

# To Start a GO Project in China

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1. Beginning with a gift “GO”
2. Short History of GW Study and Detection in China
3. Reasons for my Group to be interested in GW Detection
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5. Aim and Schedule
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年代：先秦  
作者：屈原  
作品：天问

## Asking the Universe

(250 B.C.)

遂古之初，谁传道之？  
上下未形，何由考之？  
冥昭瞢闇，谁能极之？  
冯翼惟像，何以识之？

From that period, Chinese literatures has describe  
the universe as

**宇宙 = universe**

(yu zhou)

but, 宇=space, 宙=time

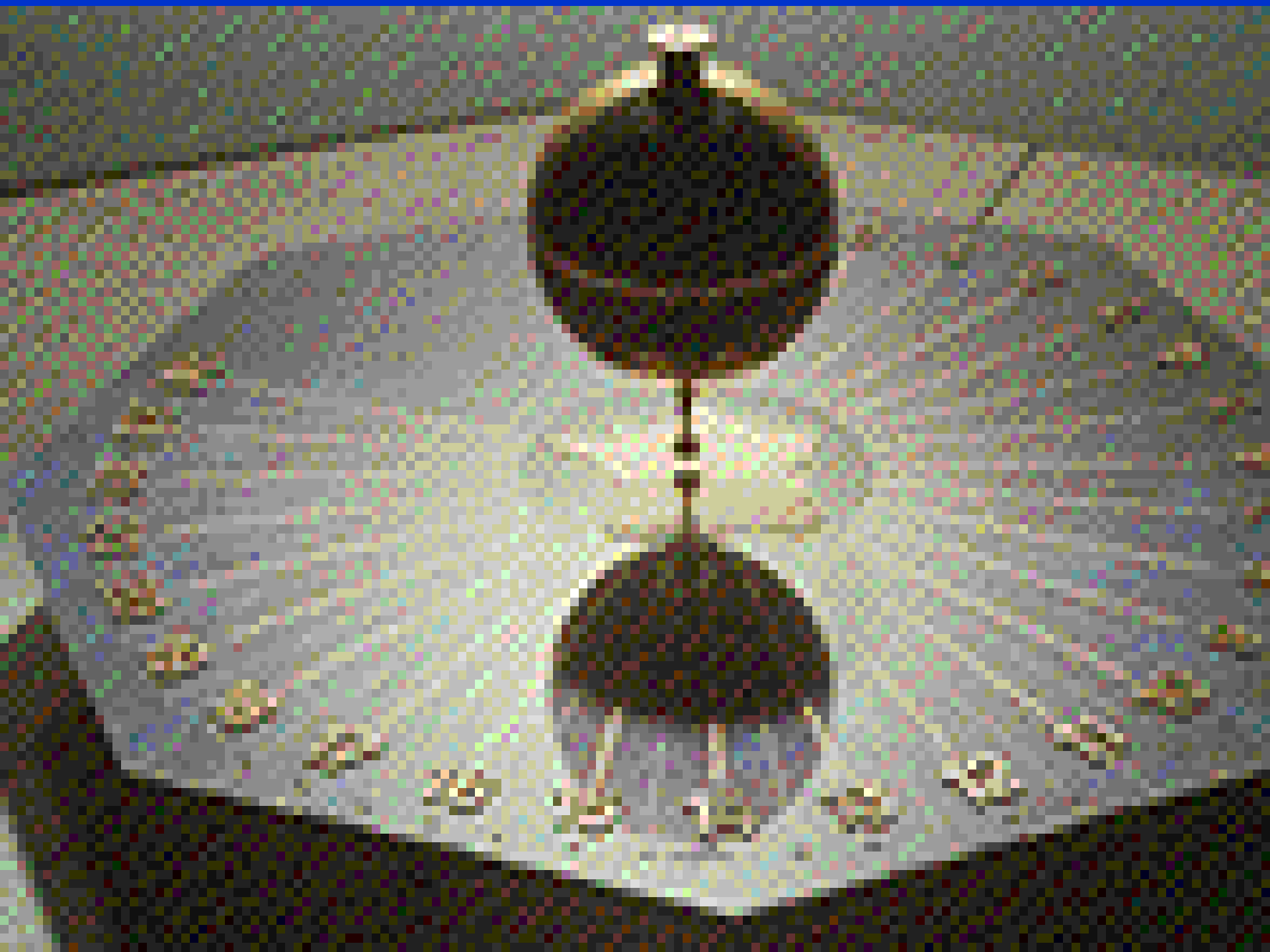
So, the concept of 宇宙 connected space with  
time.

