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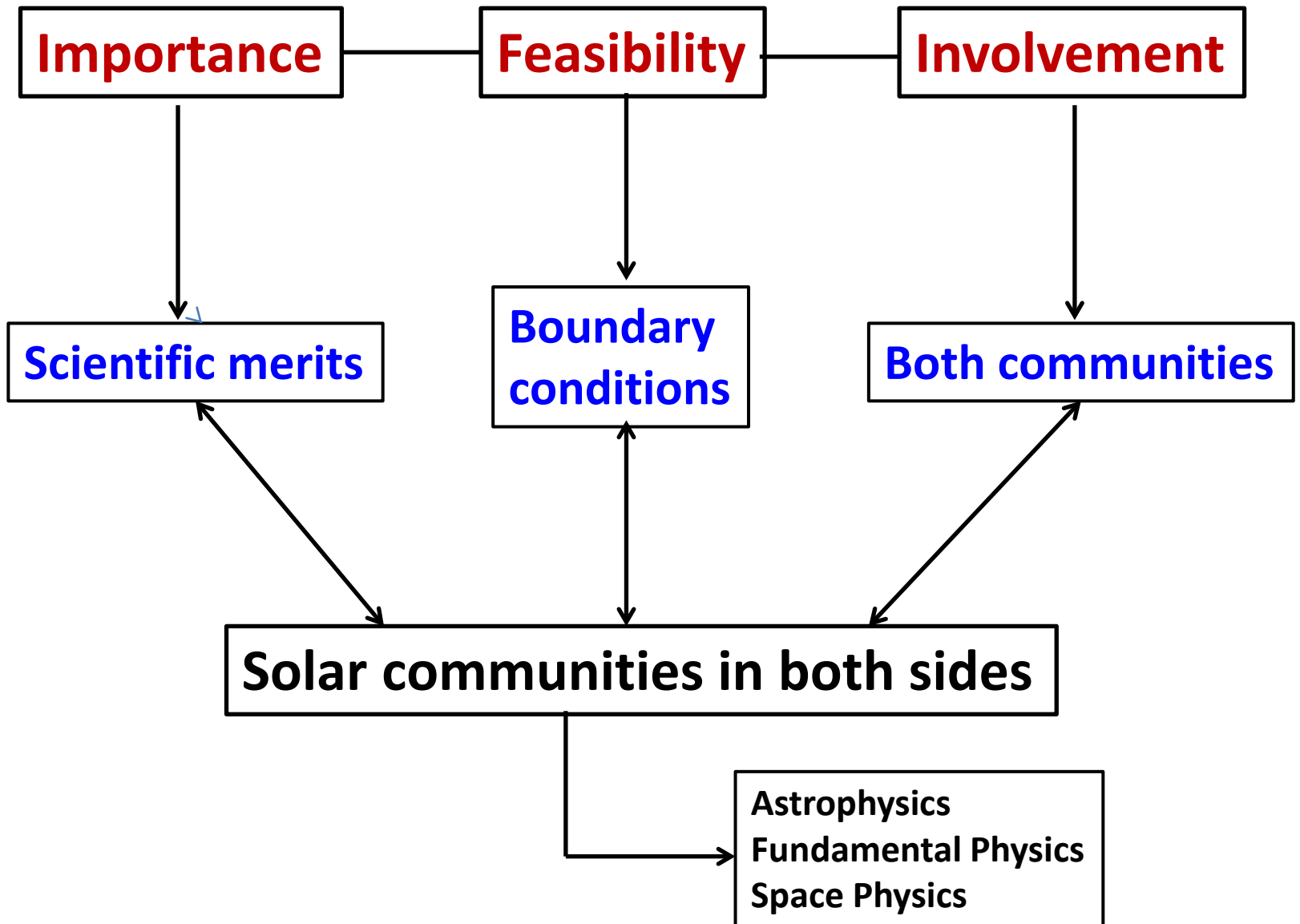
# Consideration of a Solar Mission

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**1st Workshop of a CAS-ESA Joint Mission , Chengdu , 25-26 Feb. 2014**

