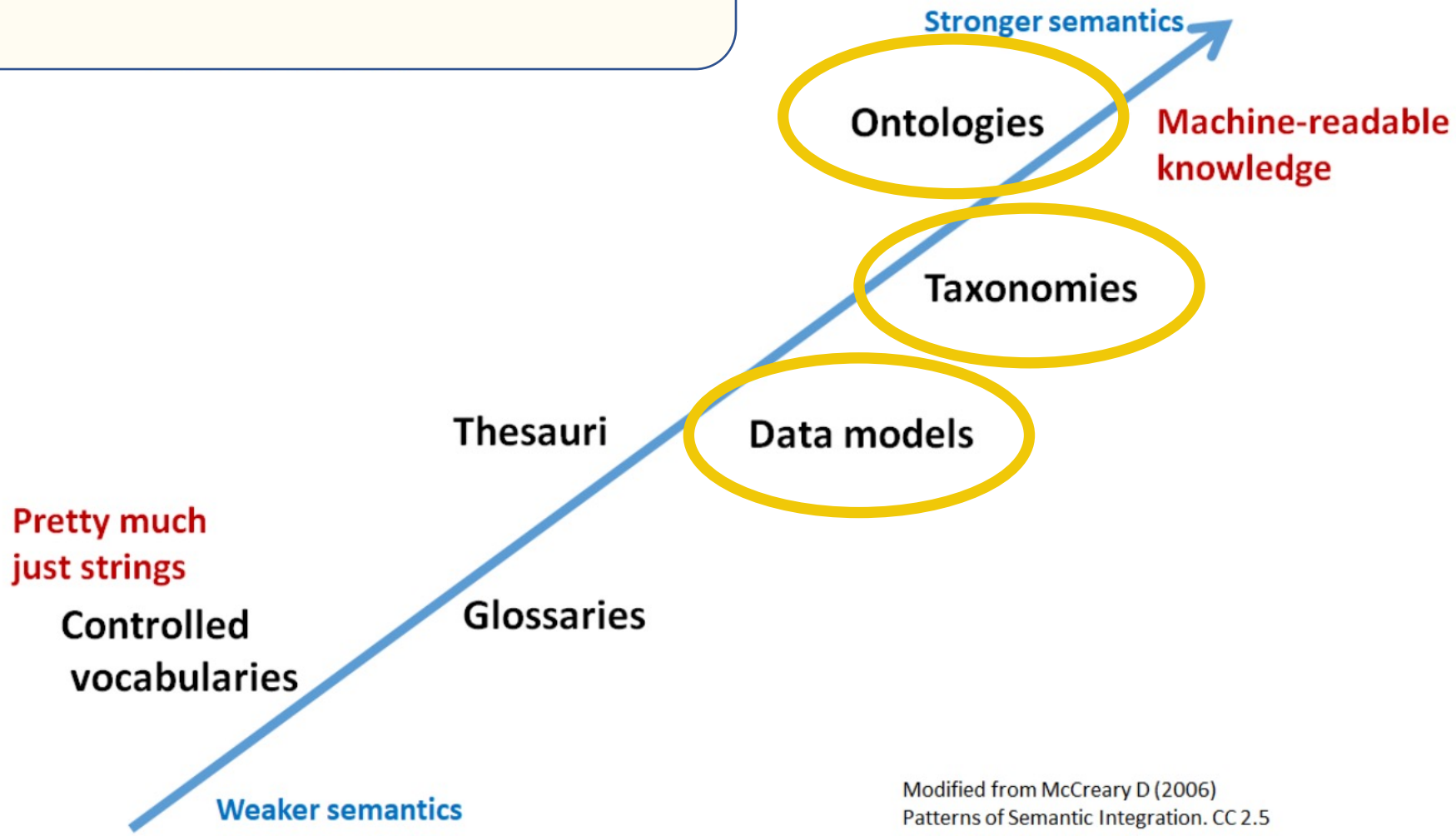
[The Heliophysics KNOWledge Network: Tools for High-latitude MI Coupling Phenomena" Mapping Workshop]



Modified from McCreary D (2006) Patterns of Semantic Integration. CC 2.5

See the Heliophysics KNOWledge Network project: https://github.com/rmcgranaghan/Helio-KNOW