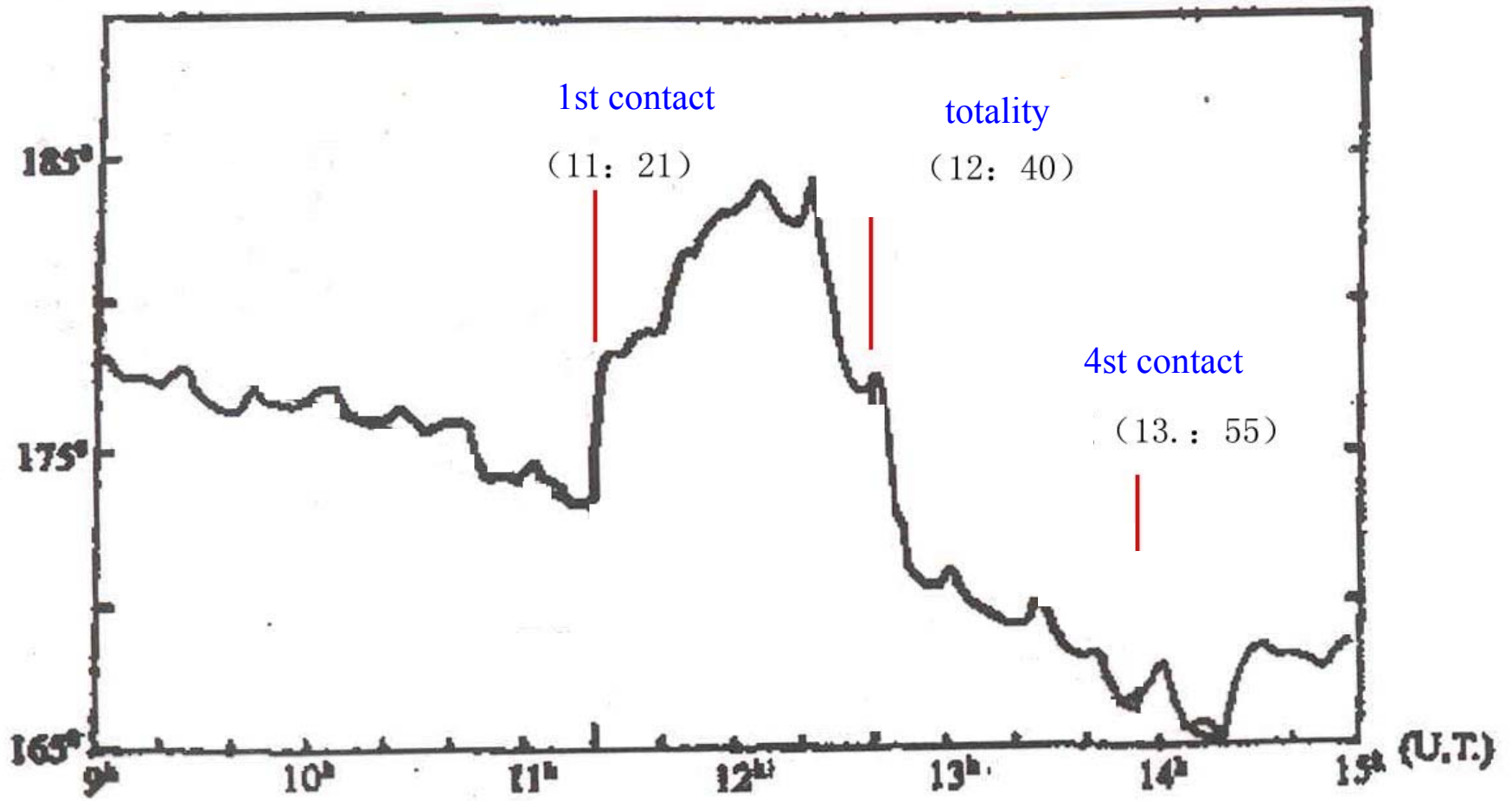
# Short History of GW Study and Detection in China

1. From 70's to 80's, Zhongshang U in Guangdong and HEP made Bars test,  $\sim 10^{-16}$
2. From 70's to now, The Astrophysics Group of USTC kept cosmology study going on
3. Beijing U, Beijing Normal U and Zhongqing U and Nanjing U continued cosmology study

# Reasons for my Group to be interested in GW Detection

1. Gravity Anomaly during the solar Eclipse of 1997, Mohe, China
2. Gravity Anomaly during the solar Eclipse of 2001, Zambia
3. Gravity Anomaly during the solar Eclipse of 2002, Australia

