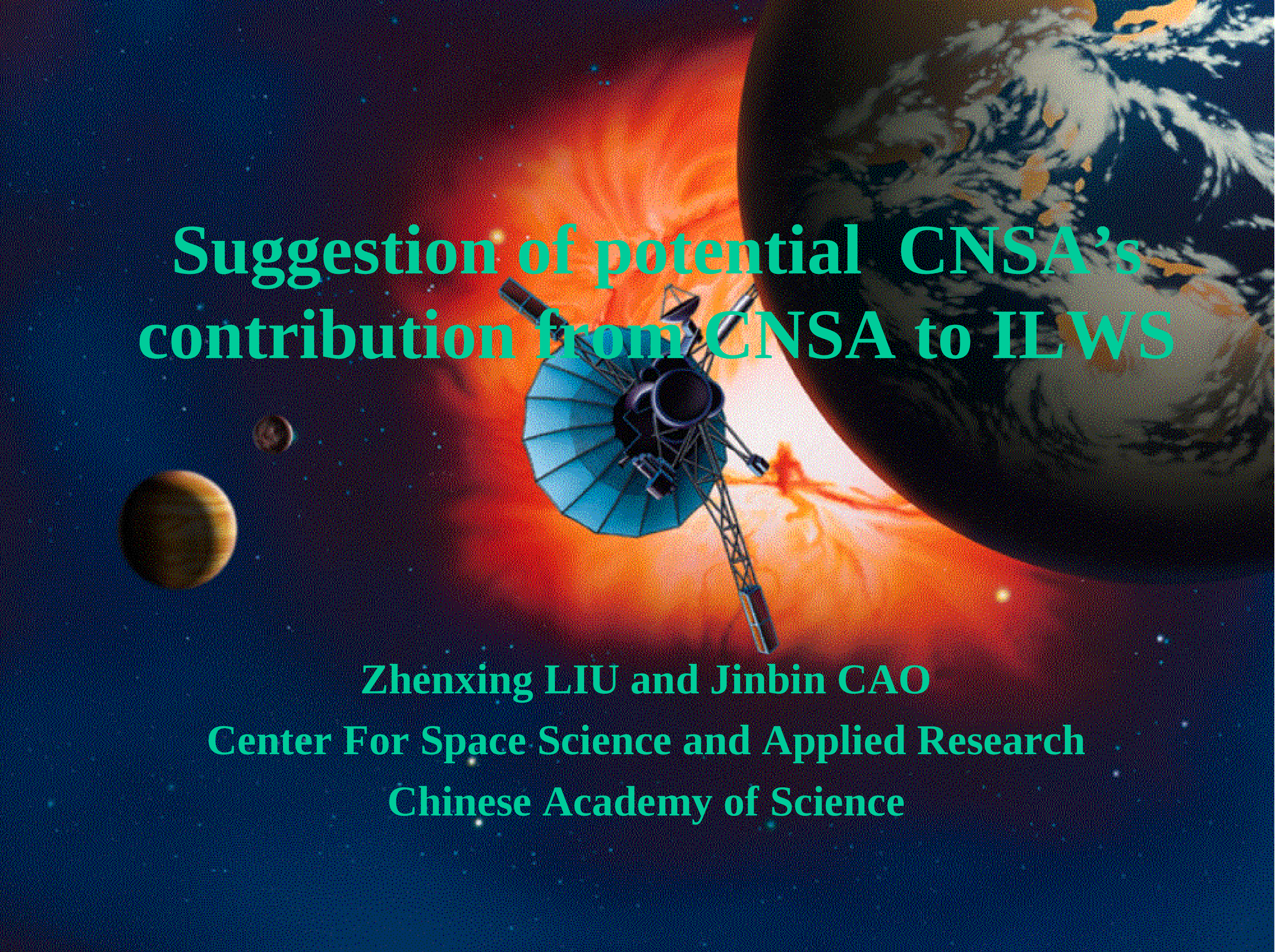


Suggestion of potential CNSA's contribution from CNSA to ILWS

Zhenxing LIU and Jinbin CAO
Center For Space Science and Applied Research
Chinese Academy of Science

Introduction

In November, 2000, Chinese government for the first time issued “the White paper of China’s Space Activities”.

Three development areas of china space:

- space science
- space technology
- space applications

Chinese government attaches a great importance to space science and supports actively the development of space science.