"Step Zero of Space Knowledge Commons" Workshop



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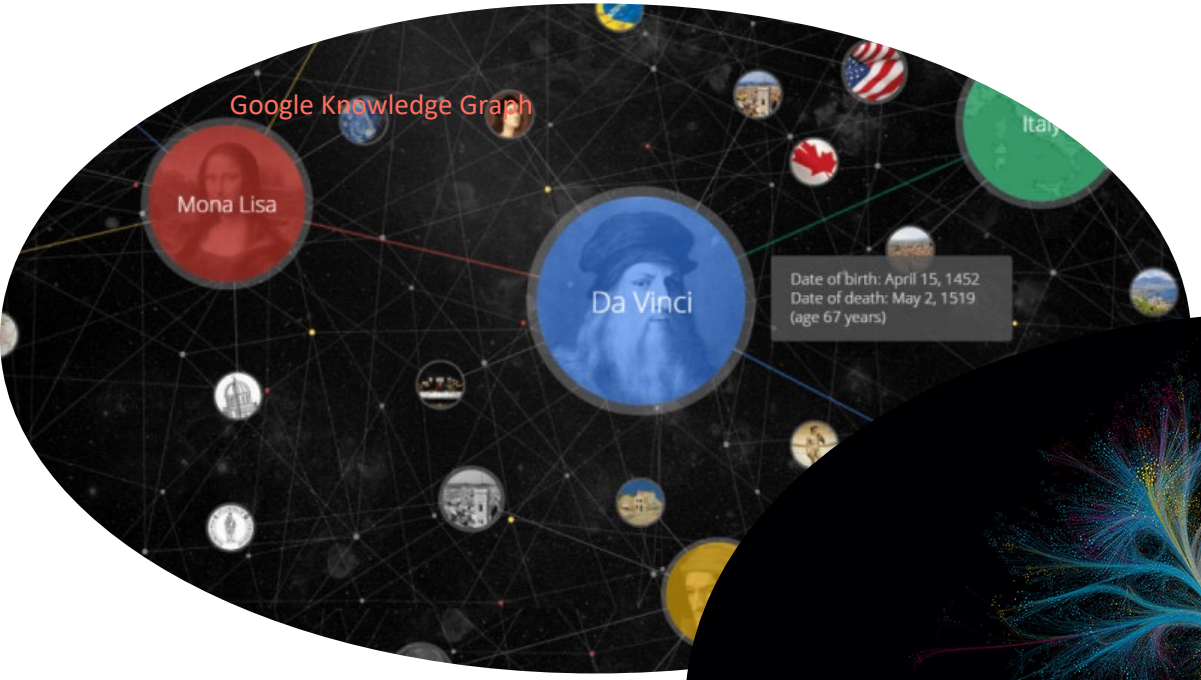
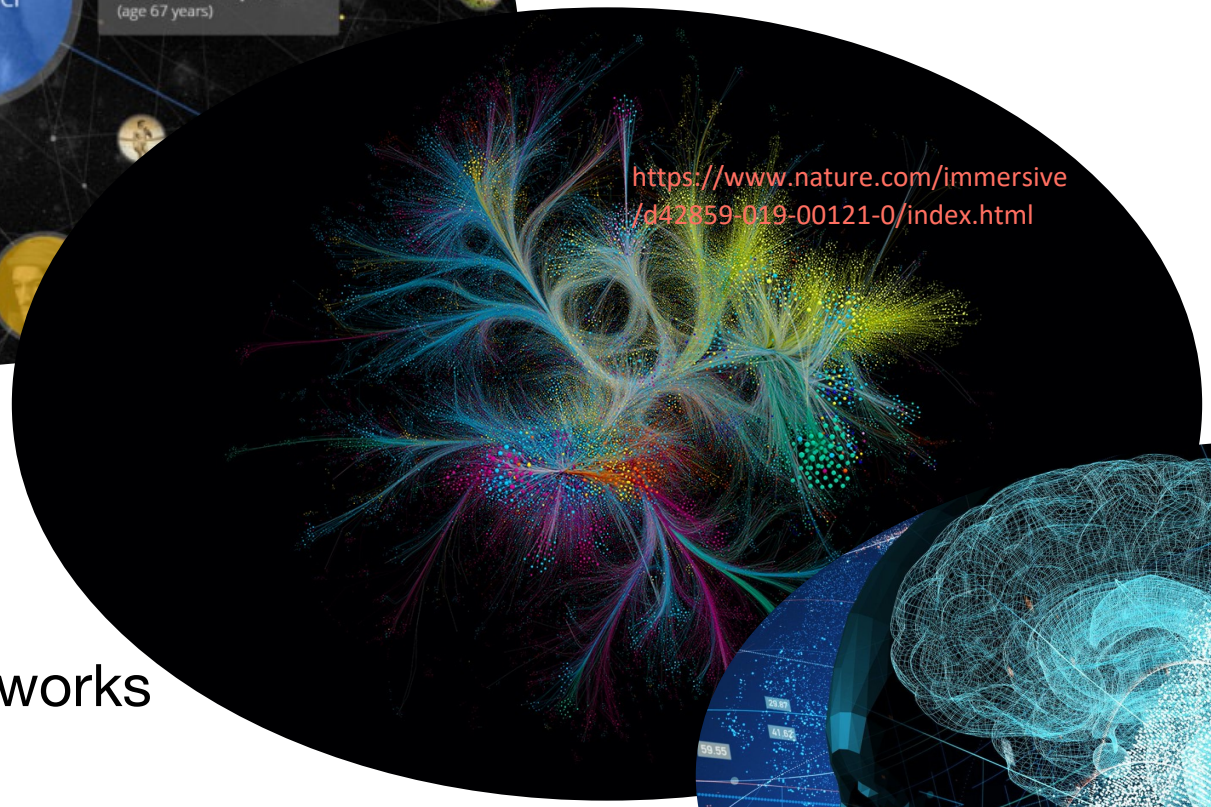
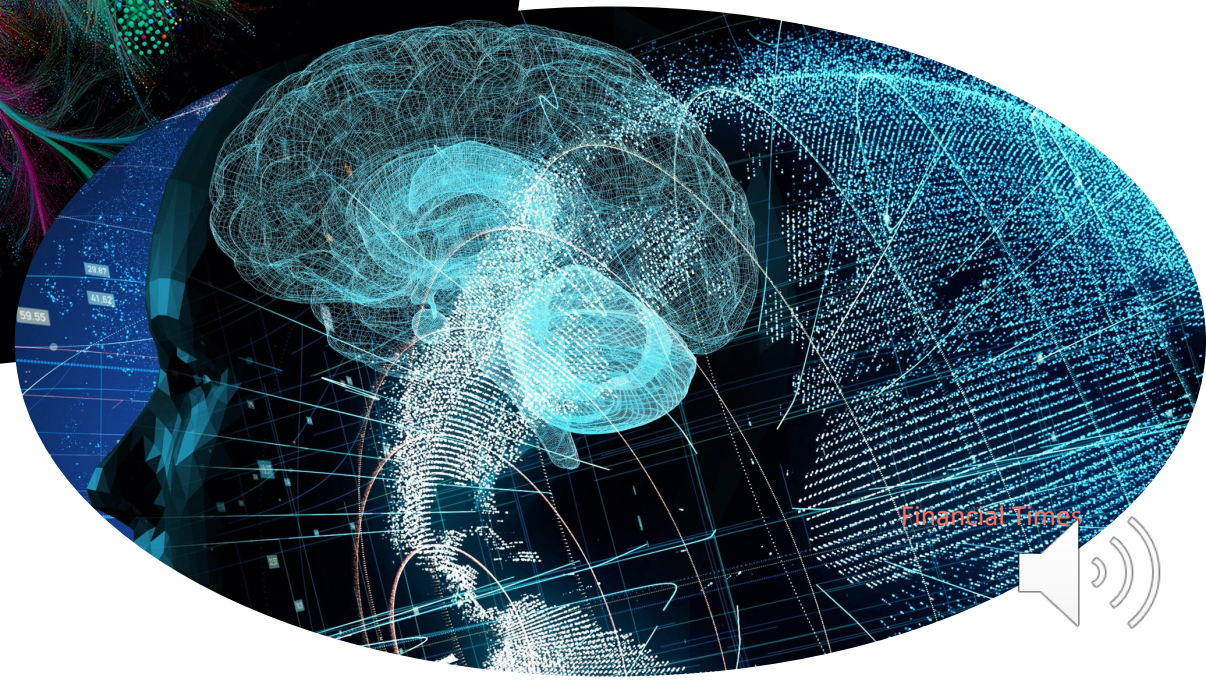