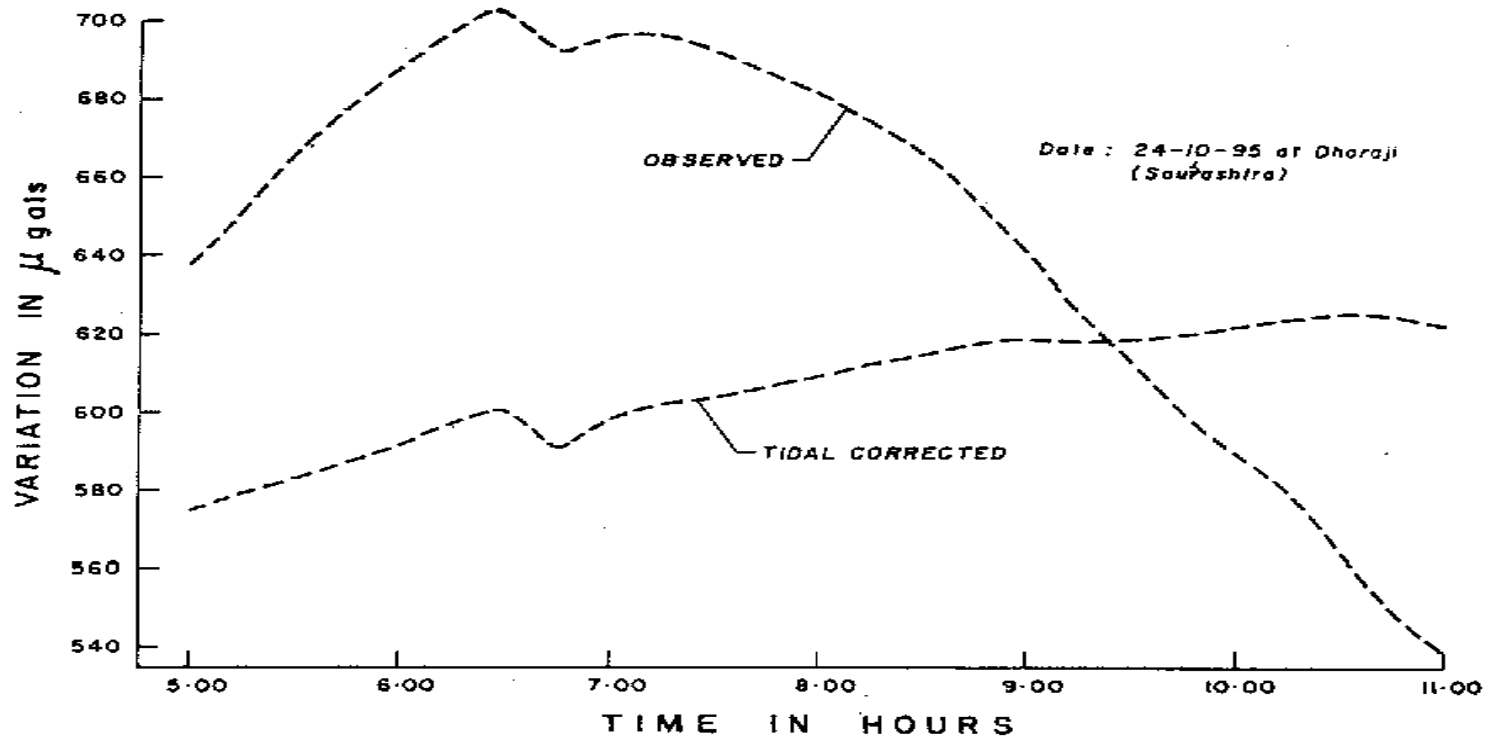




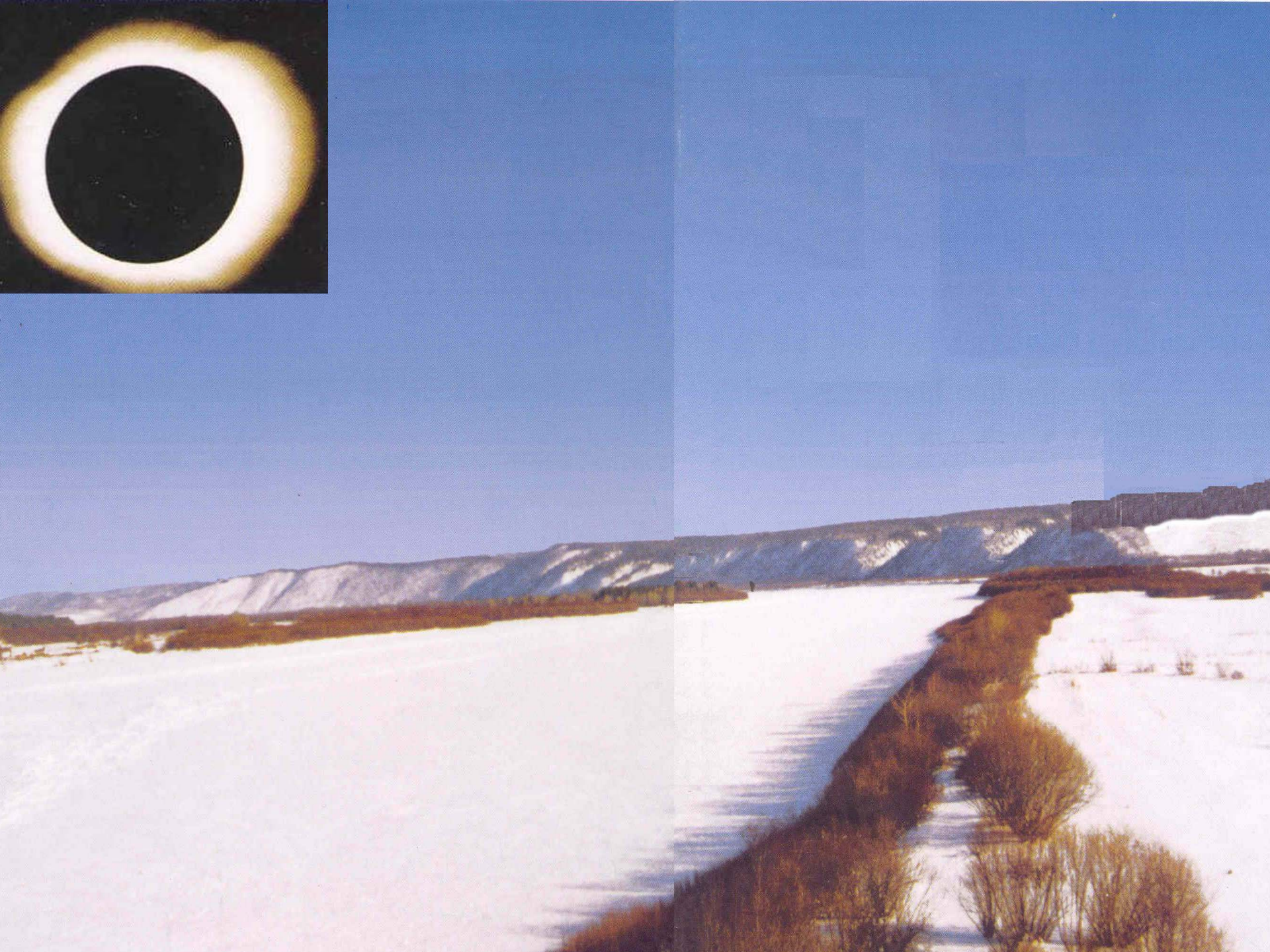
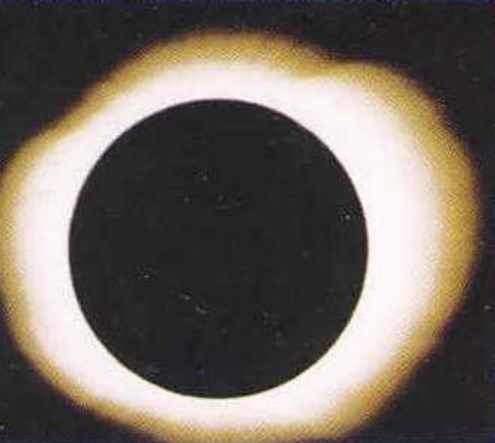
Angle's variation of the Swing Plane of the Foucault Pendulum,  
Paris, June 30, 1954