Introduction

In December 2000, Chinese government approved the Geospace Double Star Program, which was started as an important space exploration program of Tenth Five Year Plan of CNSA.

Many senior officials of CNSA stressed in many occasions that China will set up science exploration satellite series and advanced continuously the development of china space science.

Introduction

Now CNSA is preparing the space exploration plan of the period 2006-2020. The sun-earth space exploration is a key part of this plan. The currently discussed sun-earth space exploration plan will enables CNSA to take part in ILWS deeply.

Stages of CNSA's participation in ILWS

Two stages:

•First stage 2003-2006:
CNSA participates in ILWS through DSP

•Second stage 2006-2012:
CNSA participate in ILWS through SWISE program (Space Wind and Storm Exploration)

Main concepts of SWISE program

SWISE is composed by the three satellites in different orbits:

SWISE-1:

operating in the regions of ionosphere and thermosphere (300-700 km), is designed to observe the responding process of ionospheric storm and thermospheric storm to solar activities and magnetospheric disturbances

Main concepts of SWISE program

SWISE-2

•operating in the region of near earth magnetopshere (700km-7.5 R_E), is designed to observe the response of magnetospheric storm to solar activities and interplanetary disturbance.

SWISE-3

operating in the regions of near-bow shock solar wind and magnetopause boundary layer (2 R_E – 22 R_E)., is designed to observe the response of the near-earth solar wind to the solar activities and it's influence to magnetospheric storms.

Main concepts of SWISE program

If SWISE can be approved by CNSA, the satellites will be launched between 2010-2012.The three satellites can be launched by one rocket.

The planned SST (Space Solar Telescope) of CNSA can also cooperate with SWISE.

Main concepts of SWISE program

SWISE can explore the solar wind-magnetosphere-ionosphere/thermosphere system, and study the responding process of magnetospheric storms to interplanetary disturbances.

Geospace storms, including magnetospheric substorm, magnetic storm, particle storm, ionospheric storm, and thermospheric storm, are a key part of space weather. Therefore, SWISE is key component part of space weather exploration.

SWISE and other mission of ILWS coordinate, and can contribute more to the space weather research.

Scientific Objectives of SWISE

Goal of SWISE:

to understand the responding process of geospace weather to solar activity and interplanetary disturbance

Scientific Objectives of SWISE

Scientific objectives of SWISE:

to explore near-magnetosphere solar wind, magnetopause boundary layer, and near-earth magnetospheric active regions, and temporal-spatial variations of ionospheric and thermospheric disturbances, to study the driven and triggering mechanisms of geospace storms, as well as their response to solar activities and the interplanetary disturbances.

Scientific Objectives of SWISE

Research objectives are :

(1) the responding process of near-earth solar wind to the solar activities
(2) the structure and dynamics of bow shock, magnetosheath and magnetopause under different interplanetary conditions
(3) the driven and triggering mechanisms of magnetospheric substorm and geomagnetic storm

Scientific Objectives of SWISE

Research objectives are :

(4) the relation between magnetospheric substorm and geomagnetic storm, and their influences to the magnetospheric particle environment

(5) the relation between the ionospheric storm and the thermospheric storm, as well as the their responding process to the solar activities and interplanetary condition

Scientific Objectives of SWISE

Orbits of SWISE satellites :

SWISE—1, 300km-700km, 65^o, Spin stabilized

SWISE—2, 700km-7.5$R_{E,}$ 65^o, Spin stabilized

SWISE—3, 2 R_E- 22 R_E, 65^o, Spin stabilized

Orbit Configuration

- Perigee altitude / Apogee altitude
  - Sat1: 300km / 800km
  - Sat2: 700km / 7Re
  - Sat3: 3Re / 22Re
- Inclination: ~65°