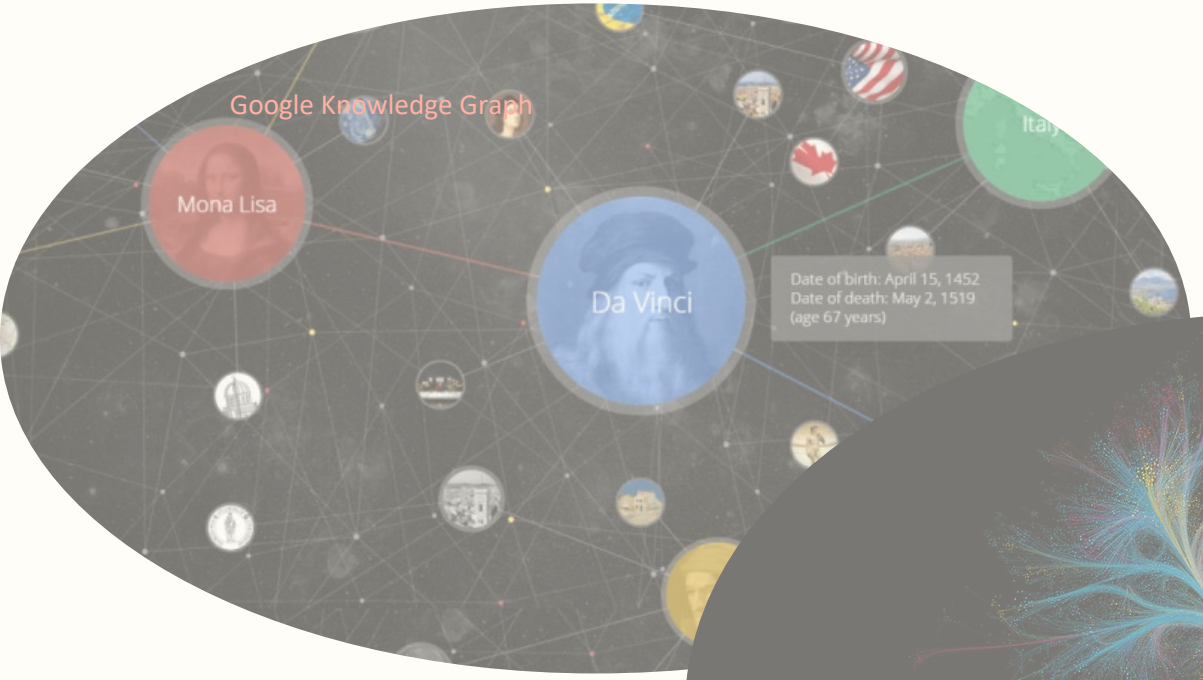
Knowledge Graphs



Knowledge Networks



Knowledge Communities



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