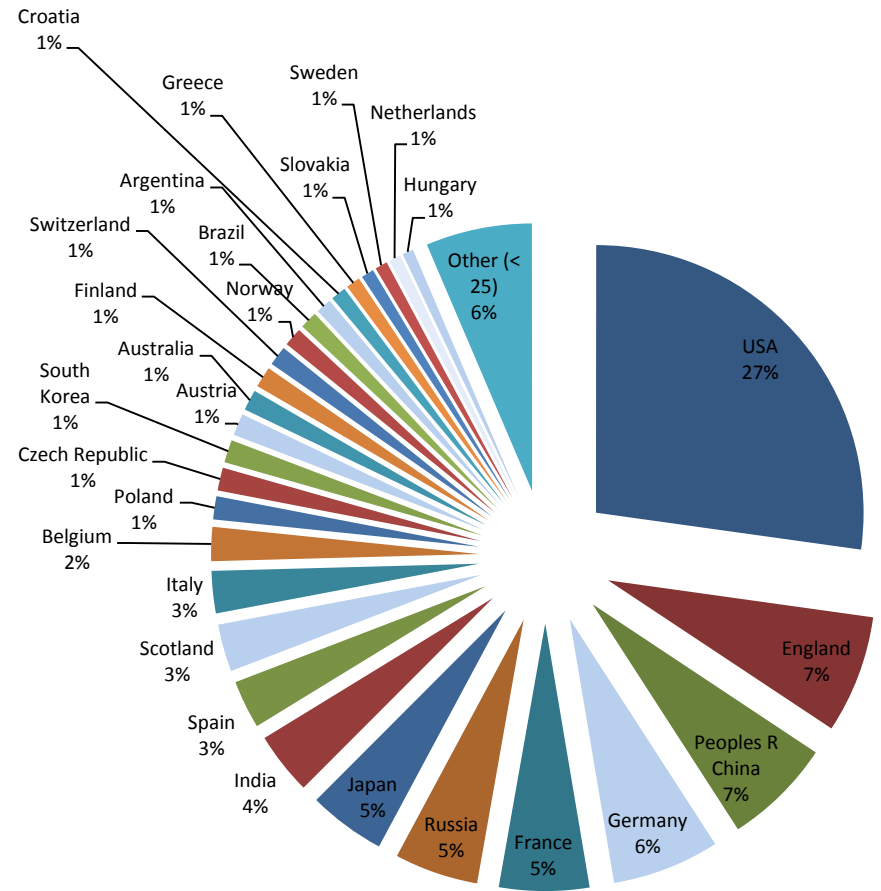
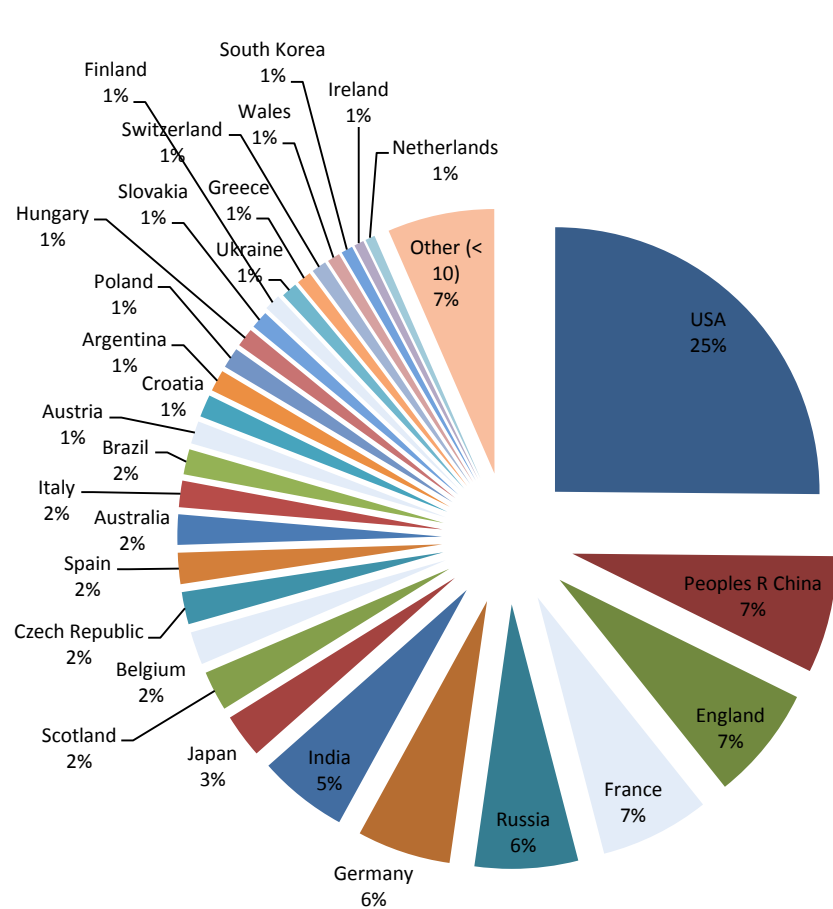


# Outline

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- **Solar Communities in both sides**
- **Scientific Objectives**
- **Feasibilities**
- **Involvement Background**
- **Remarks on three proposals**
- **Conclusions**

# Solar Communities in both sides(1/2)



**Solar Physics 2005-2010: Authors' Countries & Citing Authors' Countries**  
**European (exclude Russia) + Chinese: 50%-55%**

# Solar Communities in both sides<sub>(2/2)</sub>

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However, the number of solar space missions led by European and Chinese are relatively low (1960-2012):