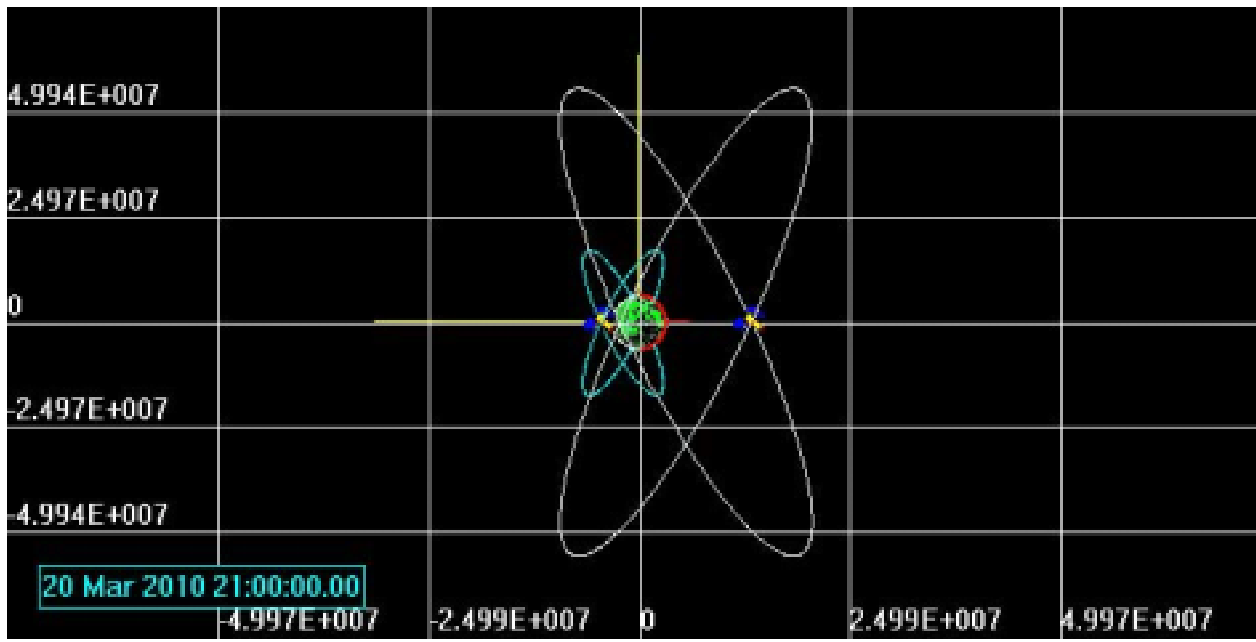
Orbit Periods and Perturbations

- **Sat2 / Sat3**
  - **period: 13.69 / 69.85 (hrs)**
  - **drift rate of the right ascension of the ascending node: -0.114021 / -0.001828 (deg/mean solar day)**
  - **Drift rate of the argument of perigee: -0.014430 / -0.000231 (deg/mean solar day)**

Example

- **Possible orbits for Sat2 and Sat3 if launched in the year 2010, specified at the time of spring equinox**
  - **Sat2: perigee at the sun side, apogee at the night side**
  - **Sat3: apogee at the sun side, apogee at the night side**
  - **Both: semi-major axis along the earth-sun line**
  - **Orbit planes: 2 possibilities for both**
    - **Ascend from the sun-side and descend at the night-side, or vice versa.**

