

INSTITUTE FOR ADVANCED STUDY

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SCHOOL OF NATURAL SCIENCES

MICHELLE SAGE, ADMINISTRATIVE OFFICER

October 2, 19

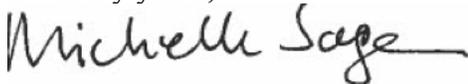
To Whom It May Concern,

This letter is confirmation that Dr. Pau Amaro-Seoane, from the Institut de Ciències de l'Espai (CSIC-IIEC), Barcelona, Spain, attended the workshop "Stellar Dynamics in Galactic Nuclei" at the Institute for Advanced Study, Princeton, USA, on November 29 - December 1, 2017. He presented a plenary talk titled:

"Mapping spacetime with extreme-mass ratio inspirals"

Abstract: In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA. In particular, I will discuss the impact of the spin of the supermassive black hole on the event rates of these EMRIs.

Sincerely yours,



Michelle Sage
Administrative Officer

CALIFORNIA INSTITUTE OF TECHNOLOGY

THEORETICAL ASTROPHYSICS 130-33

PASADENA, CALIFORNIA 91125

626-319-3263 (JPL)
626-395-4301 (Caltech)
cutler@tapir.caltech.edu

05/16/2025

To Whom It May Concern:

This letter confirms that Prof. Dr. Pau Amaro Seoane was invited to visit the California Institute of Technology (Caltech) and the Jet Propulsion Laboratory (JPL) from May 15–20, 2006. While here, he engaged in interesting and useful scientific discussions with myself and with members of the Caltech gravitational-wave research group led by 2017 Nobel Prize winner Prof. Kip S. Thorne.

During his stay, Prof. Amaro Seoane delivered an invited seminar titled "Supermassive black hole binaries: Astrophysics and gravitational waves". His presentation stimulated productive discussions with the group, contributing to ongoing research efforts in gravitational-wave astrophysics.

In summary, this visit provided a valuable opportunity for scientific exchange between Prof. Amaro Seoane and Caltech/JPL researchers working at the forefront of gravitational-wave theory and detection. For any further details regarding this visit, please feel free to contact me by either phone or email.

Sincerely,



Curt J. Cutler
Senior Research Scientist (JPL)
Visiting Associate (Caltech)

Standard disclaimer: It is a JPL requirement that I note that of course the opinions represented above are my own, and do not represent in any way the opinion or policy of JPL or Caltech.

September 28, 2019

Re: TDE17: Piercing the sphere of influence

The purpose of this letter is to confirm the participation of Professor Pau Amaro Seoane to the conference entitled "Piercing the sphere of influence" that took place from 11 September 2017 - 15 September 2017. The website of the conference can be found at: <https://www.ast.cam.ac.uk/meetings/2017/tde17.piercing.sphere.influence>

Professor Pau Amaro Seoane gave a wonderful **plenary** talk during the meeting entitled: "*Relativistic corrections in the tidal disruption of stars*". The submitted abstract of the talk follows: "*I will show new results regarding the tidal disruption of a star. The numerical code has been modified to account for post-Newtonian corrections, which allows to study the effect of the spin on the TDE.*"

Please do not hesitate to contact me if you require any additional information.

Sincerely,



Enrico Ramirez-Ruiz
Niels Bohr Professor, University of Copenhagen
Professor and Vera Rubin Presidential Chair, Department of Astronomy and
Astrophysics, UC Santa Cruz
Main Organizer, *Piercing the sphere of influence* conference



DESY | Platanenallee 6, 15738 Zeuthen

Prof. Dr. Marek Kowalski

Head of Neutrino and Cosmology group
marek.kowalski@desy.de

Astroparticle Physics Division
Platanenallee 6, D-15738 Zeuthen
Tel. +49 33762-7-7187

May 7, 2025

**- Invitation Confirmation -
Prof. Dr. Amaro Seoane's Talk at ULTRASAT Germany 2025**

To Whom It May Concern,

We are pleased to confirm that Prof. Dr. Amaro Seoane delivered an invited talk at the ULTRASAT Germany meeting held on April 28th and 29th, 2025, at Humboldt University in Berlin. The event was organized by DESY (Deutsches Elektronen-Synchrotron) in Zeuthen.

Prof. Dr. Amaro Seoane expertise and insights were a valuable contribution to the discussions on transient astrophysics. His participation greatly enriched the scientific exchange during the conference.

Should you require any further details regarding his involvement or the event, please do not hesitate to contact us.

Sincerely,

Prof. Dr. Marek Kowalski

October 20th, 2019

To Whom it may concern

This is to confirm that on a visit to the Physics Department at the University of Florida, from February 22nd-25th, 2016, Pau Amaro-Seoane gave a seminar and a colloquium in our Department. The details are:

Date and Time: Tuesday, February 23rd, 2016, 12:30pm

Seminar Title: Mapping spacetime with extreme-mass ratio inspirals.

Abstract: In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA.

Date and Time: Tuesday February 23rd 2016, 4:00pm.