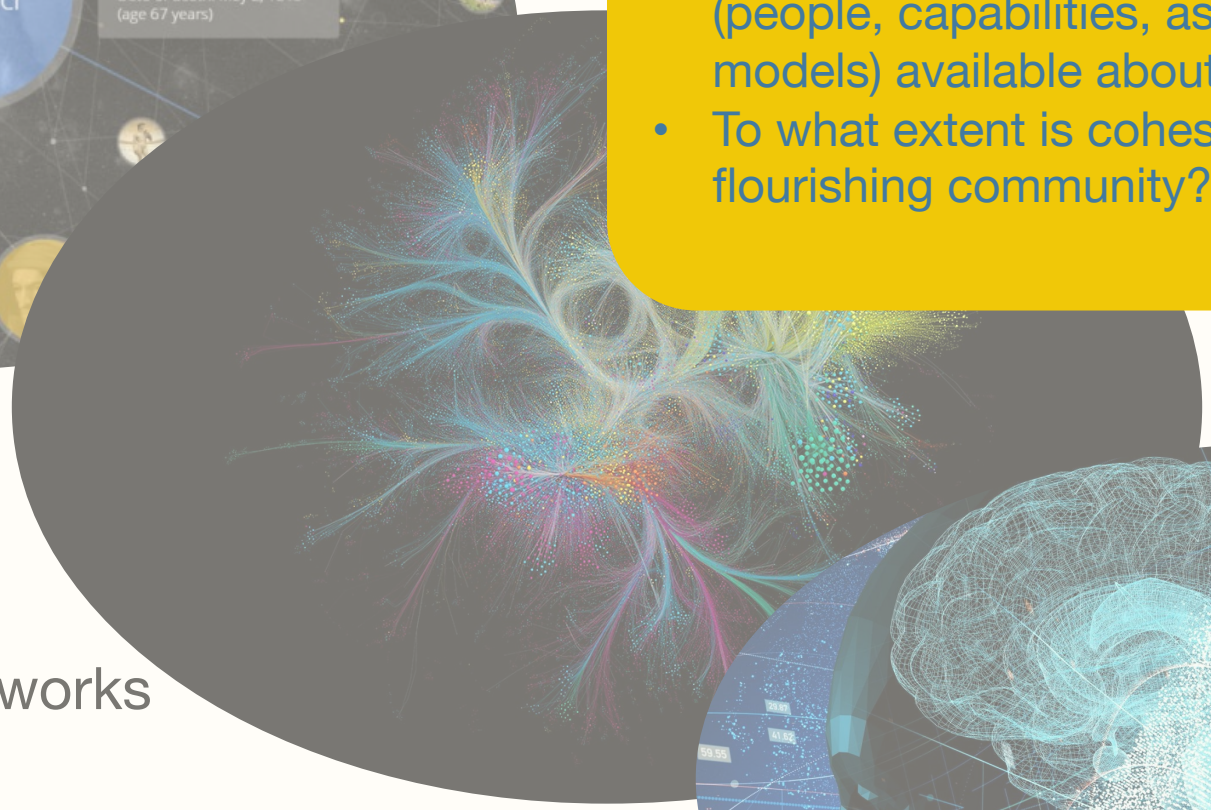

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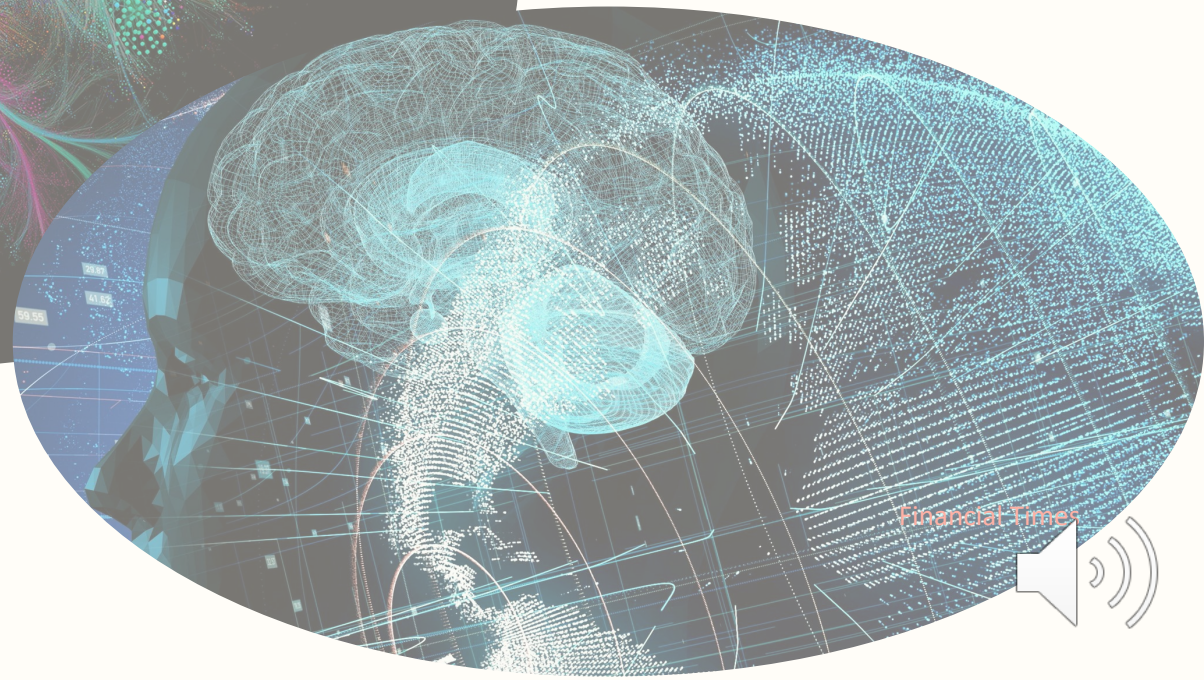