Fig.1 View From ECI-X



To show orbits clearly, viewing direction is not exactly the X axis

Fig.2 View From ECI-Y

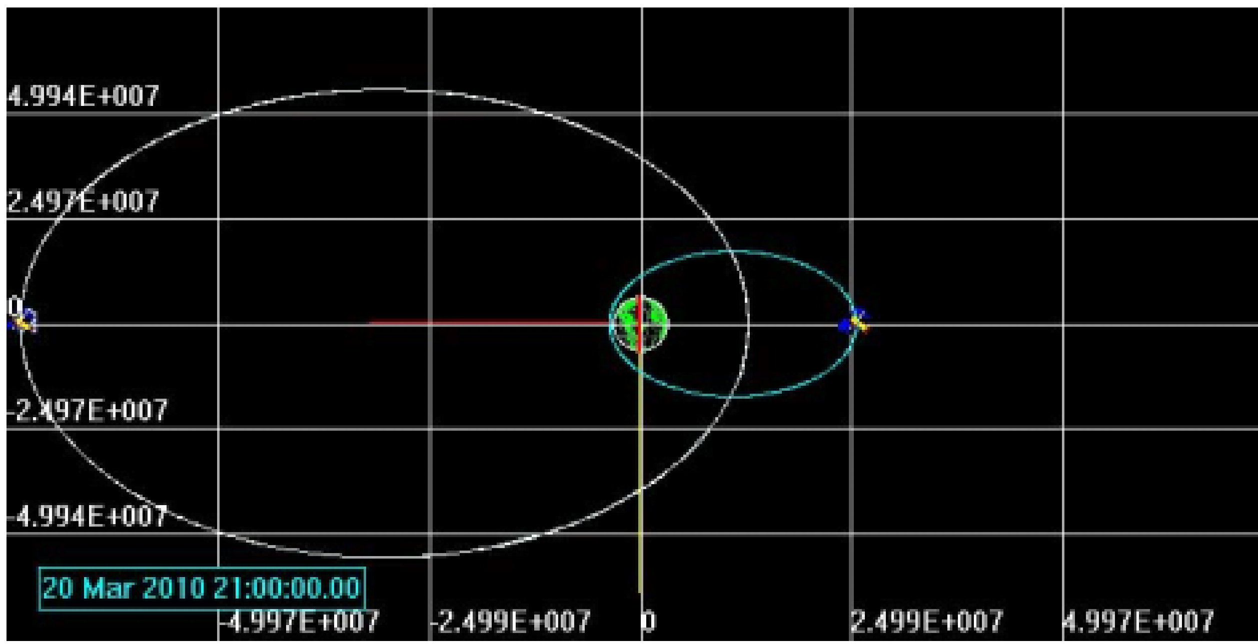
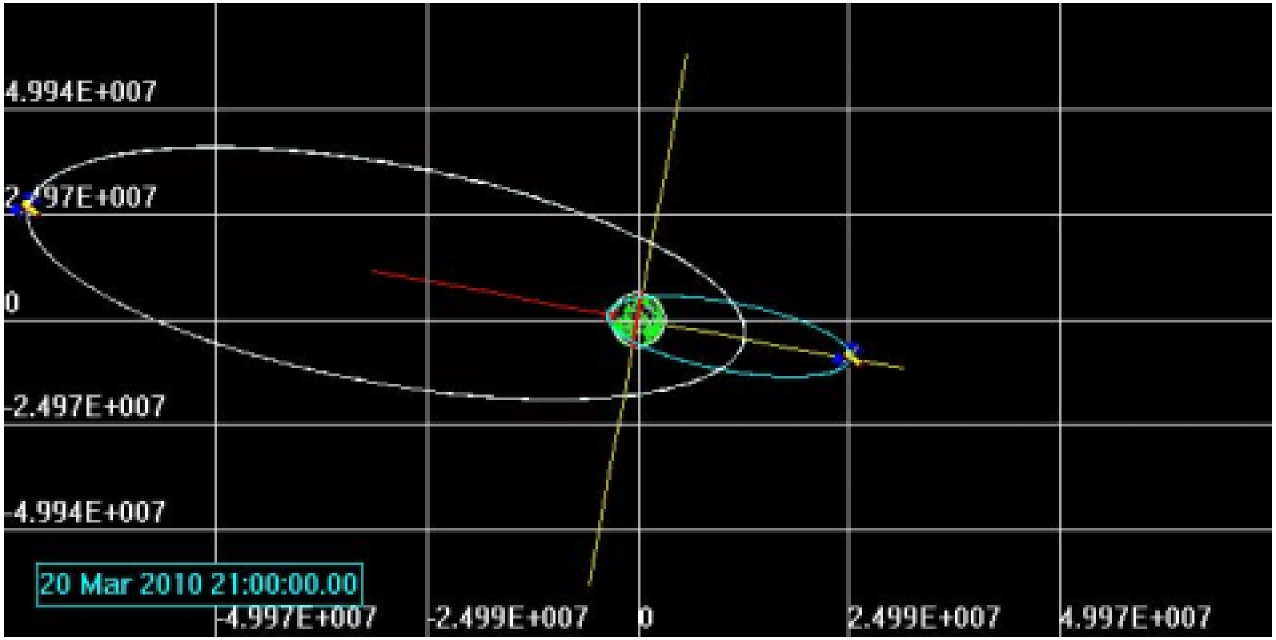
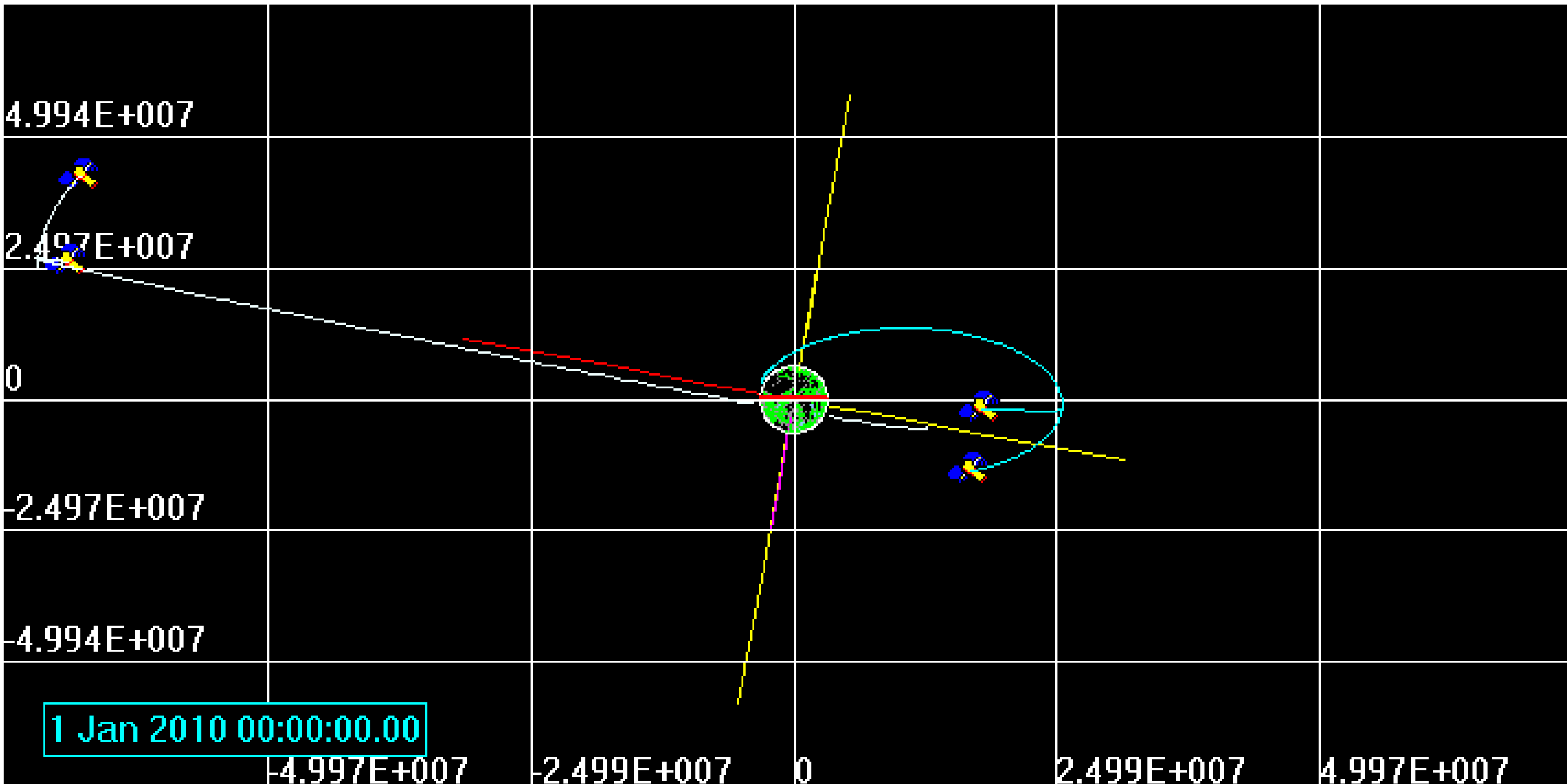


