

# DETECTING MISSING BARYONS IN THE UNIVERSE

20-21 July, 2023  
Saturn Hall A0418



FORUM  
HANDBOOK

# CONTENTS

<b>ABOUT ISSI-BJ .....</b>	<b>3</b>
<b>ORGANIZERS .....</b>	<b>4</b>
Conveners	4
<b>FORUM OUTLINE AND PROGRAM .....</b>	<b>5</b>
Context	5
Objectives	6
Program	7
<b>PRACTICAL INFORMATION .....</b>	<b>9</b>
Venue	9
WIFI Access	9
Accommodation	10
Lunch	11
Coffee Breaks	11
Useful Information	11
Emergency Contact Person in China	11
Dinner Location	12
<b>PARTICIPANTS .....</b>	<b>13</b>
<b>NOTES .....</b>	<b>14</b>

## ABOUT ISSI-BJ

The International Space Science Institute in Beijing (ISSI-BJ) was jointly established by the National Space Science Center (NSSC) and the International Space Science Institute (ISSI) with the support of the International Cooperation Bureau and the Space Science Strategic Project of the Chinese Academy of Sciences (CAS). ISSI-BJ is a close cooperation partner of ISSI in Bern. The two institutes share the same Scientific Program Committee, the same study tools, and other information of mutual relevance and interest. However, both use independent operational methods and different funding sources.

ISSI-BJ is a non-profit research institute. Our main mission is to contribute to the achievement

of a deeper scientific and technological understanding of future space missions as well as of the scientific results from current and past missions through multidisciplinary research, possibly involving, whenever felt appropriate, ground based observations, modelling, numerical simulation and laboratory experiments, using the same tools as ISSI, i.e. Forums, International Teams, Workshops, Working Groups or individual Visiting Scientists.

The Program of ISSI-BJ covers a widespread spectrum of space science disciplines, including astrophysics, solar and space physics, planetary science, astrobiology, microgravity science and Earth observation from space.

## ORGANIZERS

The Forum on “Detecting Missing Baryons in the Universe” is organized by the International Space Science Institute - Beijing (ISSI-BJ).

### Conveners

- Joel Bregman, University of Michigan, USA
- Wei Cui, Tsinghua University, China
- Maurizio Falanga, ISSI-BJ, China
- Taotao Fang, Xiamen University, China
- Dan McCammon, University of Wisconsin-Madison, USA
- Kazuhisa Mitsuda, ISAS/JAXA, Japan
- Jan-Willem den Herder, SRON, The Netherlands
- Noriko Yamasaki, ISAS/JAXA, Japan
- Feng Yuan, Shanghai Astronomical Observatory, CAS, China

# FORUM OUTLINE AND PROGRAM

## Context

The goals of this ISSI-BJ forum are to discuss the problems of missing baryons on scales of galaxies and large-scale structures and to make plans for X-ray missions that are dedicated to solving these problems. The missing baryons are deemed to constitute a major component of the circumgalactic medium (CGM) and intergalactic medium (IGM), but they are difficult to observe due to the limitations of the current instrumentation, and thus, they represent a key obstacle to our understanding of the galaxy evolution. During this activity, the forum participants will discuss the results yielded from cosmological hydrodynamical simulations on the properties of the hot CGM and IGM, the observational evidence for their existence, and the implications on galaxy evolution. Moreover, it will be discussed how to fill the observational gap of directly detecting the

missing baryons and thus measuring their properties and distributions. Since they are postulated to exist in the form of low-density, hot CGM/IGM and to radiate mainly in soft X-rays, the discussions will center on effective X-ray means. To this end, a number of proposed mission concepts will be presented. Consensus will be sought on an optimal strategy to collectively push for a high-resolution X-ray spectroscopic mission and to sustain the momentum over the long run. Besides the subject of missing baryons, the participants will also discuss some important scientific issues related to the topic that can benefit from high-resolution X-ray spectroscopic observations, including diffuse X-ray background, supernova remnants, and cluster outskirts, as well as techniques of modeling the high-resolution X-ray spectra obtained.

## Objectives

The two-days of this ISSI-Beijing Forum will be devoted to discussing and producing.