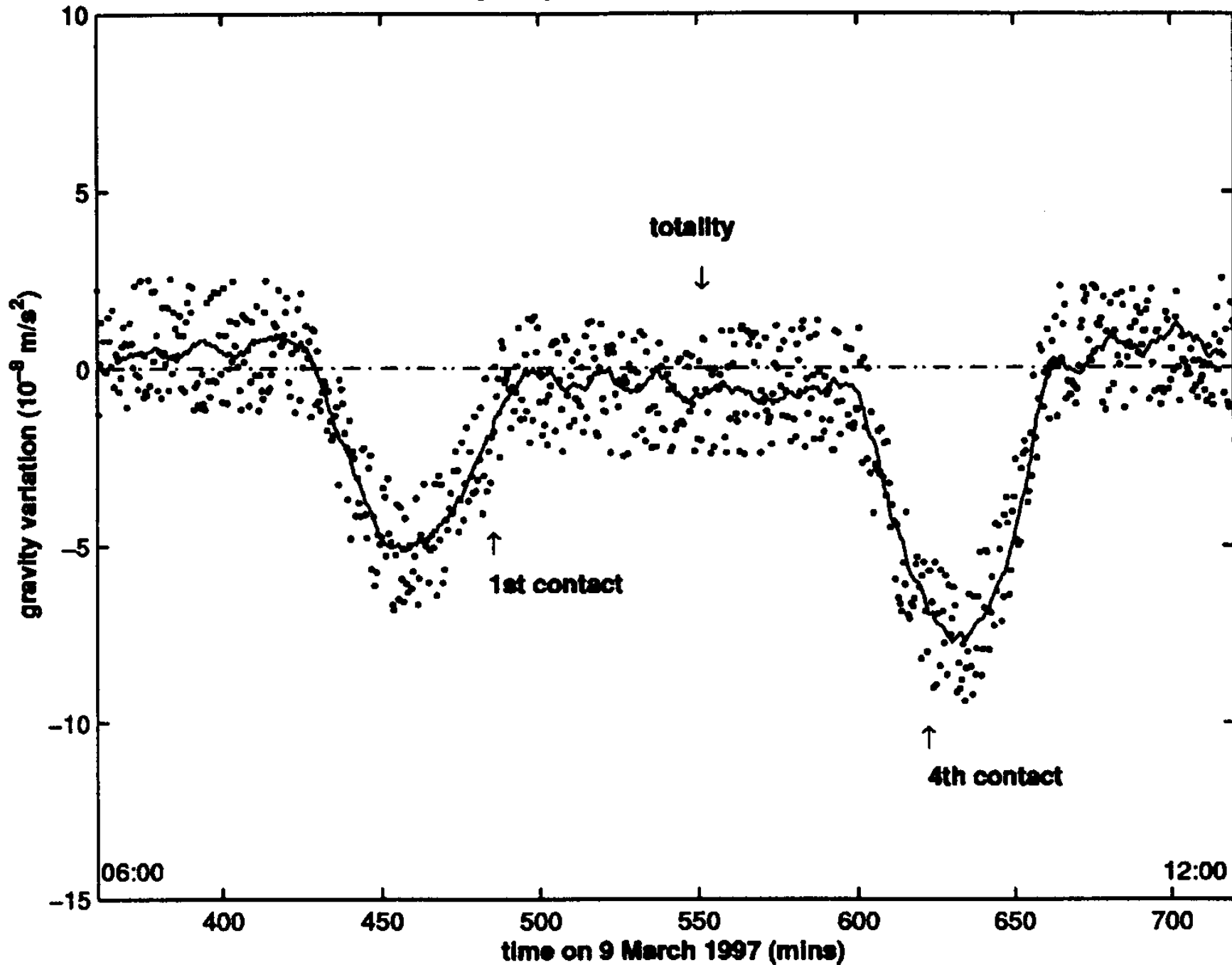
**Figure 1.** Tidal effect on 24 October 1995 at Dhoraji (Saurashtra).



**Figure 2.** Observed and tidal corrected gravity field at Dhoraji on 24 October 1995.



Measured gravity variations during total solar eclipse



# Fundamental Physics

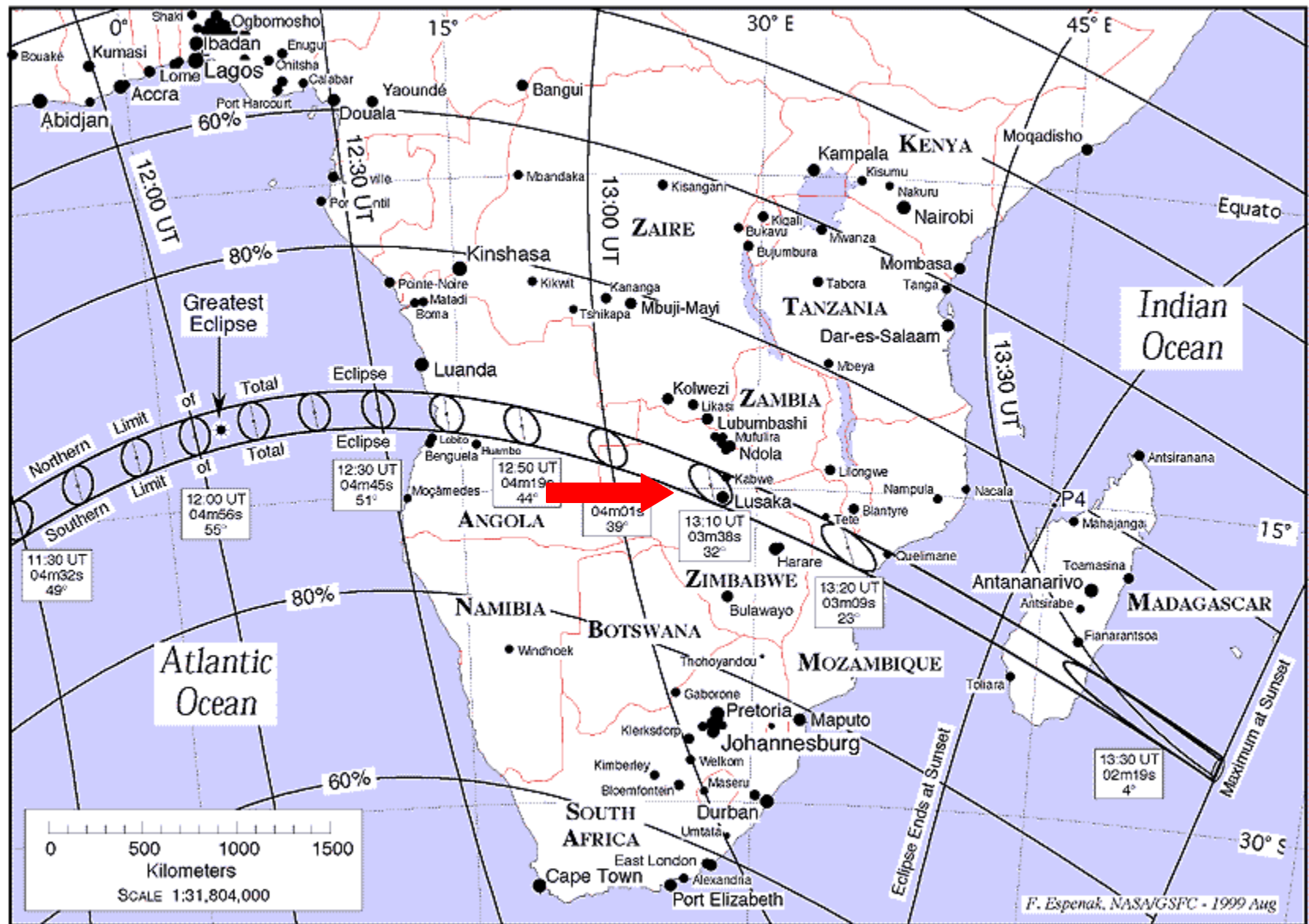
(Gillies)