**13/77 << 50%**

To develop a joint CAS-ESA Solar Mission thus seems to be much necessary, that also means zero breakthrough for Chinese solar community

# Scientific Objectives<sub>(1/3)</sub>

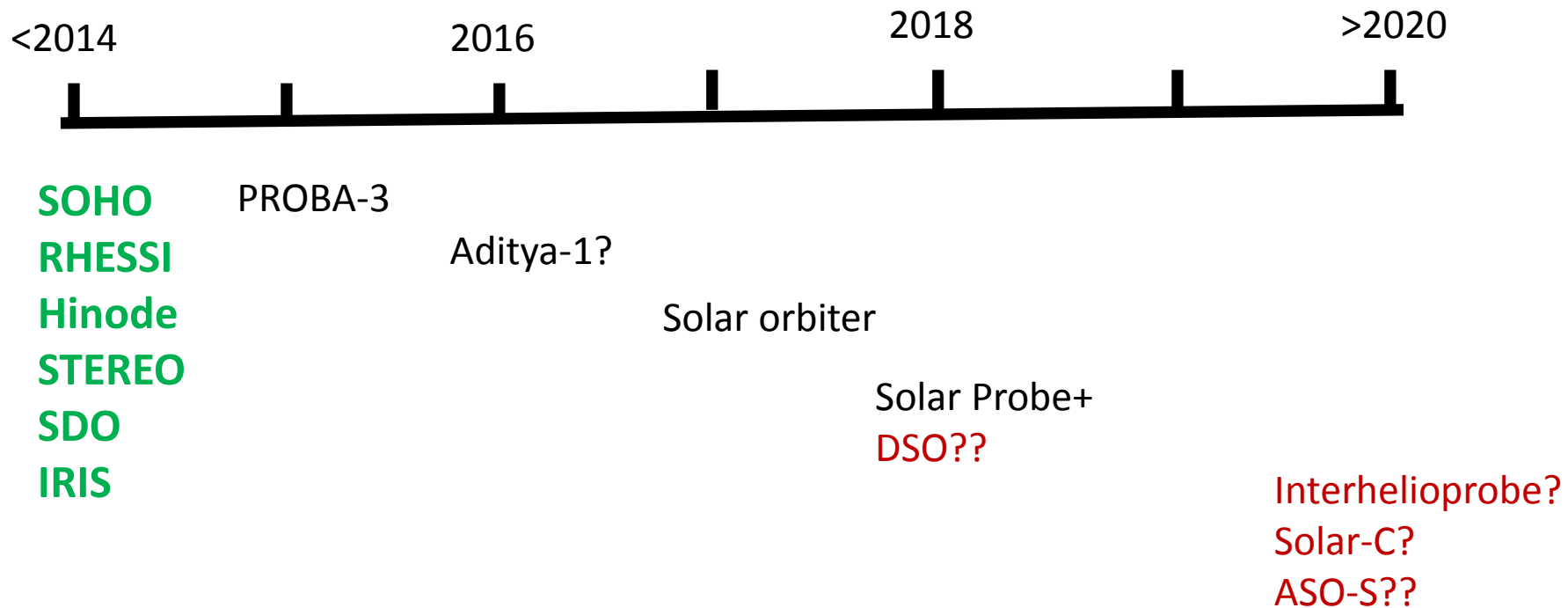
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Scientific Goals in “The 2013-2022 Decadal Survey in Solar and Space Physics”

- **Determine the origins of the Sun’s activity** and predict the variations of the space environment;
- Determine the dynamics and coupling of Earth’s magnetosphere, ionosphere, and atmosphere and their **response to solar** and terrestrial **inputs**;
- Determine the interaction of the Sun with the solar system and the interstellar medium;
- Discover and characterize **fundamental processes** that occur both within the heliosphere and throughout the universe.

# Scientific Objectives<sub>(2/3)</sub>

## Current and future solar missions



**Most current missions will be unavailable in 2021 or later!**  
**Compatibility should be considered with Solar Orbiter and Probe+.**

# Scientific Objectives<sub>(3/3)</sub>

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## Some key judgments:

- **Scope: Sun's activity or fundamental processes**
- **Observations should be new, never be done before (individually or in a combination of instruments) or play an irreplaceable role together with other missions then**
- **Focusing on some key questions, like, how does the solar eruption accumulate its energy, be triggered, and then release its energy? .....**



# Feasibilities

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## The key boundary conditions

- Payload mass  $\leq 60\text{kg}$ ;
- Payload power 50 watt average (typical);
- Operational lifetime of satellite 2-3 years.

Which exclude a mission needing a huge resource, like a comprehensive observatory;

A small mission, focusing on one or a few of significant scientific objectives, is much favorable!

