Sun, Earth and Life and Mankind
Frontier of Space Science

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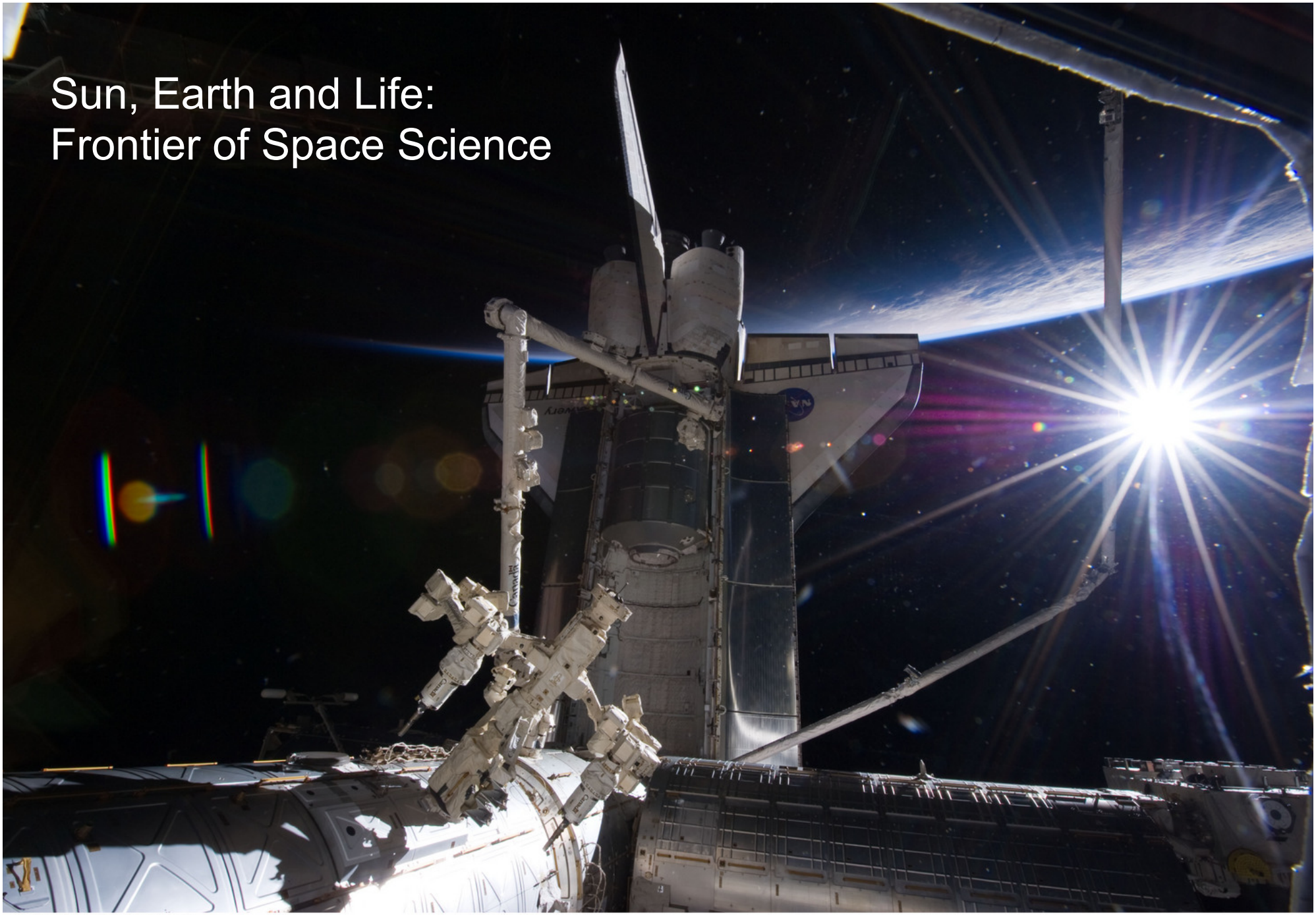
NASA

今日のお話

- 自己紹介
- 太陽活動と地球環境、そして人間の関係について（英語＋日本語）
- 「理数」と「英語」について



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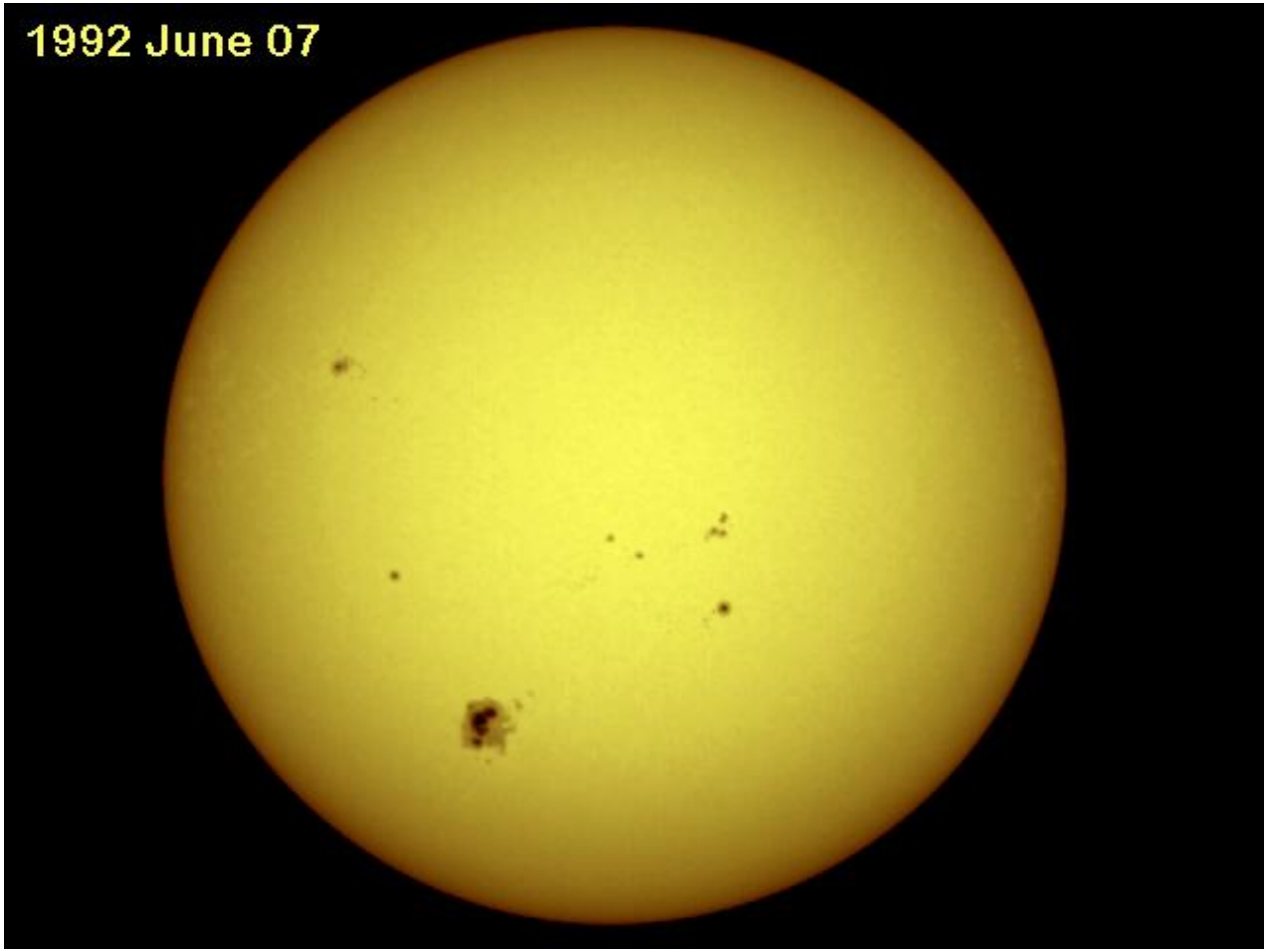
山崎直子宇宙飛行士から頂いた写真