1. Superposition
2. Inverse square law
3. Equivalence principle
4. A new non-gravitational weak force

To answer these questions, it requires more observational evidences with more precise measurements.



**FIGURE 7: Total Solar Eclipse of 2001 June 21**





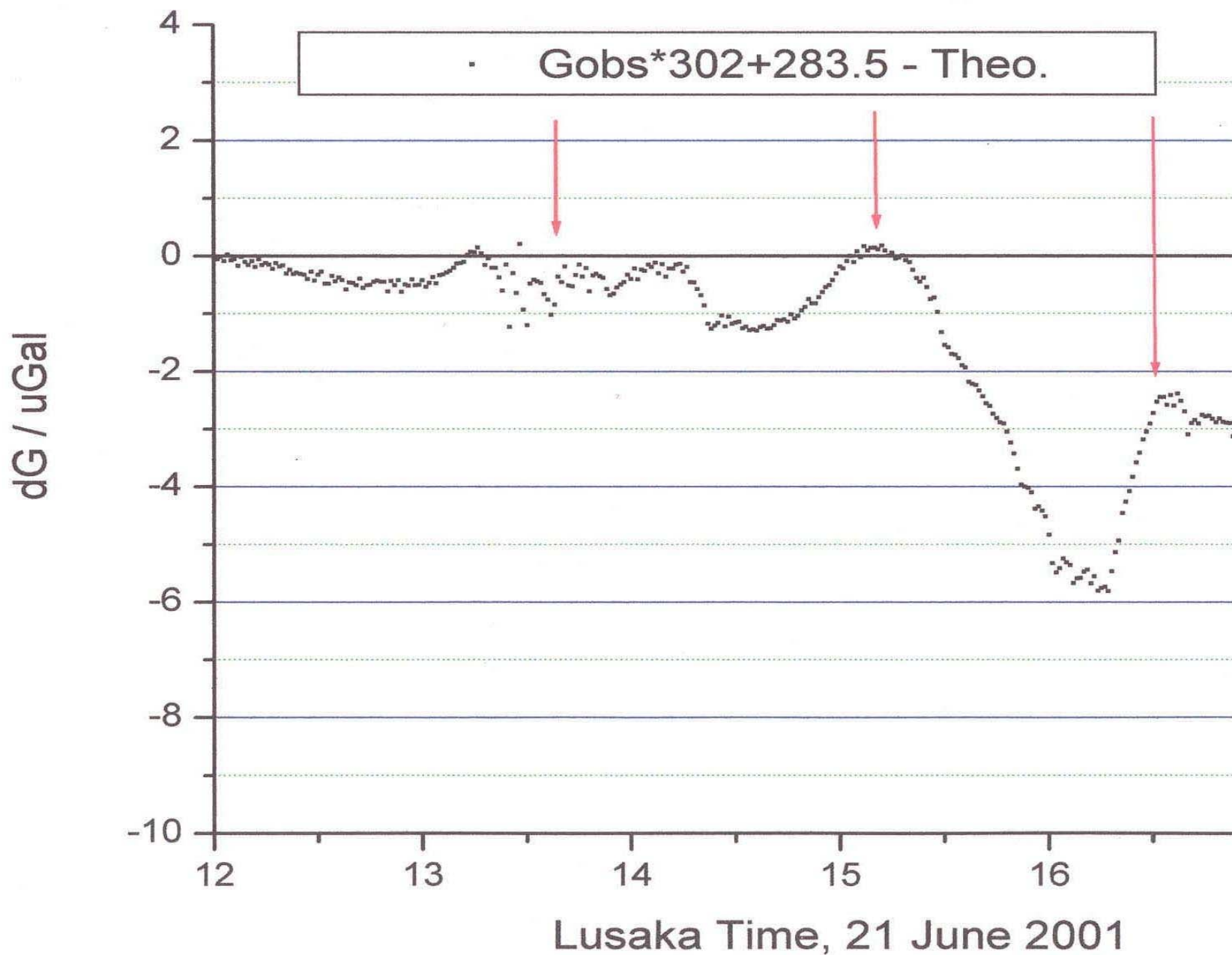
THE UNIVERSITY OF ZAMBIA





中国科学院  
暨地王日会  
科学观团

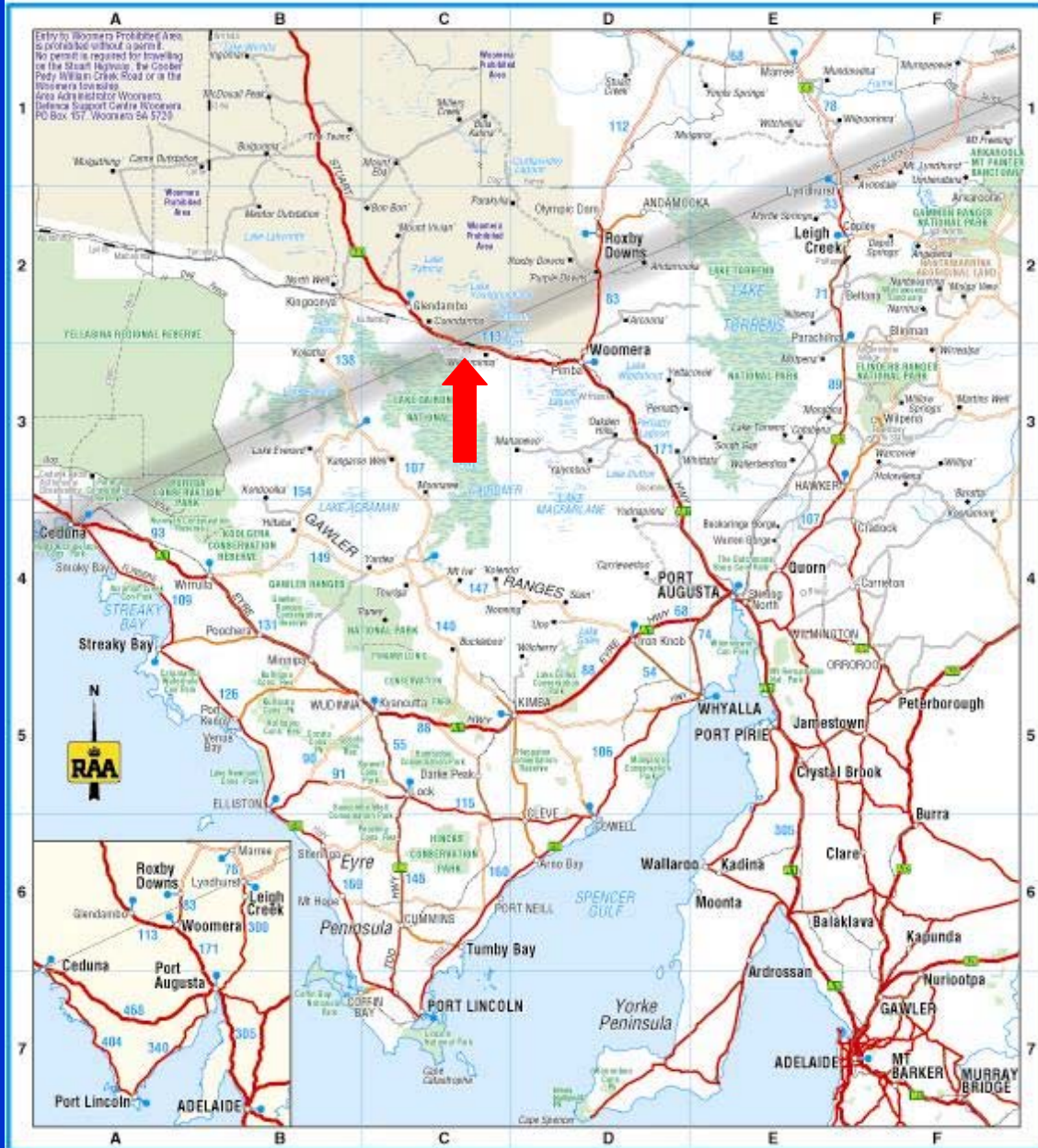








# TOTAL SOLAR ECLIPSE DECEMBER 4 - 2002



Entry to Woomera Prohibited Area is prohibited without a permit. No permit is required for travelling on the Stuart Highway, the Cooper Pedy William Creek Road or in the Woomera Localities Area Administration Woomera. Defence Support Centre Woomera, PO Box 157, Woomera SA 5729.