- Census of cosmic baryons
- Theoretical understanding of missing baryons
- Recent observations of WHIM and implications
- High resolution X-ray spectroscopic observations and modeling
- Synergies and collaborations

## Program

### 20 July 2023

	Subject	Contributor
<b>Session I</b> <b>Chair: Wei Cui</b>		
09:00-09:15	Opening remarks	
09:15-10:00	Census of cosmic baryons	Houjun Mo
10:00-10:30	Quasars and clusters of galaxies in the SRG/eROSITA all sky survey	Marat Gilfanov
10:30-11:00	Coffee Break	
11:00-11:30	Tracing warm and hot Gas in the universe with the Arcus Probe	Randall Smith
12:00-14:00	Lunch	
<b>Session II</b> <b>Chair: Kosuke Sato</b>		
14:00-14:45	Theoretical understanding of missing baryons	Feng Yuan
14:45-15:15	The Fermi bubbles tell us what created the circumgalactic medium	Yutaka Fujita
15:15-15:45	Probing the IGM/CGM with Fast Radio Bursts	Longlong Feng
15:45-16:15	Coffee Break	
16:15-17:45	Open Discussion	
18:30-20:30	Dinner hosted by ISSI-BJ	

## 21 July 2023

	Subject	Contributor
<b>Session III</b> <b>Chair: Li Ji</b>		
09:15-10:00	Observations of WHIM and implications	Kazuhisa Mitsuda
10:00-10:30	The hot phase of the Milky Way	Gabriele Ponti
10:30-11:00	Coffee Break	
11:00-11:30	The hot gas halo around low-mass disk galaxies	Zhiyuan Li
12:00-14:00	Lunch	
<b>Session IV</b> <b>Chair: Maurizio Falanga</b>		
14:00-14:45	High resolution X-ray spectroscopic missions	Dan McCammon
14:45-15:15	Status of a new X-ray satellite XRISM by JAXA	Noriko Yamazaki
15:15-15:45	Science with DIXE and HUBS	Wei Cui
15:45-16:15	Coffee Break	
16:15-17:45	Open discussion & forum summary for the Taikong Magazine	



## PRACTICAL INFORMATION

### Venue

The Forum will be held in the Saturn Hall A0418, NSSC building A, 4<sup>th</sup> Floor.

ISSI-BJ Office  
The ISSI-BJ office is located at NSSC, Building A, 4th Floor.

Address  
N°1 Nanertiao, Zhongguancun,  
Haidian District, Beijing, 100190  
北京市海淀区中关村南二条一号

### WIFI Access

Login via web:  
NSSC-Guest, Code Auth

Fill in Name & Department  
Invite Code: 395350



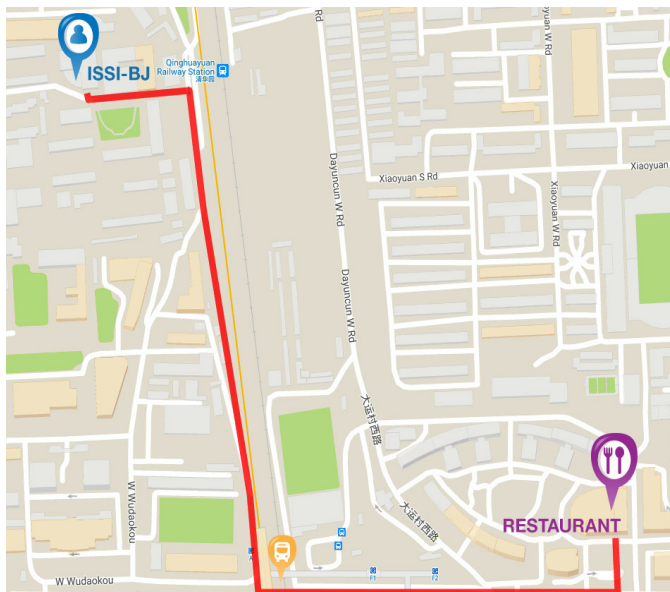
## Accommodation

ISSI-BJ covers the cost of the 3-nights accommodation and breakfast. Please kindly note that all the other extra expenses in hotel will be deducted from your check-in deposit.