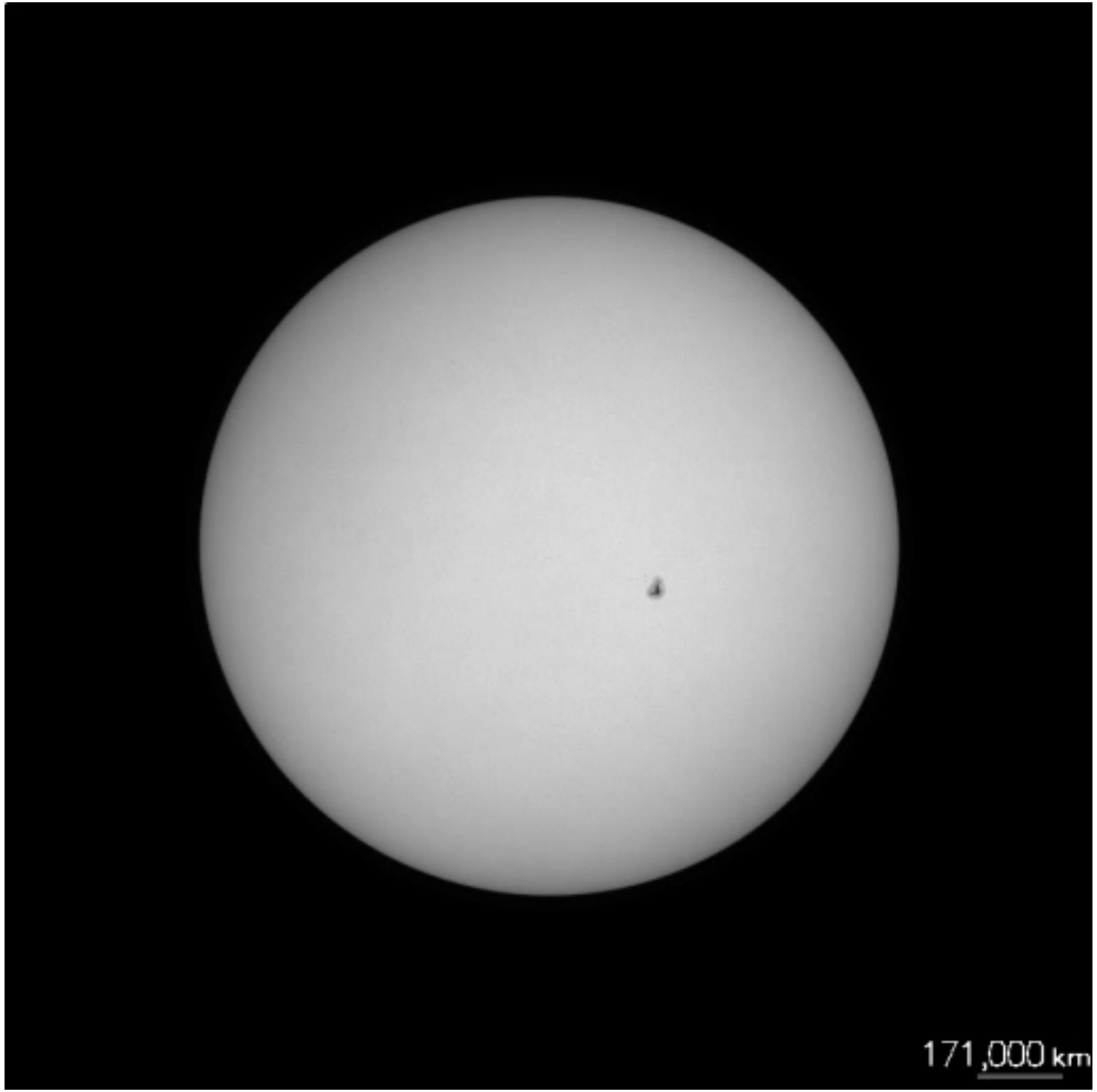
The Sun in visible light



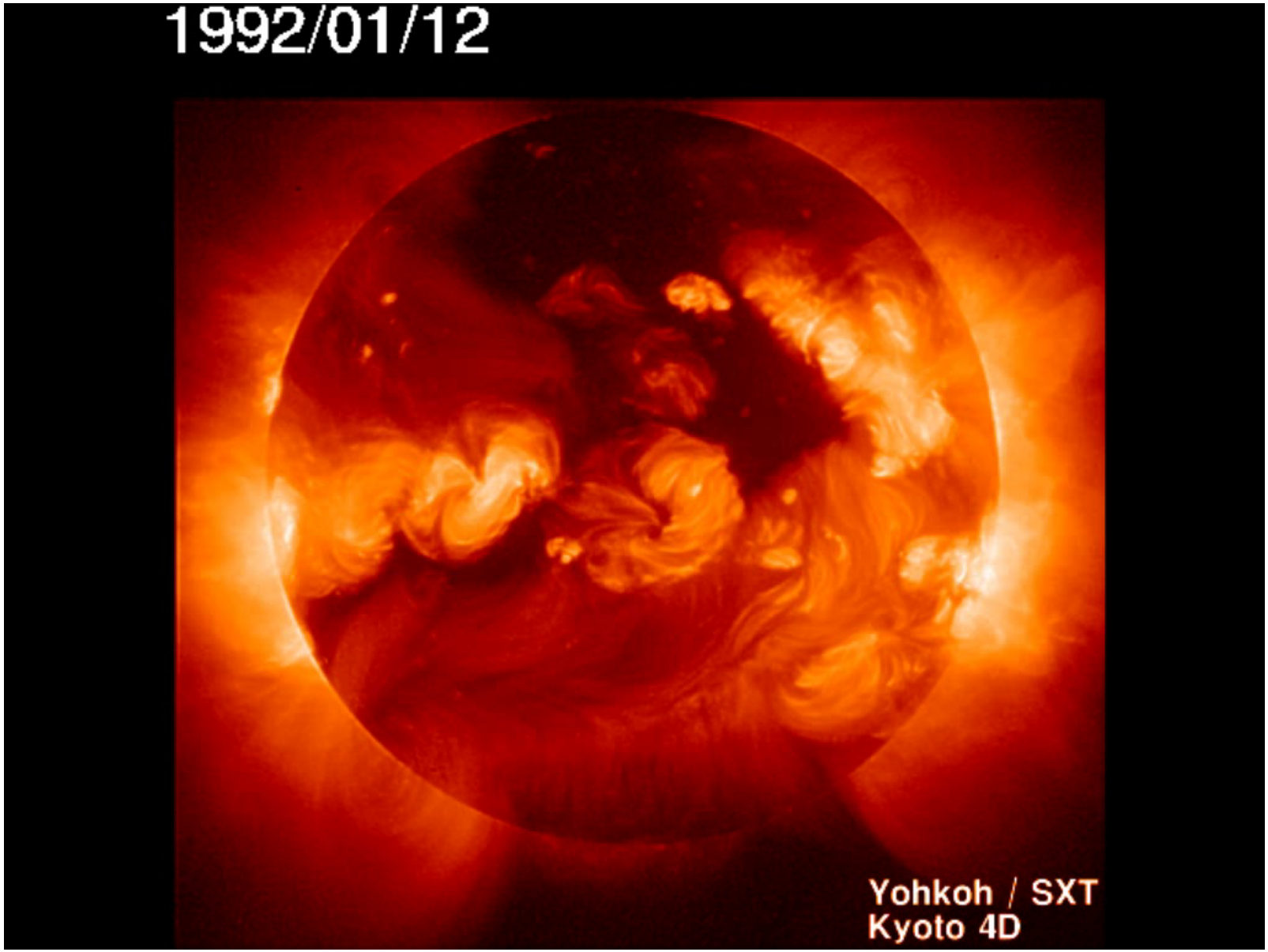
The sun as seen by your eye (but don’t look at it without proper filter)!