# Involvement Background<sub>(1/2)</sub>

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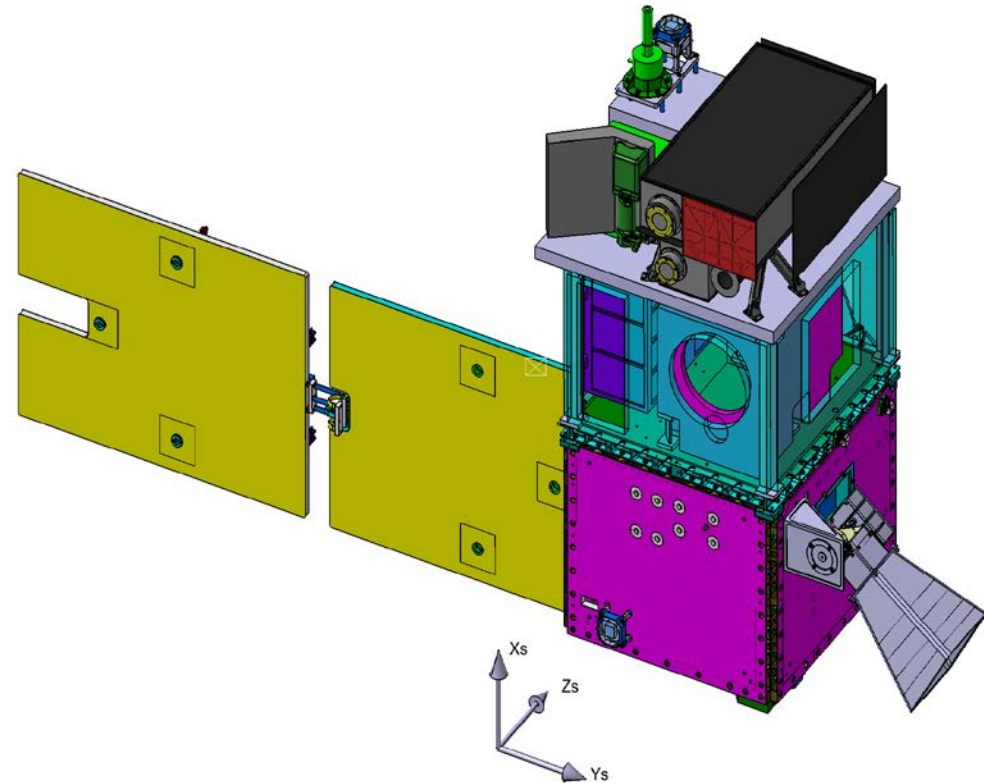
## Good relationship between two communities

- 5 times bilateral solar physics meetings **between China and France**: 1999 (Xian, China), 2002 (Paris), 2005 (Shanghai), 2008 (Paris), 2011 (Nice);
- 2 times bilateral solar physics meetings **between China and Germany**: 2012(Nanjing), 2015(Gottingen);
- **1<sup>st</sup> European-Chinese** Solar Physics Workshop is being prepared;
- **Personally**, more than half of Chinese solar physicists had a long-term working experience in Europe countries, mostly in Germany, France, and so on

# Involvement Background<sub>(2/2)</sub>

## Previous Space Project Cooperation

**SMESE** (Small Explorer for Solar Eruptions): a joint mission between CNES and CNSA. Contributors include IAS and LESIA from French side, and PMO, NJU, CSSAR, and NAOC from Chinese side. Phase-0, Phase-A and A+ studies were successfully undertaken from March 2006 to June 2008



# Remarks on three proposals<sub>(1/2)</sub>

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## Three solar proposals were proposed:

- **MASC: Magnetic Activity of the Solar Corona**  
a Hard-X-ray spectrometer, a UV/EUV imager, and a Visible Light / UV polarimetric coronagraph
- **SEEPE: Solar Energetic Emission and Particle Explorer**  
High energy band spectrometer; X-ray polarimeter;  
Energetic electron and ion detectors
- **SWUSV: Space Weather & Ultraviolet Solar Variability**  
6 instruments: from vector magnetometer, ultraviolet experiment, radiometer, to high energy burst spectrometer

(another proposal poster “A Compact Solar Hard X-ray Polarimeter” could be included in SEEPE)

# Remarks on three proposals<sub>(2/2)</sub>

	MASC	SEEPE	SWUSV
Scientific objectives			
Boundary conditions			
Cooperation			
Heritage			
Compatibility			
.....			

**For each proposal, beside the boundary conditions should be met, the importance, especially the compatibility and complementary should be emphasized.**

# Conclusions

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- **2021 is just the beginning of the 25<sup>th</sup> solar maximum, which provides an excellent opportunity to observe the activity of the Sun;**
- **Both solar communities are strong in the world and should play a commensurate role in developing solar space missions;**
- **Three proposals look very novel, deserving further investigations.**