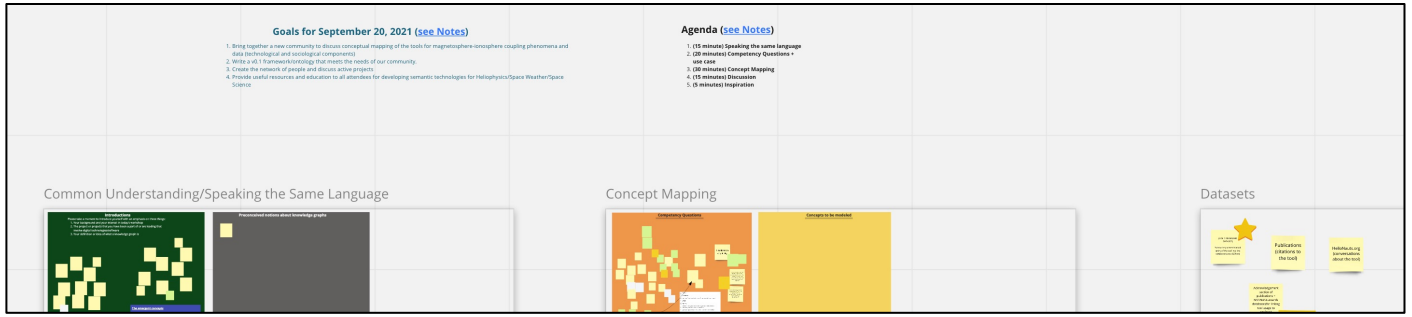
Knowledge Communities

Knowledge Commons

- How can we better understand the resources (people, capabilities, assets, contents, data, models) available about outer space?
- To what extent is cohesion the key to a more flourishing community?

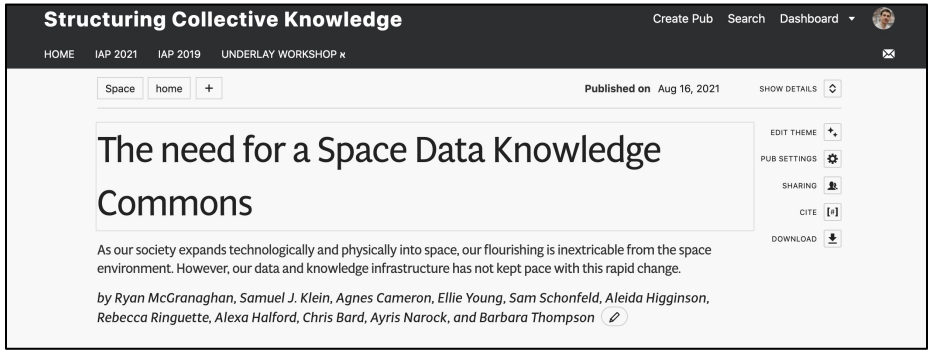
Where these conversations are happening and what you can do *today*

Join collaborative Helio-KNOW workshops to develop Heliophysics ontologies and their links to ontologies from other domains



Contribute pieces to the Space Collection that become living conversations around the *Space Data Knowledge Commons*

→ https://tinyurl.com/SpaceCommons



Join the Center for HelioAnalytics Network (ask me about the *Knowledge Team*)

Join an uncommon event to explore the role of Open Science in cross-disciplinary discovery: 2022 Jack Eddy Cross-Disciplinary Symposium