Sunspot observed by the Japanese solar observation satellite “Hinode”

Courtesy of
T. J. Okamoto



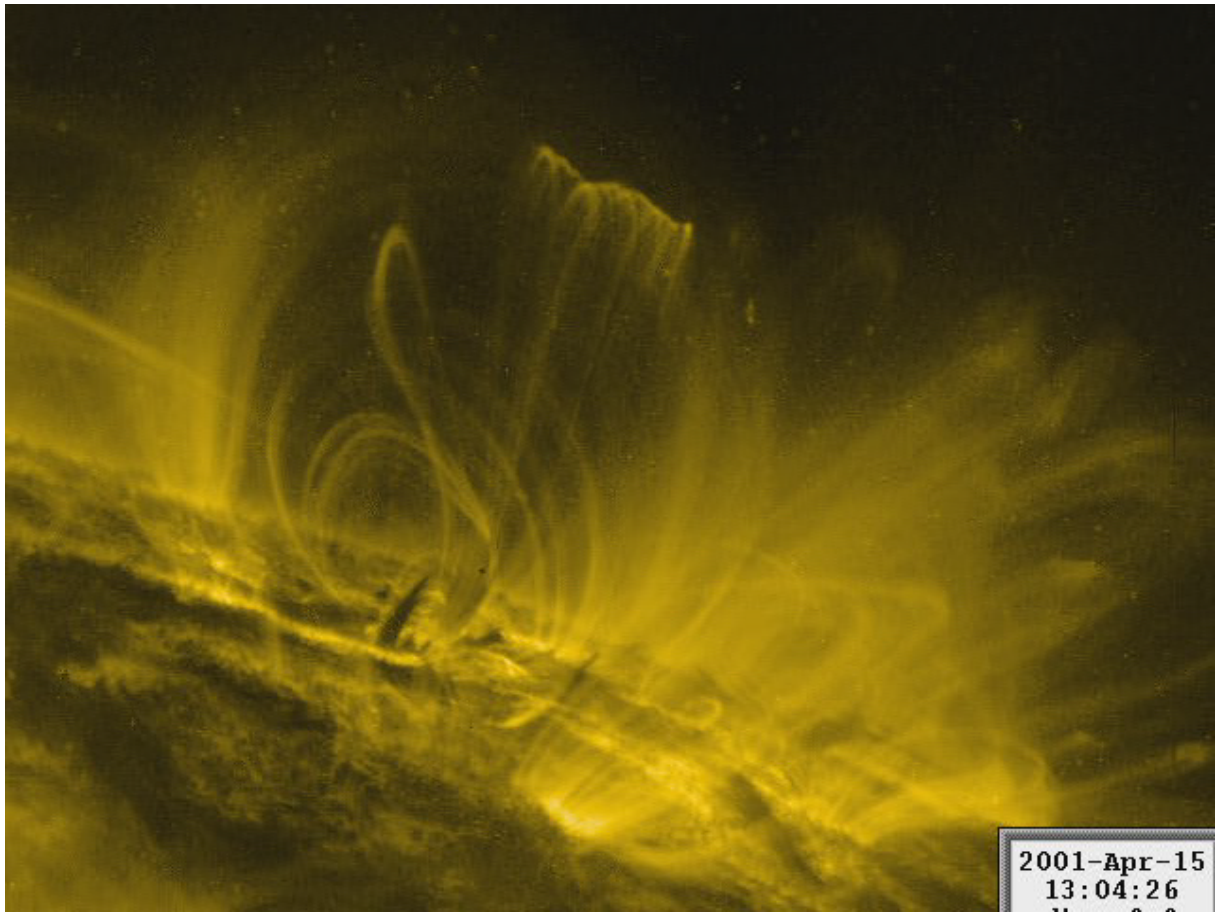
The Sun in X-ray



Yohkoh (JAXA)

Solar flare

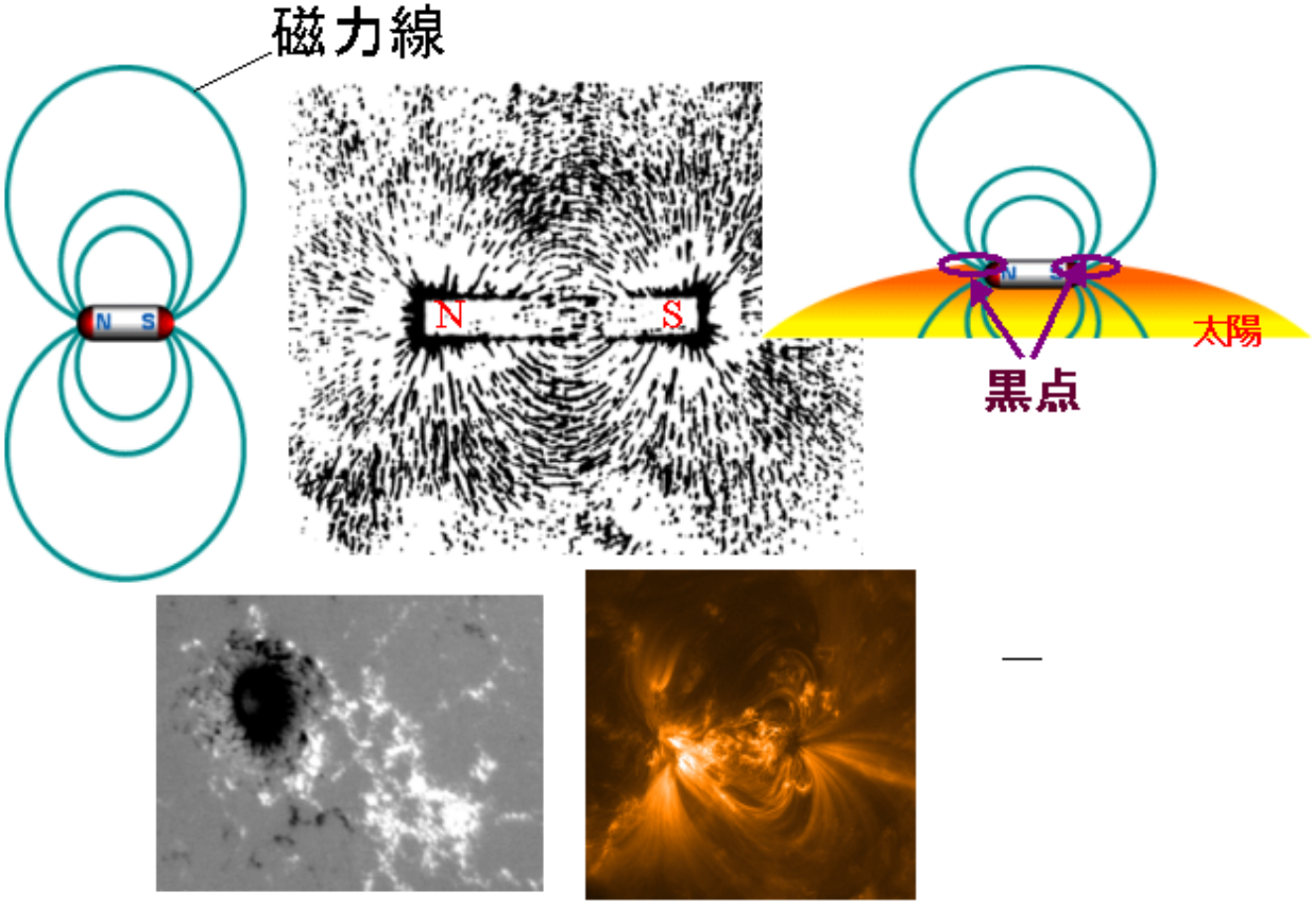
The noisy bright dots are high energy particles emitted from the flare that hits the CCD came on board the satellite



If an astronaut is outside the space ship at this time, he will be exposed fatal amount of radiation.