**ECLIPSE PATH**

**4 DEC 6-8<sup>PM</sup>**

**OBSERVE  
SPEED LIMITS**













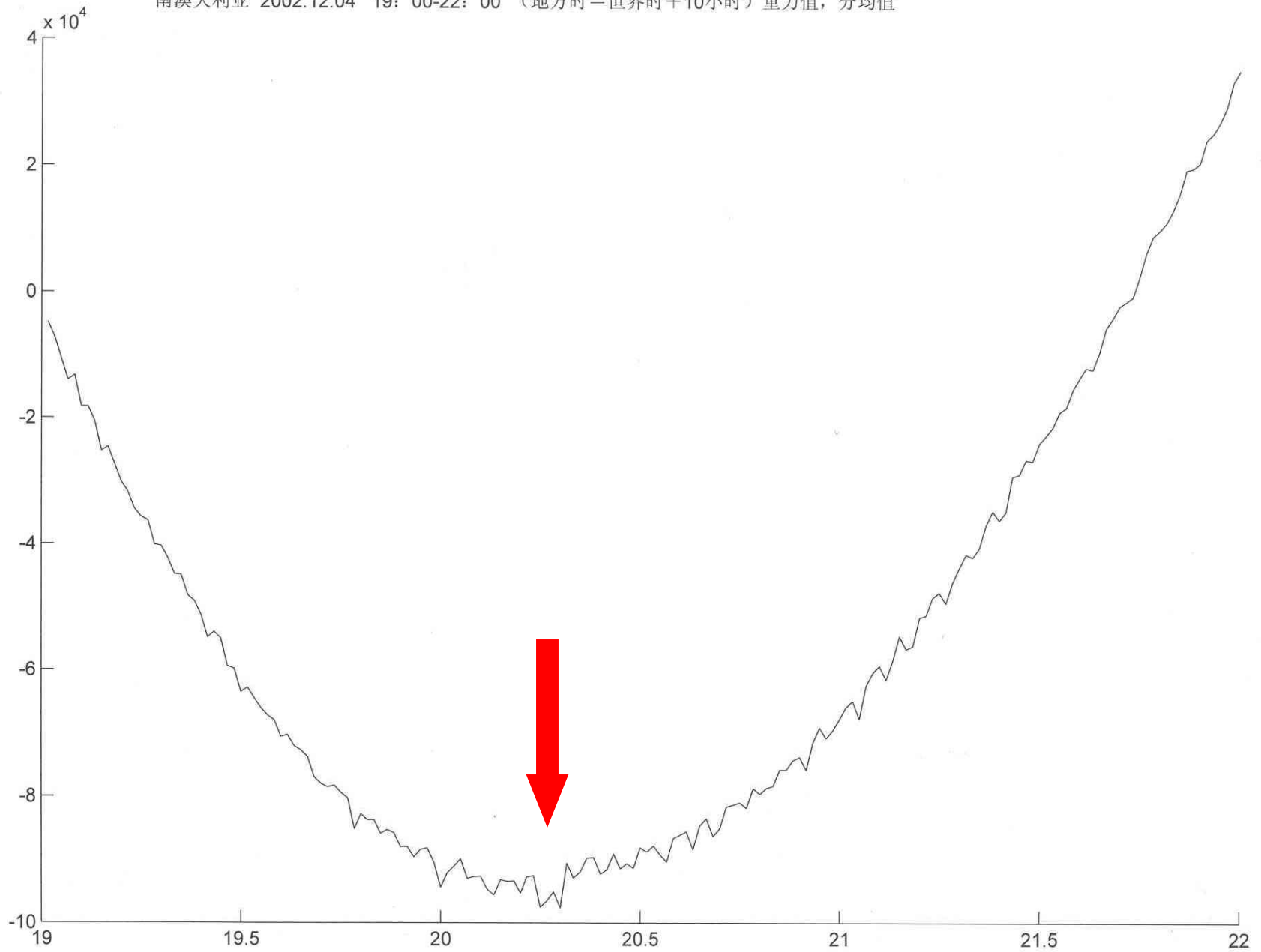
中国科学院  
大别山日全食  
科学观测队

INFORM

Bin it!  
Keep litter where it belongs.  
KESAB



南澳大利亚 2002.12.04 19: 00-22: 00 (地方时=世界时+10小时) 重力值, 分均值





## What's the matter with gravity?

It may be four centuries since Newton's fateful day under the apple tree, but new measurements hint that we still don't quite understand gravity, Mark Haw finds.

18 August 2000

Mark HAW

Allegedly, Isaac Newton got the inspiration for his description of the force of gravity from a falling apple.

Enter a huge mass: the Moon coming between the Earth and the Sun, during a total solar eclipse in March 1997 in Helongjiang Province, China. Researchers Qianshen Wang and colleagues of the Chinese Academy of Sciences, Beijing, China, went looking for the effects of the eclipse on the 'acceleration due to gravity'. They report what they found in *Physical Review D*.

Wang's group did indeed see a decrease in  $g$ , just at the time of the eclipse. They claim that the measured change in  $g$ , even when corrected for all the effects (like tides) predicted by existing theory, was still too big to be explained by errors in their instruments.





These unsolved problems  
awakened our interest in GW

# Senior Scientists Who are Interested in GW Detection in China

1. 10 institutions
2. > 40 senior scientists,

Including 6 academicians in the fields of  
Astrophysics, High Energy Physics, Optics,  
Metrology, Space Physics and Geophysics

We have strong interest and requirement in GW  
detection in China

# Institute of Geological and Geophysics, CAS

- Jiwen Teng, Academician CAS, Geophysics
- Keyun Tang, Res. Prof. in Space Science
- Qianshen Wang, Res. Prof. in micro gravity
- Changcai Hua, Res. Prof. in gravity measurement
- Fenglin Peng, Space Science, Ph.D.
- Qingyu You, specialist in micro-electronics, Ph.D.
- Yi Xu, Geophysics, Ph.D.
- Ligu Xu, Res. Prof., specialist in micro-electronics,