Park Plaza Hotel Beijing Science Park  
No.25, Zhichun Road, Haidian District, 100083, Beijing China  
北京市海淀区知春路25号

Directions: Turn right on Zhichun Rd. (知春路) when going out of the hotel. Climb the stairs to the entrance of the

metro station ZhiChunLu (Exit A), turn left and walk straight for about two minutes. Then turn right on West Wudaokou (西五道口), following the northbound elevated subway. Walk for about 10 minutes, towards the direction of Liaoning International Hotel (辽宁大厦) or the National Microgravity Laboratory Tower, finding NSSC (国家空间科学中心) on the left. The way is highlighted in red on the map.



## Lunch

Lunch buffet for all participants of the ISSI-BJ Forum will be available at the canteen on the -1 floor of the NSSC Building A.

## Coffee Breaks

Coffee breaks will be provided at the ISSI -BJ office. See the Program section to check the coffee break times.

## Useful Information

**Credit Cards:** Credit and debit cards can be used in ATMs displaying the appropriate sign. Credit cards are increasingly becoming accepted in major shopping zones and high level restaurants but keep some cash handy just in case.

You can find two ATMs at the NSSC lobby of Building A.

**Currency:** Chinese Yuan Renminbi (RMB)  
(1 USD = approx. 7.2 RMB)  
(1 EUR = approx. 7.9 RMB)

**Drinking Water:** Avoid drinking tap water directly. Bottled water and mineral water can be found in convenience stores and drink stalls. The price is 2-10 yuan RMB per bottle.

**Electricity:** 220 volts AC

**Taxi:** Please contact Ms. Lijuan  
EN: +86-136-9912-1288 if you need to book a taxi.

**Time:** UTC/GMT +8 hours

## Emergency Contact Person in China

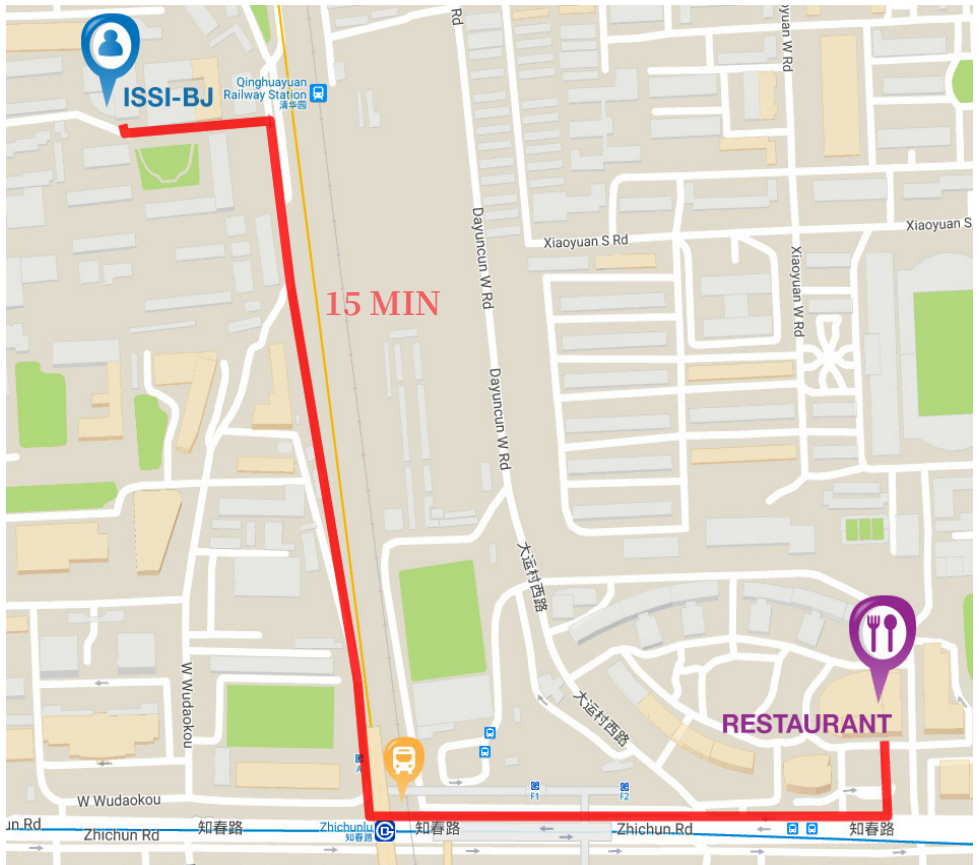
Ms. Lijuan EN +86-136-9912-1288

## Dinner on 20 July, 2023

Dinner offered by ISSI-BJ on  
20 July, 2023 at 18:30.