A little bit of physics…energy source of solar flare

太陽磁場



Sunspot is big magnet. Strength of magnetic field is about 1500 Gauss

Energy of solar flare come from the magnetic energy of sunspots

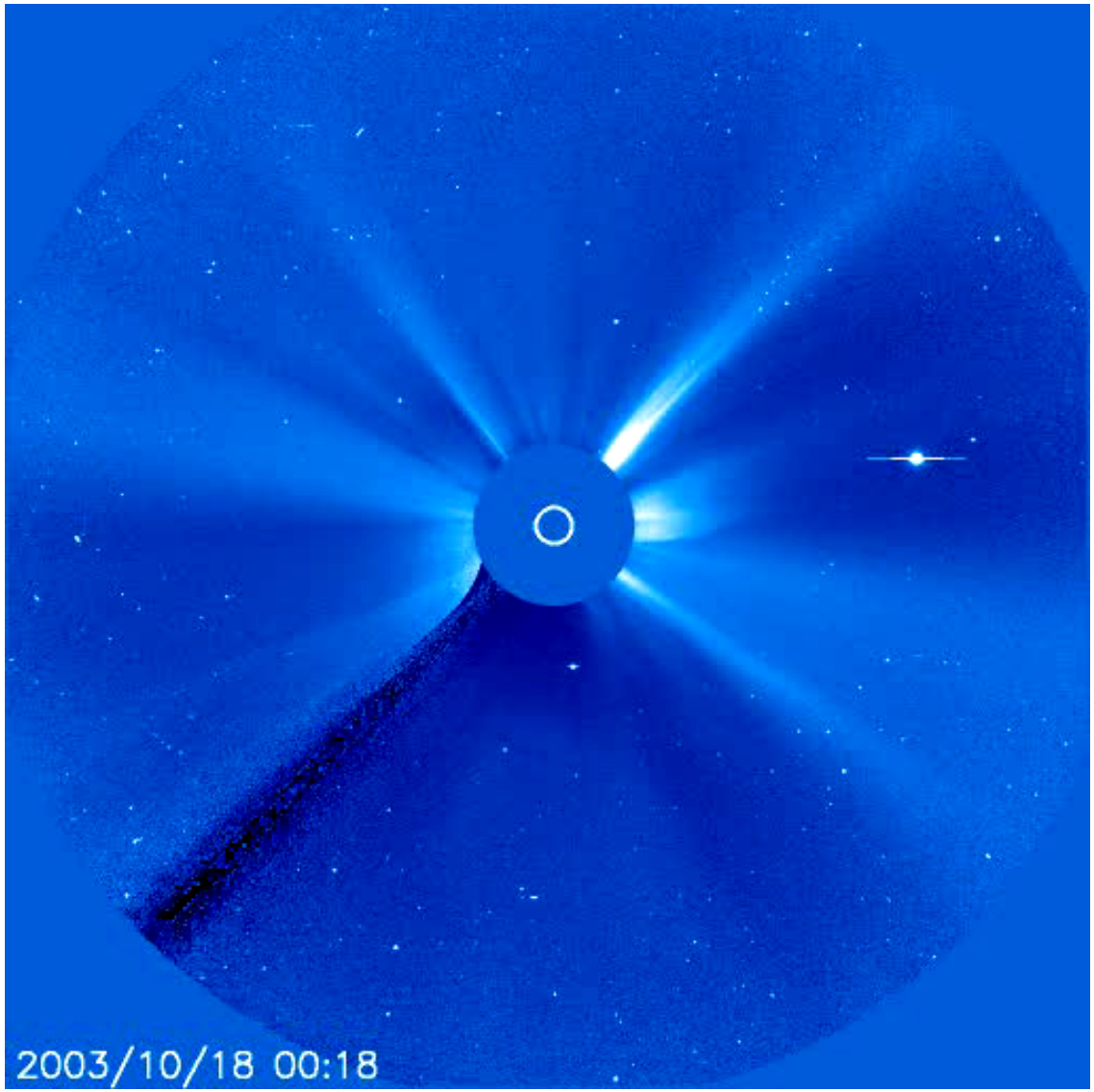
Relation of the Sun, Earth and human activities