- Chongrong Ran, Res. Prof. ,specialist in micro-electronics,
- Youguang Guo, Res. Prof., specialist in Laser Interferometer
- Dalun Huang, Res. Prof., specialist in Laser Interferometer
- etc.,

# China Academy of Machinery Science and Technology

- Shangyang Lin, Academician
- Fei Kang, Res. Prof., Nuclear Physics,
- Precision Machinery Design
- Yujie Zhou, Res. Prof., Precision Machinery Design
- Dousheng Zhao, Precision Machinery
- Ling Zhao,
- Anzhao Yue,
- etc.,

# University of Science and Technology of China (USTC)

- Youyuan Zhou, Academician of CAS, Astronomy
- Yang Zhang, Professor, Astronomy, Ph.D.
- Hongfang Chen, Professor, Particle Physics and Nuclear Physics
- Rongshan Fu, Professor, Geophysics
- Bin Liu, Professor, Geophysics, Ph.D.
- Xiaojun Wang, Associate Professor, Theoretical physics, Ph.D.
- Xiaolian Wang, Professor, Particle Physics and Nuclear Physics
- Tinggui Wang, Professor, Astronomy, Ph.D.
- Jian Wu, Associate Professor, Particle Physics and Nuclear Physics, Ph.D.
- Zizong Xu, Professor, Particle Physics and Nuclear Physics
- Mulin Yan, Professor, Theoretical physics
- Yefei Yuan, Associate Professor, Astronomy, Ph.D.
- Ziping Zhang, Professor, Particle Physics and Nuclear Physics
- etc.,

- **Peking University**

- Yanlin Ye Prof., Dean of Physics College
- Zuhui Fan Prof.
- etc.
- 

- **Tsinghua University**

- Jingkang Deng Prof. , Physics Department Head
- Chuangang Ning Prof.
- etc.
-

# Shanghai Institute of Optics and Fine Mechanics, CAS

- Jun Xu                      Research Prof.,
- Fuxi Gan                  Academician,
- Runwen Wang          Research Prof.,
- Shensheng Han        Research Prof.,
- etc.,

- **Institute of High Energy Physics, CAS**
- 
- **Institute of Geodesy & Geophysics, CAS**
- Houze Xu, Academician, tides theory and  
Measurement
- Shunliang Chi, Research Prof., specialist in micro  
gravity measurement
- etc.,
- **Institute of Remote Sensing science and  
Application, CAS**
- Qingxi Tong Academician etc.
- -----
- Prof. Wang Yun Yong (retired from IHEP)