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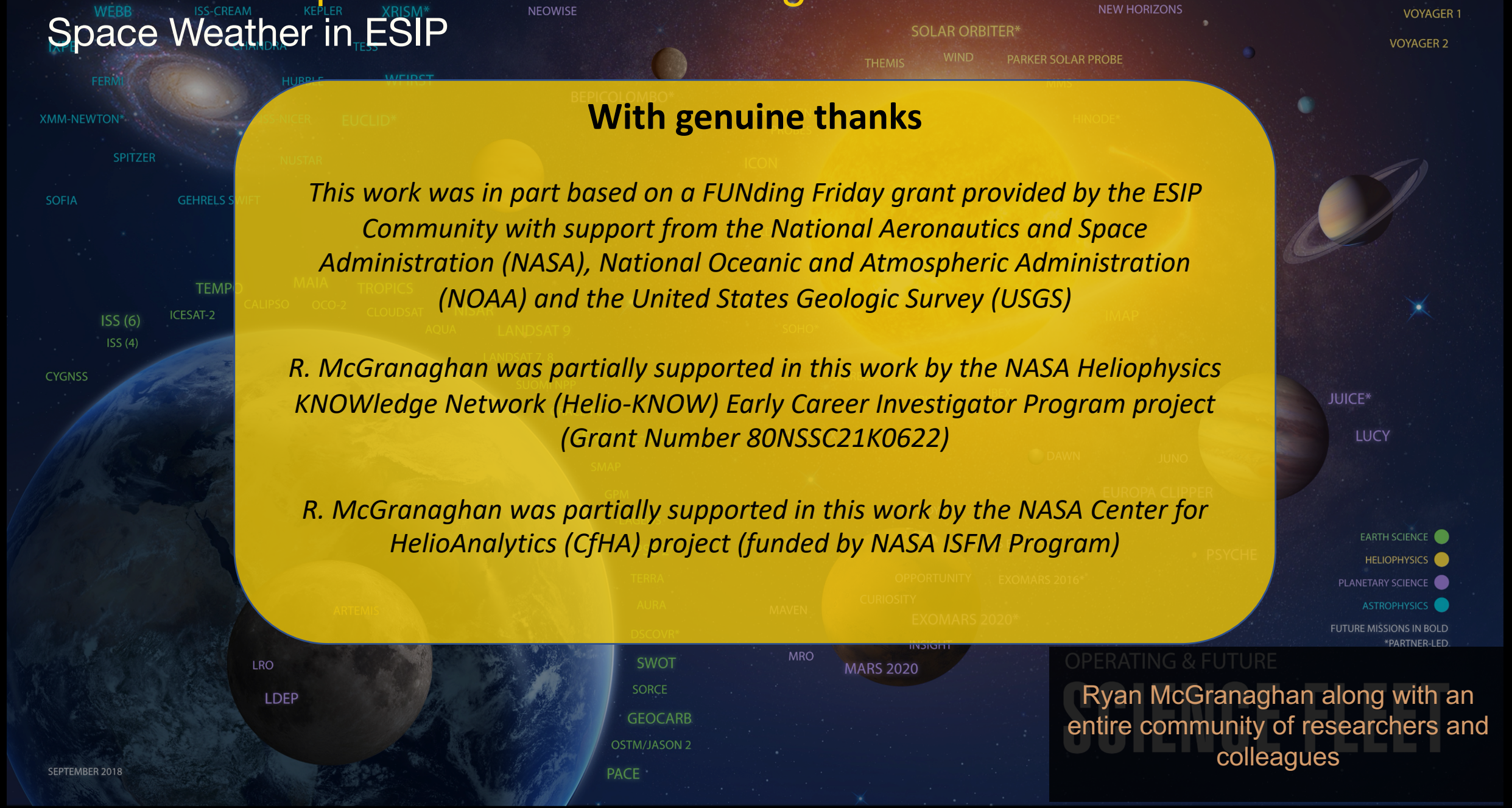

With genuine thanks

This work was in part based on a FUNding Friday grant provided by the ESIP Community with support from the National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA) and the United States Geologic Survey (USGS)

R. McGranaghan was partially supported in this work by the NASA Heliophysics KNOWledge Network (Helio-KNOW) Early Career Investigator Program project (Grant Number 80NSSC21K0622)

R. McGranaghan was partially supported in this work by the NASA Center for HelioAnalytics (CfHA) project (funded by NASA ISFM Program)

Ryan McGranaghan along with an entire community of researchers and colleagues