ISS006E49121

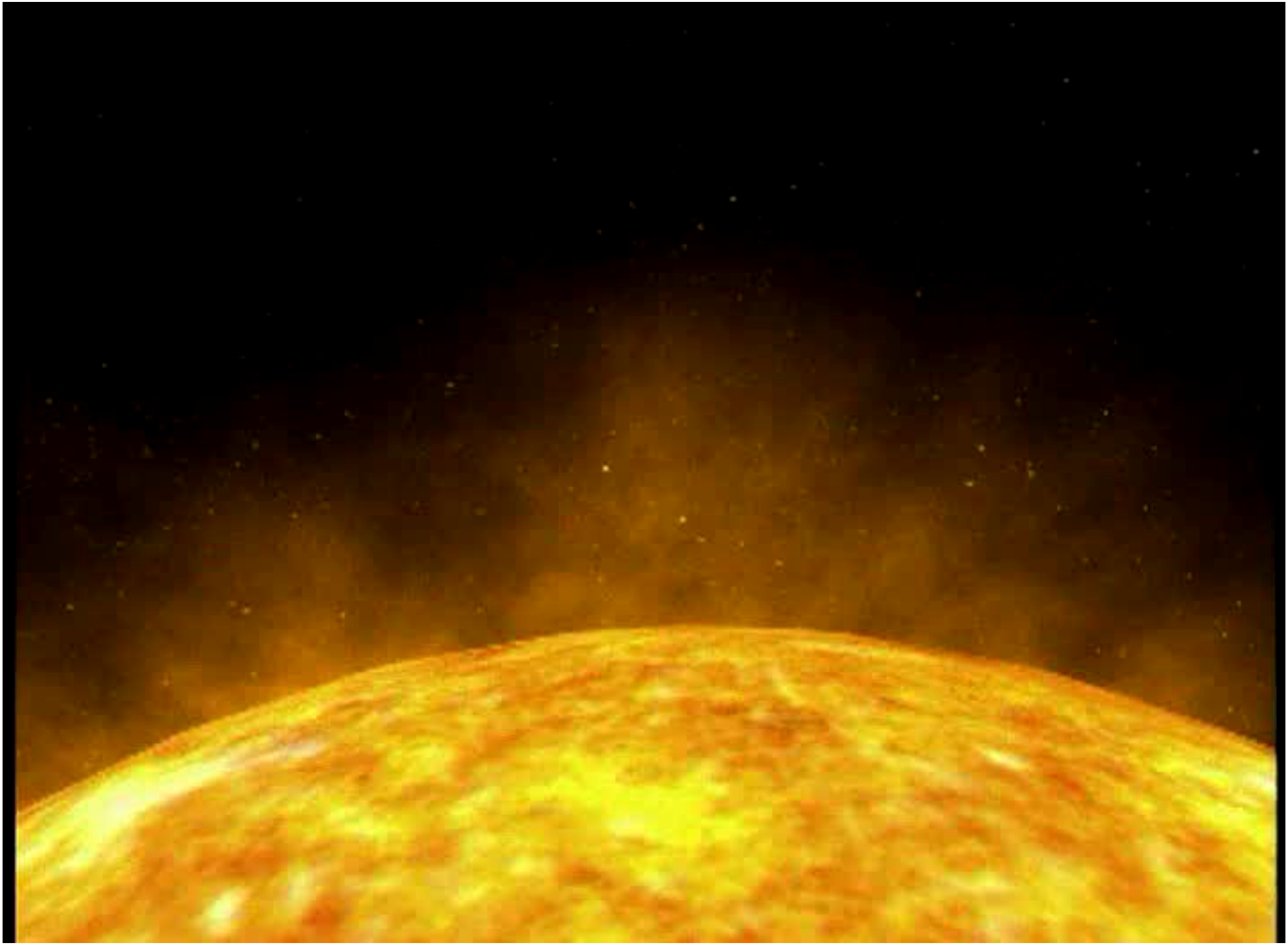
Solar wind

Gas flowing out from the sun, called “Solar Wind”.

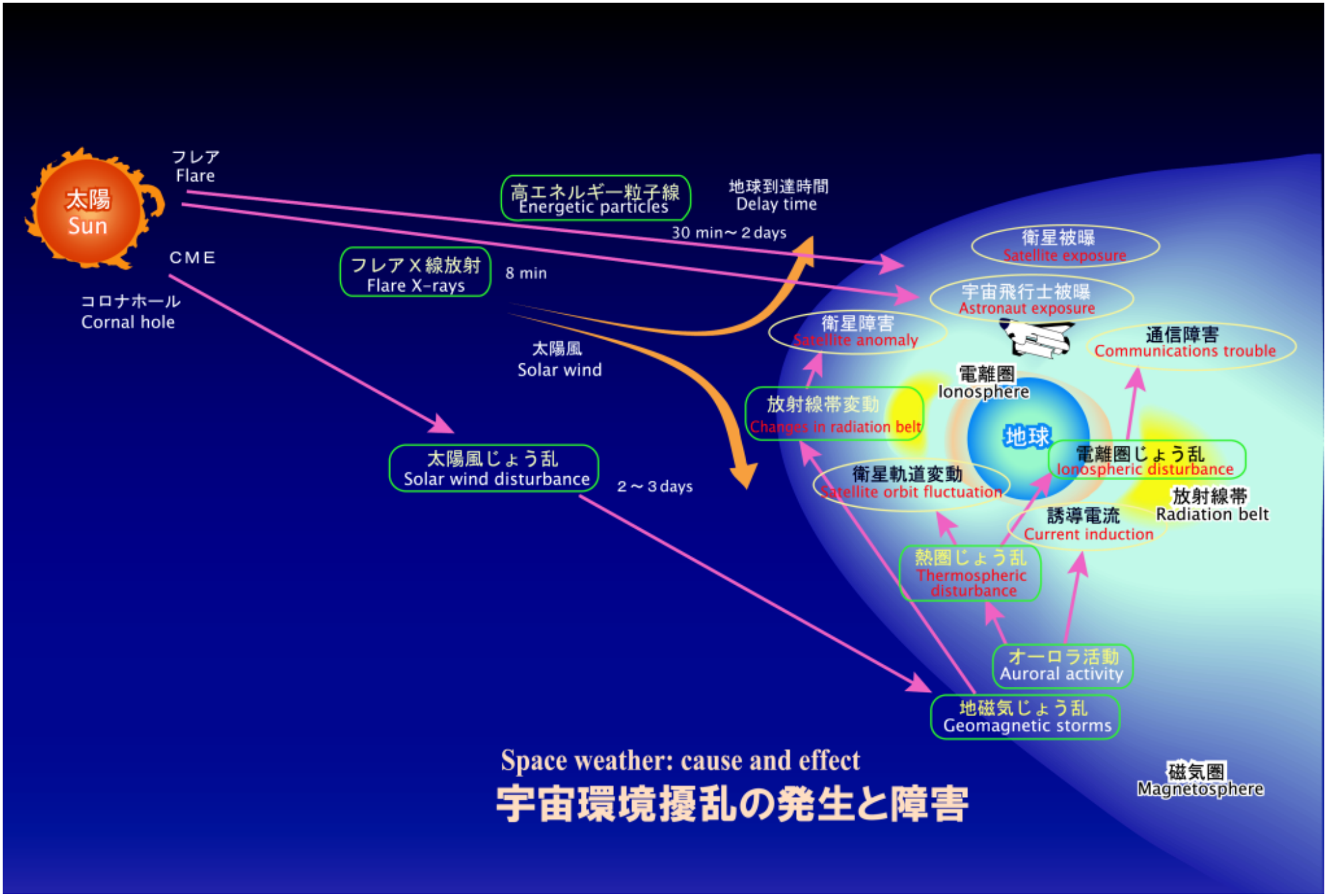
When a flare (explosion) occurs, a bulk of mass is ejected out from the Sun. Some of them are directed to the Earth, and then…



