CSSAR Space Science Cooperation

WANG Shuzhi
Center for Space Science and Applied Research
Chinese Academy of Science (CSSAR)
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- Brief History of CSSAR
- International Cooperation
- CAS Strategic Pioneer Research Program on Space Science
Part 1: Brief History of CSSAR
It was set up by CAS on Oct. 1958, dedicated for the development of the first Chinese satellite.
Mainly participation in first Chinese satellite DFH-1, which was launched on April 24, 1970.
participation in Chinese many space science programs and satellite programs, including manned space flight programs, SJ series satellites, Fengyun series satellites, Chang’e series satellites...
Part 2: International Cooperation
International Space Weather Meridian Circle Program (ISWMCP)

The International Space Weather Meridian Circle Program (ISWMCP), propose to connect 120ºE and 60ºW meridian chains of ground based observatories and enhance the ability of monitoring space environment worldwide.
Cooperation with ESA

- Established stable cooperative relationship with ESA
- Holding annual bilateral meetings on space science since 2004
- Joint missions: DSP, KUAFU, HXMT, YH-1
Double Star Project

- Two satellite running in equatorial and polar orbits
- Measurement of Earth magnetosphere with fields and particle detectors
- Cooperation with ESA, Nearly 50% of science payloads are provided from European countries

- Forming a six-point measurement with ESA’s Cluster mission first time in the human history to explore the geo-space
Double Star Project

National Award on Scientific and Technological Advancement, 2010

Laurels Team Achievement Award, International Academy of Astronautics, 2010
China-Russia Joint Research Center on Space Weather (2000- )

- More than 100 joint publications
- 10 Bilateral Scientific Workshop
- Cooperative Program
- More than ten Institutes involved between Russia and China
Yinghuo-1

- Yinghuo-1 is the first Chinese Mars exploration program, will be launched Nov. 2011, together with Russia’s Phobos-Grunt mission.

- YH-1 is aiming to explore the Martian space environment in a large elliptical orbit with FGM, Plasma package, Camera and a UHF receiver.

Courtesy of Phobos-Grunt Team
Other Partnership

◆ INPE of Brazil
◆ NCAR of USA
◆ SSL at UC Berkerley, USA
◆ Canada Space Agency
◆ IKI of Russia
◆ ......
COSPAR

- 36th COSPAR Scientific Assembly
- COSPAR Capacity Building Workshops
- Joint CAS/COSPAR Jeoujang JAW Award
International Fellowship & Consulting

- CAS Einstein Professorship
- CAS Visiting Professorships for Senior International Scientists
- CAS Fellowships for Young International Scientists
- Other International Consulting and Training
Part 3 :CAS Strategic Pioneer Research Program(SPRP):
Space Science
• 31.3.2010, the state council has approved the proposal from CAS called “Innovation 2020”, which is a 10 years plan for innovation research strategic and programs

• 11 Jan. 2011, Space Science Pioneer Program has been approved by the government as one strategic pioneer research programs (SPRP)
The Main Goal of SPRP on Space Science

- In the selected areas such as black hole, quantum theory, dark matter, space weather, microgravity and life science, develop and launch 5 space science satellites (2011-2015), making great breakthrough in basic science and related application areas, promote space science in China in general.

- Select background and pre-study space science missions for future
CSSAR, as the System Level Management Center, Leading the CAS Strategic Pioneer Science and Technology Project on Space Science.
<table>
<thead>
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<th>Content</th>
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<td>Black Hole</td>
<td>HXMT</td>
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<tr>
<td>Microgravity / Life Science</td>
<td>SJ-10</td>
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<tr>
<td>Quantum Theory</td>
<td>QTDS</td>
</tr>
<tr>
<td>Dark Matter</td>
<td>DDS</td>
</tr>
<tr>
<td>Space Weather</td>
<td>KUAFU</td>
</tr>
</tbody>
</table>

**Project 1**

**Project 2**

**Project 3**

**Project 4**

**Project 5**
Strategic Pioneer Project on Space Science

**Content**

- Selection and pre-study of missions for 2015-2020

**Means**

- Background Development

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Strategic and research on future mission concept and technology

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Project 6

Project 7
The Hard X-ray Modulation Telescope (HXMT)

Scientific Objectives:

✓ Hard X-ray full sky survey
  • Diffuse background and cosmic variance
  • Discover highly obscured supermassive BHs
✓ Broad band (1-250 keV) and large collection area (5000 cm²@100 keV) pointed observations of high energy objects
  • Dynamics and radiation near BH horizons of stellar mass and supermassive BHs

Launch: 2014
Recoverable Satellite for space microgravity and space life science (SJ-10)

SJ-10 is expected to make breakthroughs in

✓ the basic laws of motion for matter
✓ biology gene expression
✓ efficient drug development
✓ efficient combustion of coal ...