Fig.3 View From ECI-Z

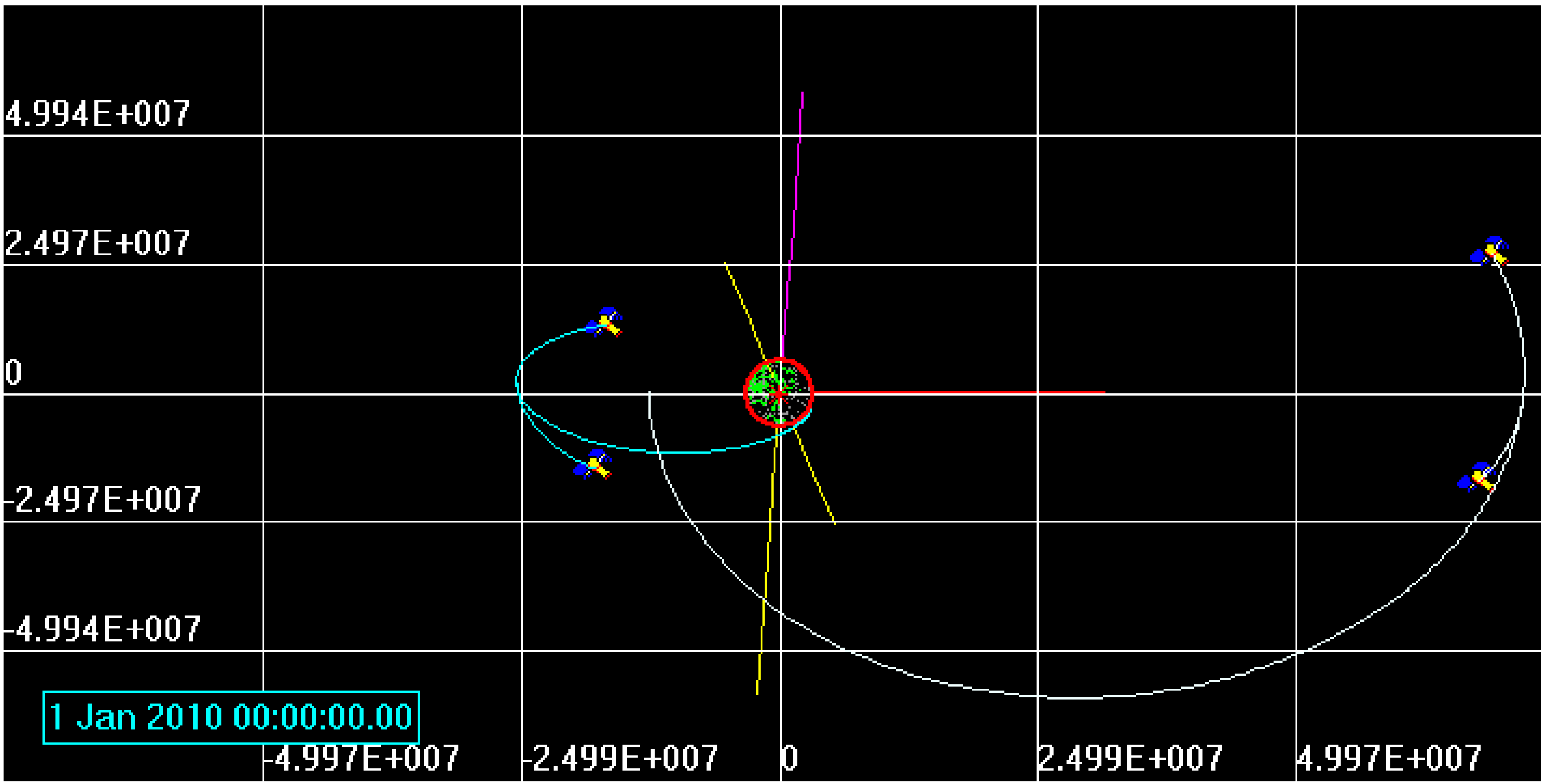


Animation: View From the North Pole of Ecliptic (2010/01/01 ~ 2011/12/31)



The rotating axes are the axes of ECI coordinate. The red one is the positive ECI-X, and the pink is the positive Z.

Animation: View From Sun to Earth in Ecliptic (2010/01/01 ~ 2011/12/31)



The rotating axes are the axes of ECI coordinate. The red one is the positive ECI-X, and the pink is the positive Z.

Payloads of SWISE

SWISE—1, 300km-700km, 65º, Spin stabilized

- Fluxgate magnetometer
- Ionospheric particle detector
- Low energy plasma detector
- Electromagnetic wave detector
- Energetic neutral particle mass spectrometer
- Thermospheric wind and temperature detector
- High energy particle detector
- Solar ultraviolet radiation detector
- Auroral imager

Payloads of SWISE

SWISE—2, 700km-7.5$R_{E,}$ 65^{o}, Spin stabilized

- Fluxgate magnetometer
- Low energy plasma detector
- Energetic particle detector
- High energy particle detector
- Energetic neutral atom imager
- Auroral imager
- Active satellite potential controller

Payloads of SWISE

SWISE—3, 2 R_E- 22 R_E, 65º, Spin stabilized

- Fluxgate magnetometer
- Low energy plasma detector
- Energetic particle detector
- High energy particle detector
- Electromagnetic wave detector
- Active satellite potential controller

Thanks a lot
for your attention