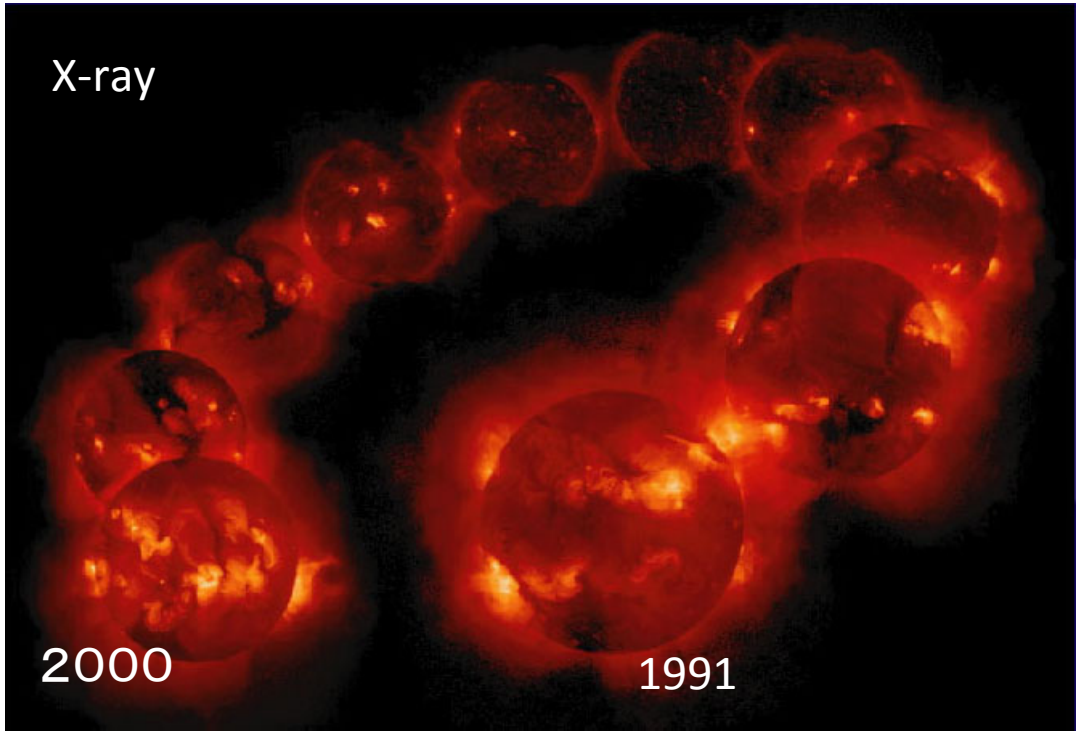
Aurora



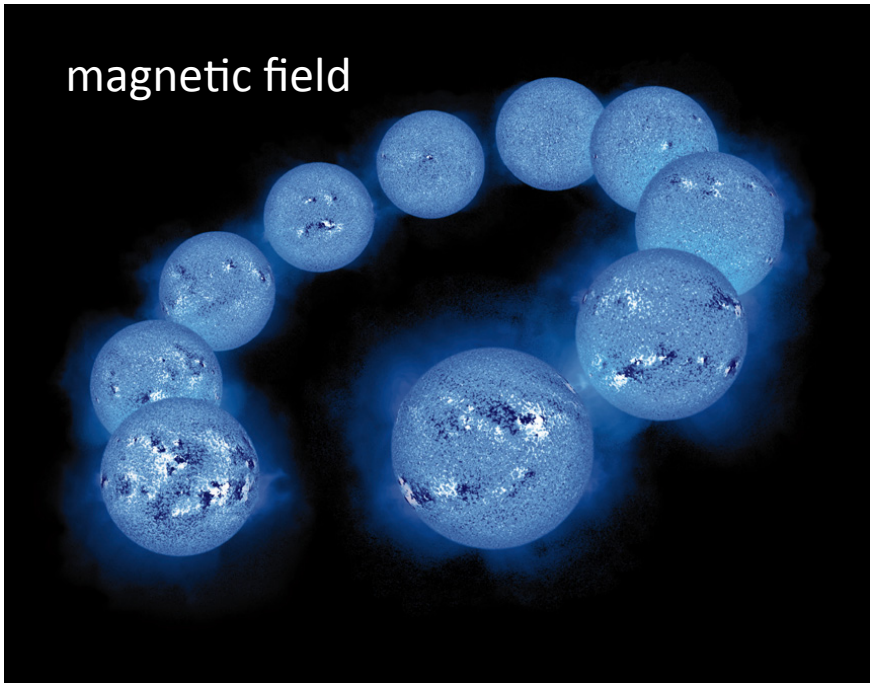
Space weather



Number of sunspot changes with 11-year period

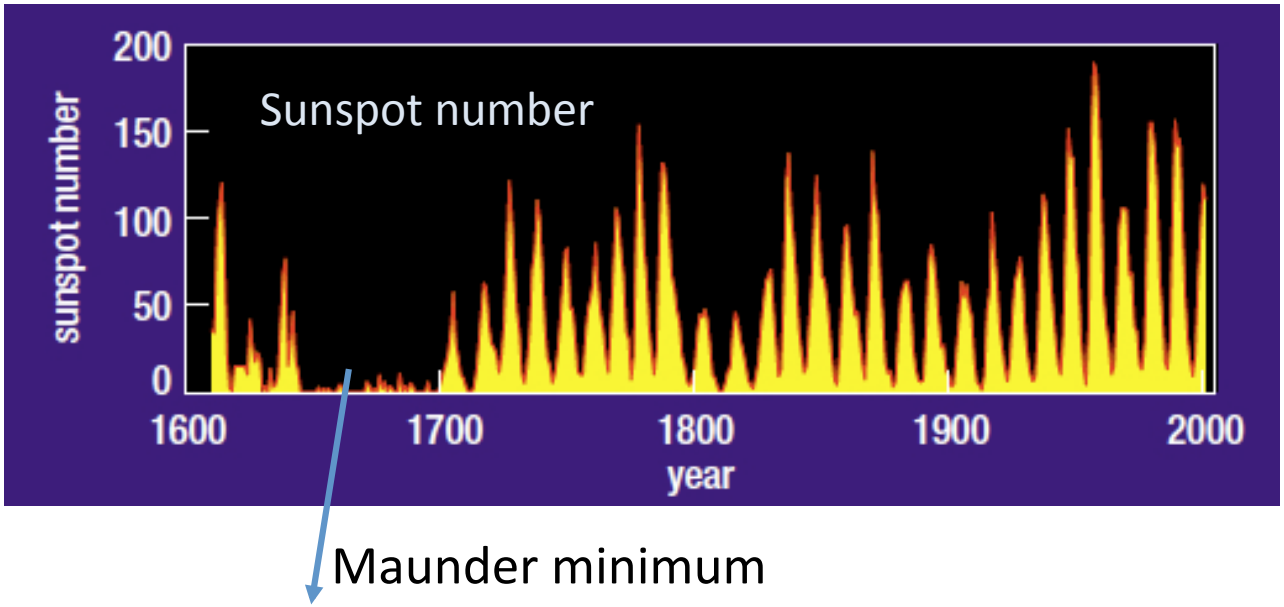


Flare activities also change accordingly.



Why it changes in 11 years is not understood.

Sunspots and Earth climate?



Maunder minimum

- Almost no sunspots for several decades in 17th century
- The earth was slightly colder in that time

Picure of Thames river in that time

Older records show that there is a correlation between the sunspot number and cimate. The earth was colder when sunspot number is less. The mechanism is still uncertain, though.

Global warming

The *Intergovernmental Panel on Climate Change* concluded that it is highly likely that the earth is warming because of the green house effect by CO2
emitted by human activities.