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Center for Space Science and Applied Research, Chinese Academy of Sciences
Recoverable Satellite for space microgravity and space life science (SJ-10)

Space Science Experiments

Microgravity Sciences
- A1 - Microgravity Fluid Physics
- A2 - Microgravity Combustion
- A3 - Space Materials Science
- A4 - Space Fundamental Physics

Space Life Sciences
- B1 - Space Radiation Biological Effects
- B2 - Gravity Biological Effects
- B3 - Space Biotechnology

9 experiments aboard the orbit capsule + 11 aboard the reentry capsule
Quantum Experiments at Space Scale (QUESS)

Scientific Objectives:

✓ Accomplish for the first time satellite-to-ground absolutely secure communication with the core of quantum key
✓ Carry out the first time satellite-to-ground quantum entanglement distribution and Bell inequality test in the world
✓ Investigate possibility of achieving satellite-to-ground quantum teleportation experiment
✓ Establish Wide-area quantum communication network

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Orbit</td>
<td>800km</td>
</tr>
<tr>
<td>Inclination</td>
<td>98.6°</td>
</tr>
<tr>
<td>Stability</td>
<td>±0.02°/s</td>
</tr>
<tr>
<td>Mass</td>
<td>300kg</td>
</tr>
</tbody>
</table>
Dark Matter Particle Detection Satellite

Scientific Objectives:

- Find and study dark matter particle through high-resolution observation of high energy electron, gamma-ray spectrometry and its space distribution
- Study the origin of cosmic ray through observation of high energy electron spectrum and anisotropy above TeV
- Study the propagation and acceleration mechanism of cosmic ray through the observation of its heavy ion spectra
Dark Matter Particle Detection Satellite

**Conceptional Design:**

- **Track detector**
  - (6 layers plastic scintillator, to detect the particle direction and to discriminate gamma-rays from particles)
- **BGO detector**
  - (12 layers, to measure the energy of the incident particles and to discriminate electrons from protons)
- **Neutron detector**
  - (He-3 proportional counter, to improve the discrimination of electrons from protons)
Scientific Objectives:
To observe the complete chain of disturbance from the solar atmosphere to the geo-space:
✓ Solar flares, CMEs,
✓ Interplanetary clouds, shock waves,
✓ Their geo-effectiveness, such as sub-storms and magnetic storms, aurora activities

KUAFU-A Payloads

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Mass (kg)</th>
<th>Power (w)</th>
<th>Data Rate (bps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUV/FUV Disk Imager</td>
<td>25</td>
<td>20</td>
<td>100k</td>
</tr>
<tr>
<td>Coronal Dynamics Imager</td>
<td>35</td>
<td>35</td>
<td>50k</td>
</tr>
<tr>
<td>Radio Burst Instrument</td>
<td>12</td>
<td>10</td>
<td>4k</td>
</tr>
<tr>
<td>Solar Wind Instrument Package</td>
<td>6</td>
<td>6</td>
<td>4k</td>
</tr>
<tr>
<td>Solar Energetic Particle Sensor</td>
<td>8</td>
<td>10</td>
<td>1k</td>
</tr>
<tr>
<td>X-ray/γ-ray Detector</td>
<td>3</td>
<td>5</td>
<td>1k</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
<td>86</td>
<td>160</td>
</tr>
</tbody>
</table>
## New missions under study and for selection

<table>
<thead>
<tr>
<th></th>
<th>Name of the mission concept</th>
<th>Key Technology needed to be studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X-Ray time variation and polarization Telescope (XTP)</td>
<td>Integrated low and high energy X ray detectors</td>
</tr>
<tr>
<td>2</td>
<td>Solar Polar Orbit Radio Telescope (SPORT)</td>
<td>VHF Interferometric Radio Telescope, RTG</td>
</tr>
<tr>
<td>3</td>
<td>Magnetosphere-Ionosphere-Thermalsphere Coupling Program (MIT)</td>
<td>Multi spectrum and multifunctional detectors</td>
</tr>
<tr>
<td>4</td>
<td>Near-Infrared Astronomy Mission</td>
<td>Near Infrared Low Noise Detectors</td>
</tr>
<tr>
<td>5</td>
<td>Atmosphere-Ionosphere Micro/Nono satellite Constellation</td>
<td>Constellation technology</td>
</tr>
<tr>
<td>6</td>
<td>3-D Solar Magnetic Field Observation</td>
<td>Specific Filters</td>
</tr>
<tr>
<td>7</td>
<td>Near space atmosphere</td>
<td>FP interferometer and other payloads</td>
</tr>
</tbody>
</table>
Summary

• China is paying more attention to space science.

• Great efforts should be made to develop and launch all 5 missions by 2015.

• Cooperation with European countries in future missions is expected.
Thanks!