Restaurant:  
Amber 6, 3rd Floor of Park  
Plaza Beijing Science Park  
丽亭华苑酒店金辉6厅

Address:  
No. 25 Zhichun Rd. (知春路),  
Haidian District, Beijing  
北京市海淀区知春路25号

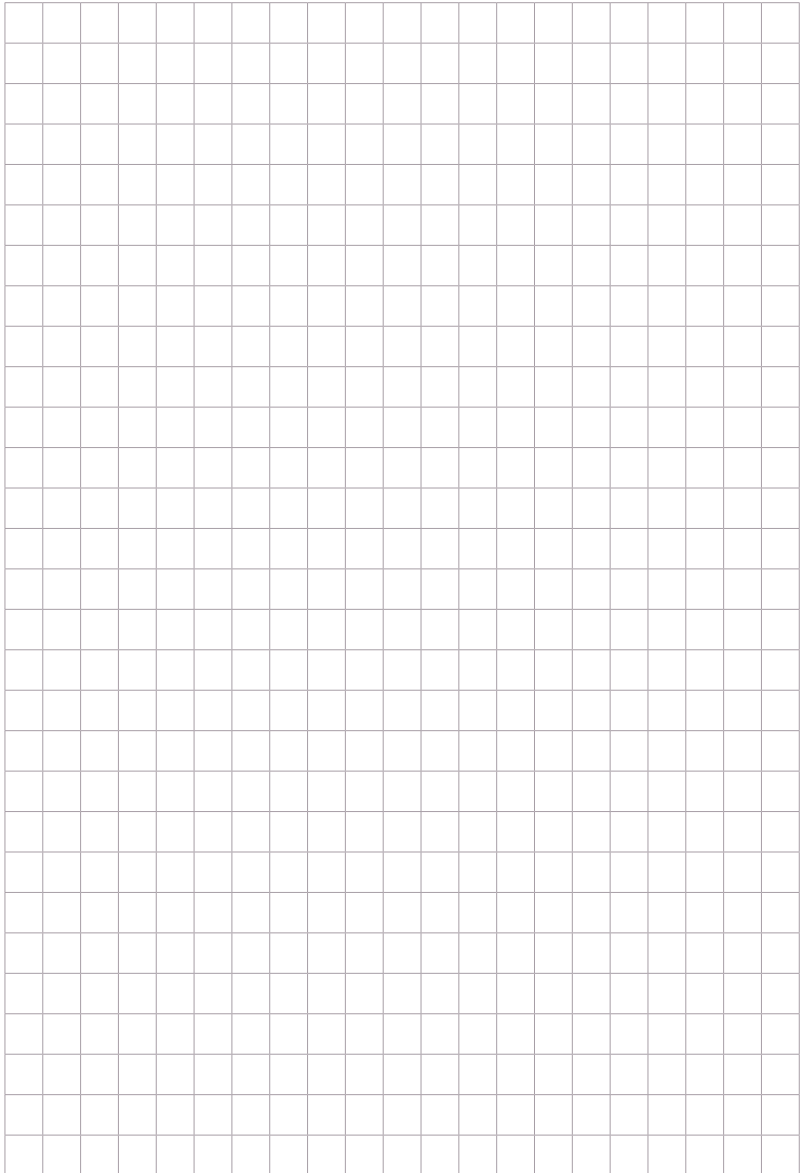


## PARTICIPANTS

No.	Name	Institution
1	Wei Cui	Tsinghua University, China
2	Maurizio Falanga	ISSI/ISSI-BJ, Switzerland/China
3	Longlong Feng	Sun Yat-sen University, China
4	Yutaka Fujita	Tokyo Metropolitan University, Japan
5	Marat Gifanov	Max Planck Institute for Astrophysics, Germany
6	Fulai Guo	Shanghai Astronomical Observatory, CAS, China
7	Li Ji	Purple Mountain Observatory, CAS, China
8	Suoqing Ji	Shanghai Astronomical Observatory, CAS, China
9	Cheng Li	Tsinghua University, China
10	Zhaosheng Li	Xiangtan University, China
11	Zhiyuan Li	Nanjing University, China
12	Junjie Mao	Tsinghua University, China
13	Dan McCammon	University of Wisconsin-Madison, USA