全国地球温暖化防止活動推進センター http://www.jccca.org/より

Intergovernmental Panel for Climate Chage)IPCC) report

人為起源

太陽の影響

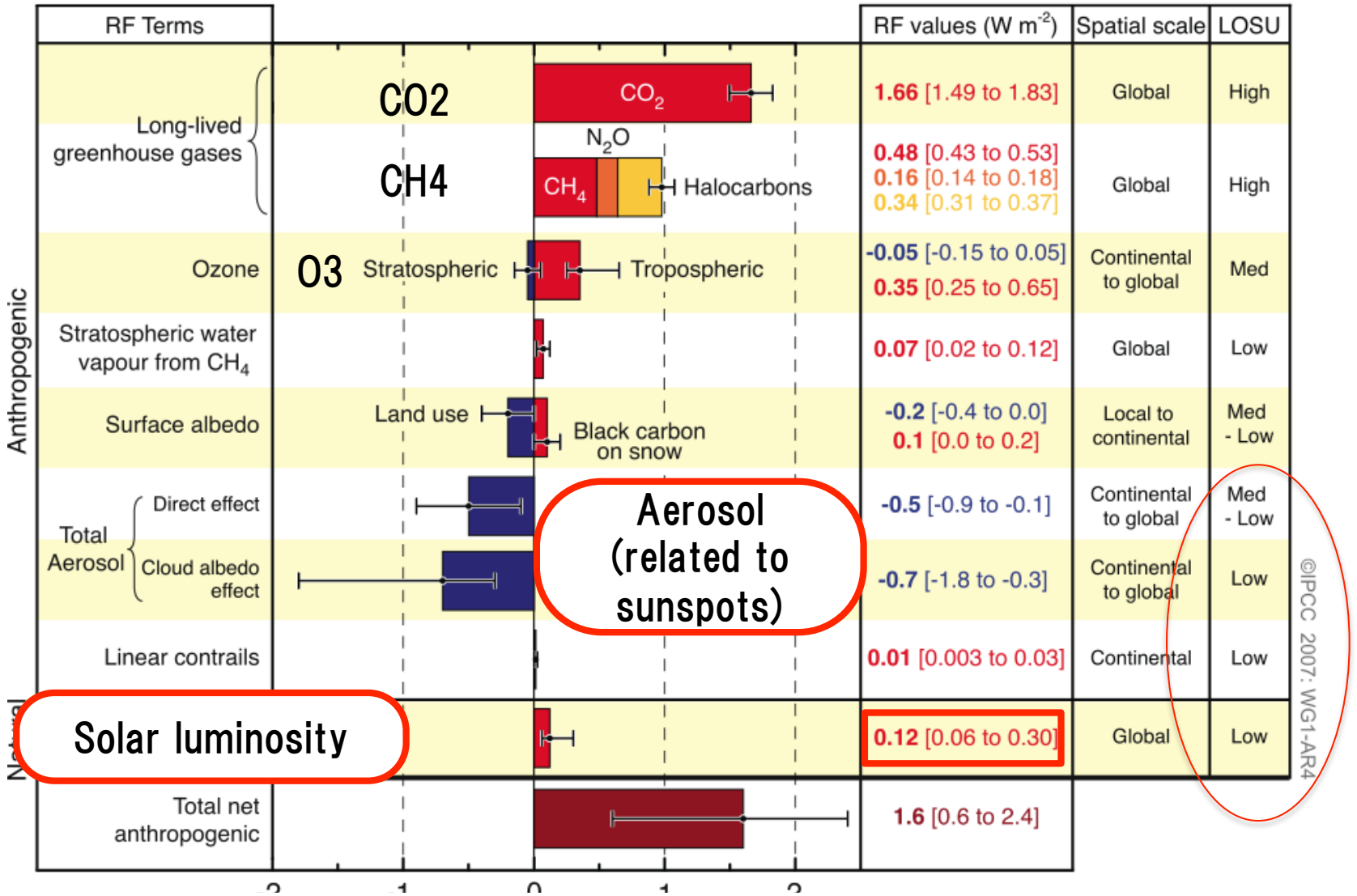
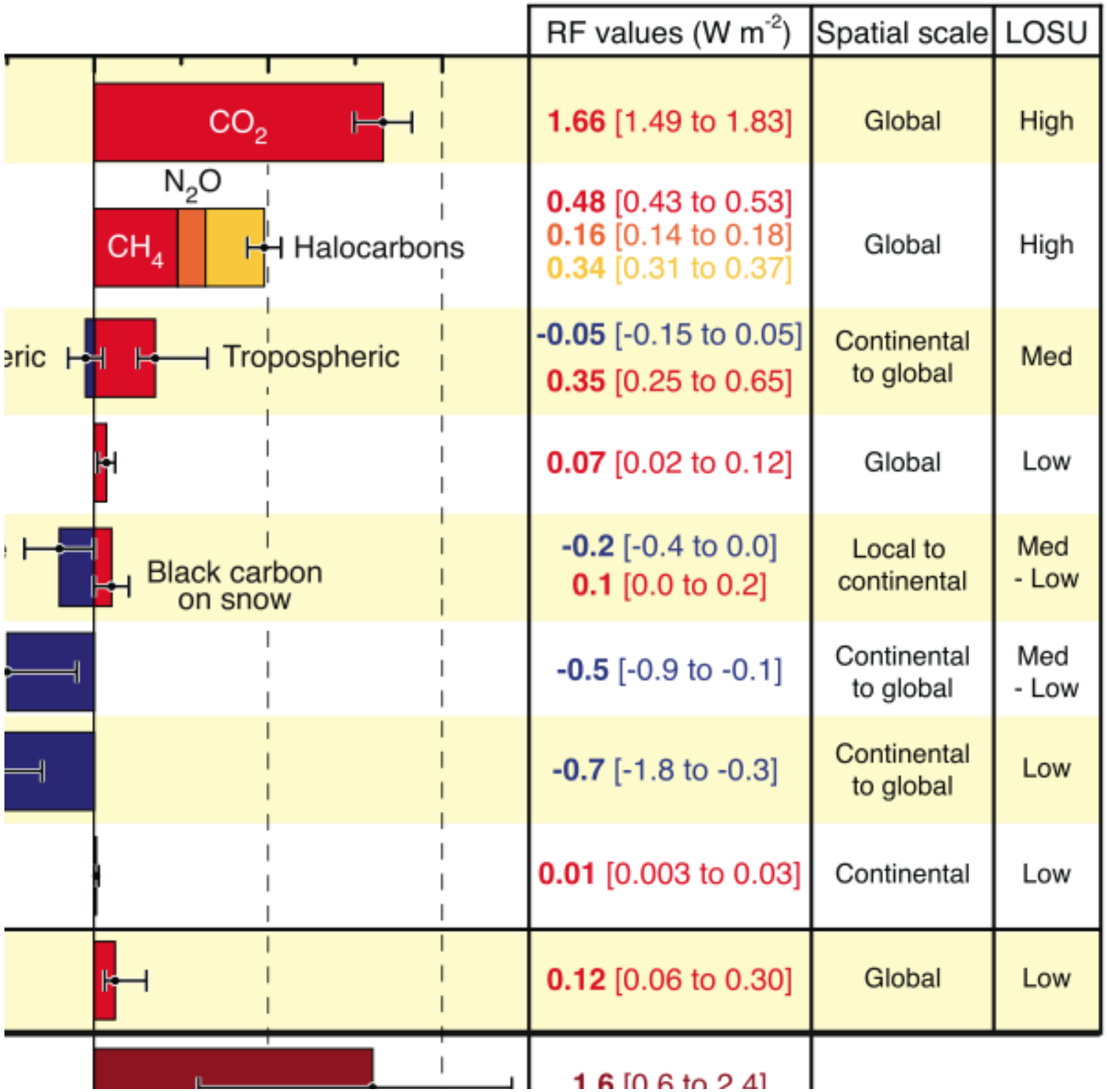


Table of various effects on climate. Some have warming effect, the others have cooling effect.



LOSU
= Level Of Scientific Understanding
= 科学的理解の度合い

There are several effects, such as sunspot number, whose impact on climate is poorly understood.

Summary

- The sun is variable a star. Many flares (explosions).
- Solar flares cause serious damage to satellites and astronauts. Modern civilization is vulnerable (=weak) to “space weather”.
- Sunspots and flares may also influence the Earth’s climate, though uncertainties remain.
- Astrophysics of the Sun used to be merely a pure science, but it is now becoming a social issue.

Let’s have a little bit longer perspective...

The biggest achievement of Space exploration in 20th century

Who will emigrate to space?

F. Dyson “Disturbing the Universe”

	Mayflower	Mormons	Space colony	Asteroid colony
Year	1620	1847	2???	2???
Number	103	1,891	10,000	23
Load (t)	180	3,500	3.6 million	50
Cost (USD in 1975)	6 million	15 million	100 billion	1 million
Cost per 1 poud	$15	$2	$13	$10
Cost per family (annual income)	7.5	2.5	1,500	6

MARS ONE

Human settlement of Mars in 2023

Mars One will take humanity to Mars in 2023, to establish the foundation of a permanent settlement from which we will prosper, learn, and grow. Before the first crew lands, Mars One will have established a habitable, sustainable settlement designed to receive new astronauts every two years. To accomplish this, Mars One has developed a precise, realistic plan based entirely upon existing technologies. It is both economically and logistically feasible, in motion through the integration of existing suppliers and experts in space exploration.