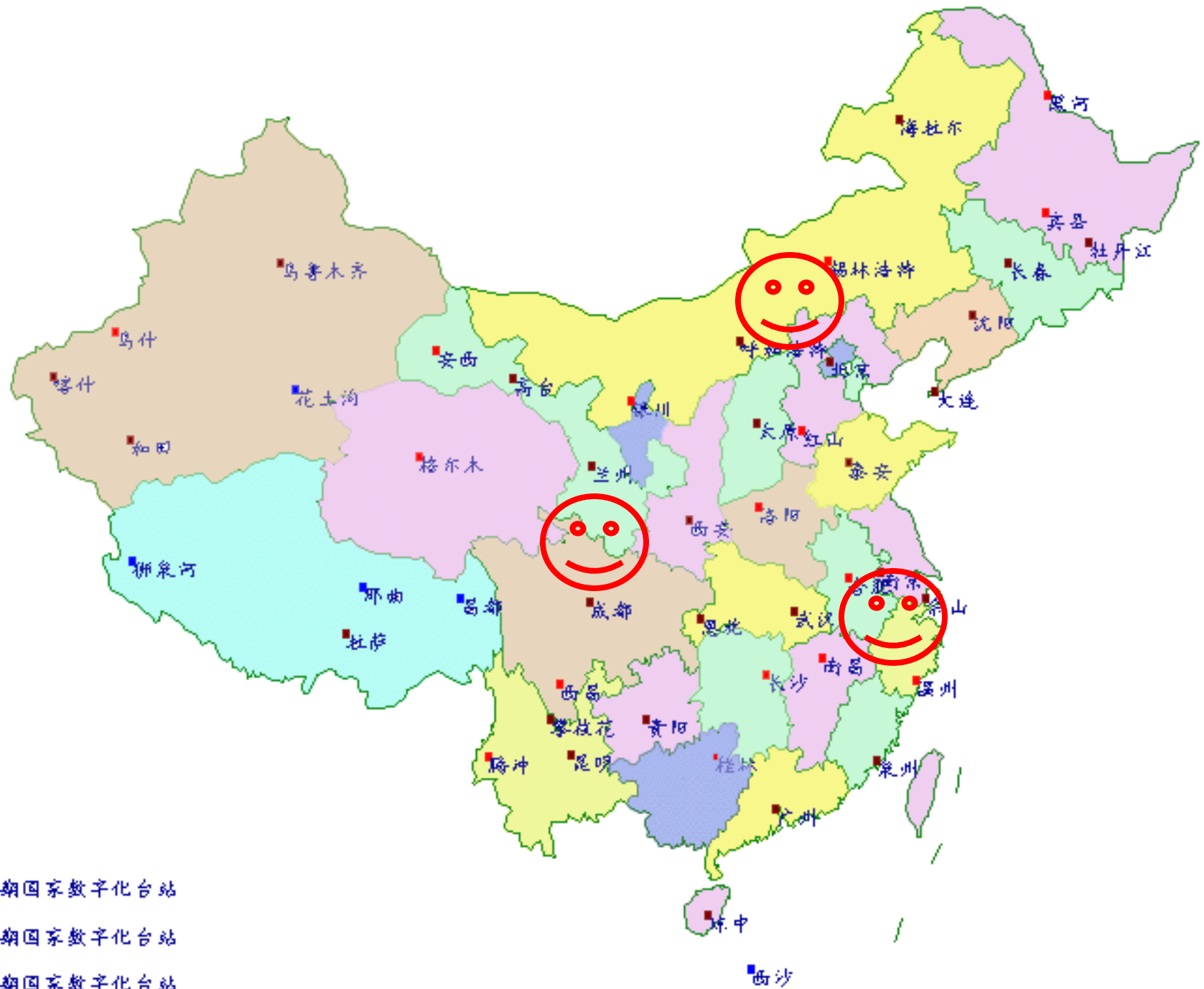


# Main Aim

Build a underground facilities in China for multiple interferometers. It opens for external contribution, initially based on the design of LIGO2, build same gravitational wave detector in China. It will run synchronized with LIGO2, may with one year delay.

Chinese scientists wish:

1. For identical observation, the laser and interferometer should be same, it's better if the laser and interferometer provided by LIGO, or
2. Chinese scientist will collaborate with the R & D for the main laser and interferometer, and make a copy for China
3. For the LF case, Chinese scientist will do R & D on high precision micro accelerometer and strain meter in order to eliminate underground Newtonian noise around laser interferometer.



- 第一期国家数字化台站
- 第二期国家数字化台站
- 第三期国家数字化台站

# Plan and Schedule

1. Collect the enthusiastic of Chinese Scientists interested in GW detection, wrote an letter intent to National Science Development Plan, before the end of 2003;
  2. Solicit scientific and technical support from GW community, first quarter of 2004;
  3. Submit a tentative proposal to S & T Ministry and CAS, before the end of March, 2004;
  4. Organize an initial design committee with participation from all GW community, 2004;
  5. Complete the application procedure to government, 2005;
  6. Start people's training , from the 2<sup>nd</sup> half of 2004 or 2005
- If the proposal accepted by government, OK,
7. Complete the construction , 2006;
  8. Complete the installation , 2007
  9. Start the test run, 2008

# Name for China's GO Project

CEGO

- China Einstein Gravitational wave Observatory
  - $130/1.3b=10^{-7}$
  - $0.13b/1.3b = 10^{-1}$

GO, let's go

Thank you for your Time



# Induced Gravitational Field

1. Due to the moving of gravitational mass
2. Due to the density changing of gravitational mass

# Atmospheric Pressure Variations during the Total Solar Eclipses

date	location	pressure variation (hPa)	observers
1970.3.7	Florida	0.25	Anderson
1976	Oxford	0.4	Jones
1979.2.29	Saskatchewan	0.12	McItosh et al.
1983	East Java	0.5	Seykora
1997.3.9	Mohe, China	<1.0	Wang, Tang
2001.6.21	Lusaka	<0.6	Tang et al.
2002.12.4	South Australia	<1.0	Tang et al.