14	Kazuhisa Mitsuda	National Astronomical Observatory of Japan (NAOJ), Japan
15	Houjun Mo	University of Massachusetts, USA
16	Gabriele Ponti	INAF Osservatorio Astronomico di Brera, Italy
17	Kosuke Sato	Saitama University, Japan
18	Randall Smith	Harvard-Smithsonian Center for Astrophysics, USA
19	Haiguang Xu	Shanghai Jiaotong University, China
20	Noriko Yamasaki	ISAS/JAXA, Japan
21	Renbin Yan	The Chinese University of Hong Kong, China
22	Feng Yuan	Shanghai Astronomical Observatory, CAS, China

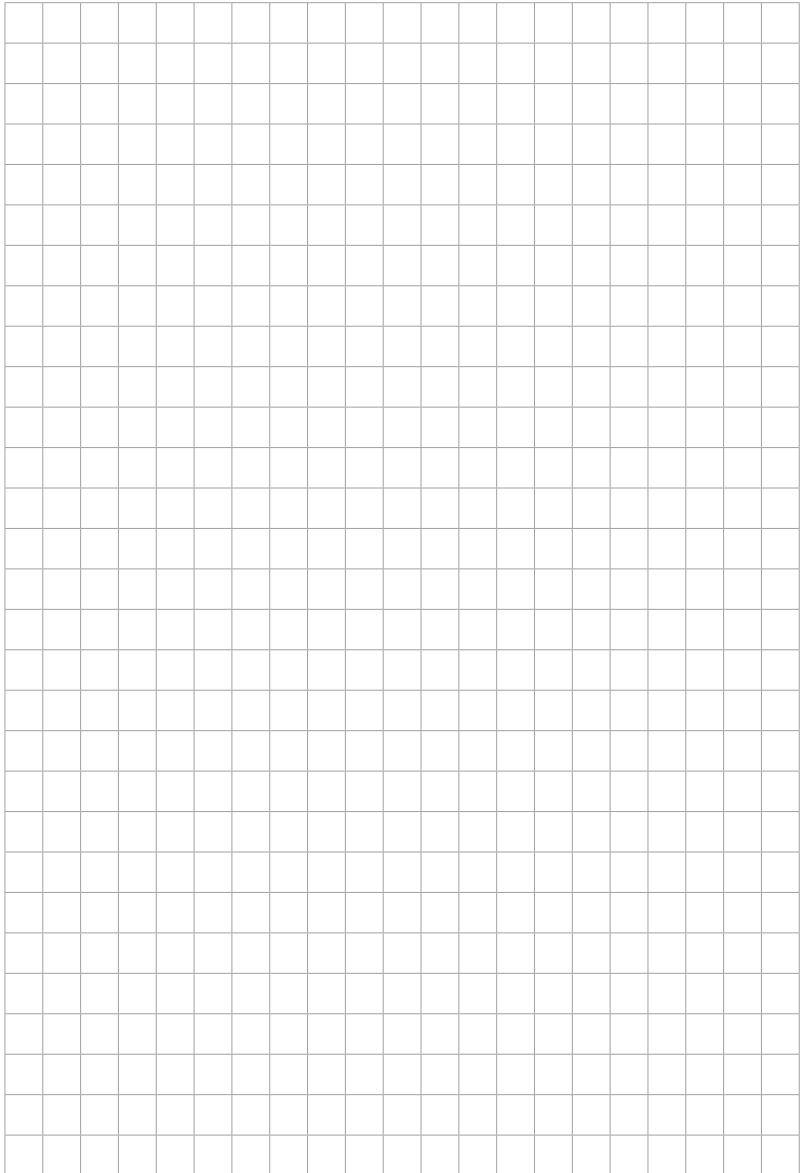
















# Advancing Space Science Research by Worldwide Collaboration

International Space Science Institute - Beijing  
N°1 Nanertiao, Zhongguancun, Haidian District  
Beijing, China | Postcode: 100190

**Forum Website**

[http://www.issibj.ac.cn/program/forums/2023/202306/t20230628\\_332570.html](http://www.issibj.ac.cn/program/forums/2023/202306/t20230628_332570.html)