We invite you to participate in this journey, by sharing our vision with your friends, by supporting our effort and, perhaps, by becoming the next Mars astronaut yourself.

Watch our Mars One introduction film

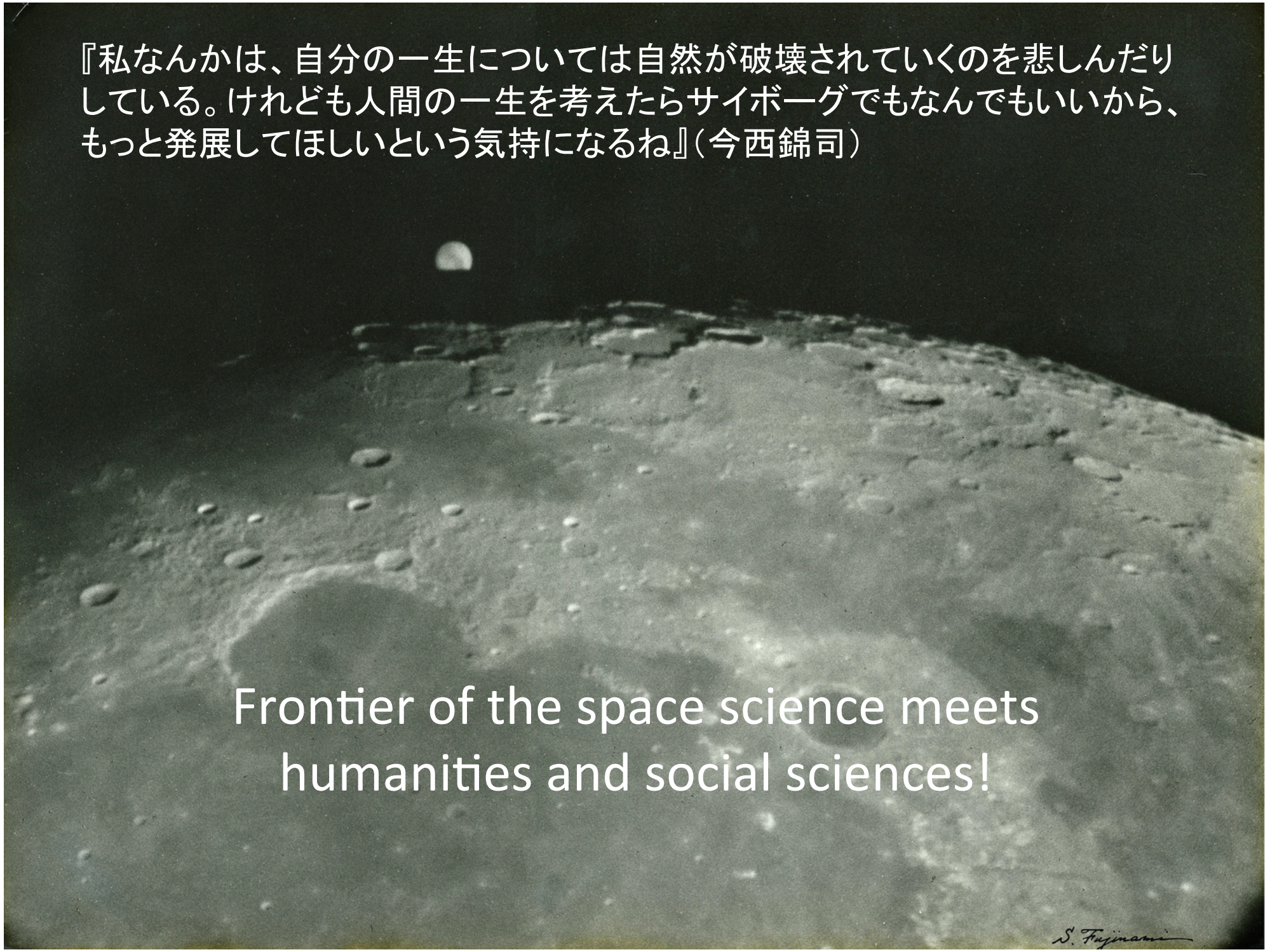
What are the consequences of going to the space?

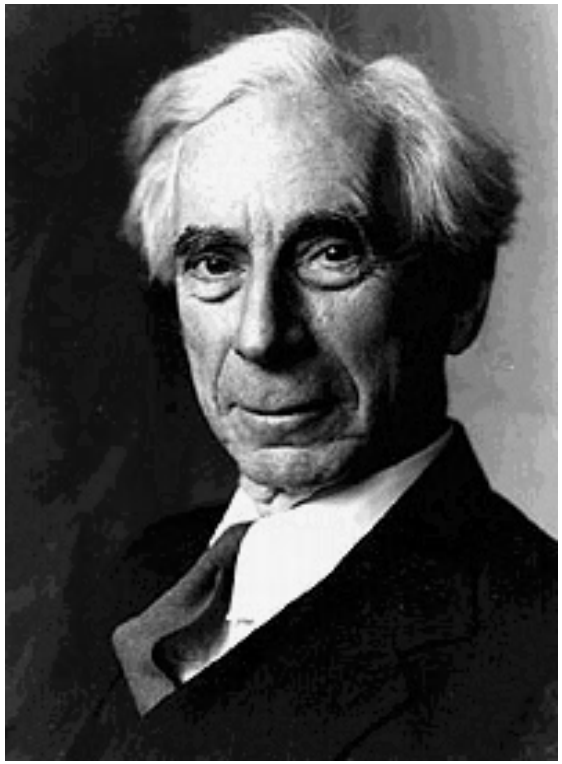
- New community outside current law and order
- Adaptation to new environment may cause/require changes in human body, mind and society
  - Bio-technology

2001, A space odyssay
http://en.wikipedia.org/wiki/File:2001child2.JPG

今西錦司『民族文化などは、人間が意識的につくりあげようとしてできたものではなくて、自然にそうなってきたものでしょう。こういう文化と、サピエンスとして人間が意識的に努力して作り出した文化とは、はっきり分ける必要がある』

梅棹忠夫『目的的発想は自然的所与とちごうてかなり自由度が高い。洋々たる可能性をはらんでいるとともに、一面大変恐ろしいところがある』


『私なんかは、自分の一生については自然が破壊されていくのを悲しんだりしている。けれども人間の一生を考えたらサイボーグでもなんでもいいから、もっと発展してほしいという気持になるね』（今西錦司）
Frontier of the space science meets
humanities and social sciences!
S. Fujinami



ICARUS
or The Future of Science

Bertrand Russell

http://www.marxists.org/reference/subject/philosophy/works/en/russell2.htm

理系に進む人にも、英語は重要

というか、実は理系の方がより英語が必要

（分野によりますが。）

英語を勉強すべき理由

- 受験に必要だから

- 世界中の人と意思疎通するため
  - 国際共通語

- 違う見方、考え方を獲得するため
  - 別に英語でなくてもよい

英語ができたとして、それで何を話しますか？

1944年

2014年

2112年

みなさんが生きている間に、世界はどれほど変わるだろう？

- 「理数系」を基礎とした「科学・技術」は、変化に適当するためにも必要だし、同時に私たち自身も変化させている
  - 電気、自動車、飛行機
  - インターネット、バイオテクノロジー、宇宙開発

- 科学・技術の最先端を学ぶ人は、人文・社会科学を避けては通れない
  - 語学はその重要な一部分

- 同時に、そこに新しい科学がある