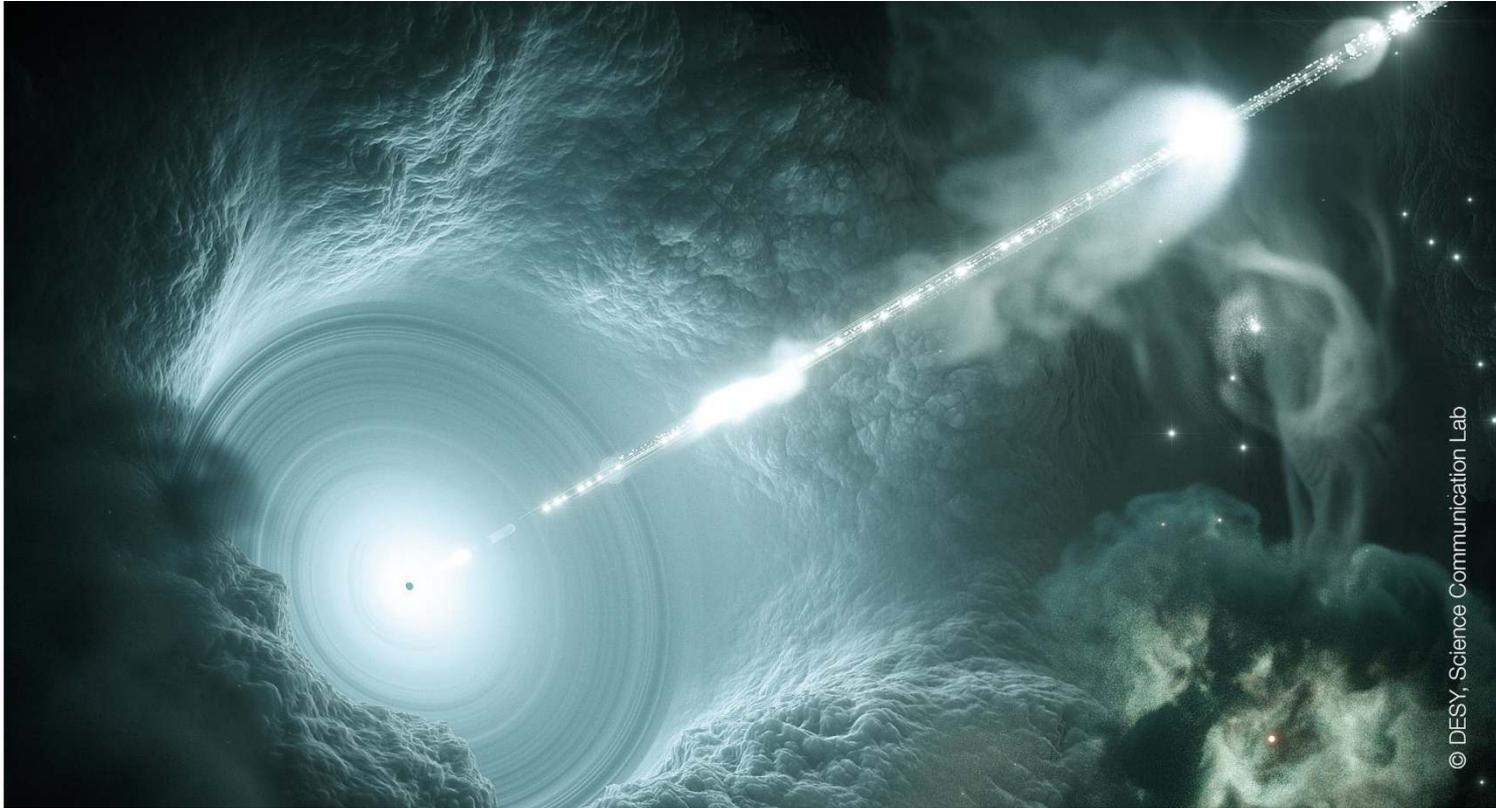
Colloquium Title: Peeling the onion - Layer by layer to the event horizon.

Abstract: Gravity dictates the structure of the whole Universe. Although it is triumphantly described by the theory of General Relativity, gravity is the least understood force in nature. One of the cardinal predictions of the theory are black holes. Massive, dark objects are found in the majority of galaxies. Are they supermassive black holes, or do we need alternatives? The answer lies in the defining characteristic of a black hole: The event horizon. Unfortunately, an event horizon is remarkably tiny from the point of view of the galaxy, and difficult to detect. The key to probe it is its interactions with stellar mass objects in its neighborhood. In this talk I will explain how dynamics can help us to probe General Relativity via the inspiral of compact objects on to a massive black hole, commonly referred to as an extreme-mass ratio inspiral. In this talk we will see how dynamical studies of galactic nuclei work. What are the main features? What needs to be modeled? What are the computational bottlenecks?

Yours sincerely,



Bernard Whiting
Professor of Physics
University of Florida



© DESY, Science Communication Lab

ASTROPARTICLE CERTIFICATE.

Invited talk at the DESY

This is to certify that

Pau Amaro Seoane

gave an invited talk entitled

SgrA* and the 2020 Nobel Prize

at the DESY Astroparticle Physics Seminar Series on

23 October 2020

Signed

Summer Blot

AP Seminar Organizers

Artem Bohdan

Sylvia Jiechen Zhu



Paris, 30 September, 2019

Attestation for Pau Amaro-Seoane

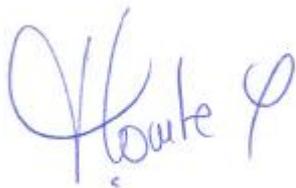
By this letter, I confirm that Pau Amaro Seoane was invited to give a seminar conference at the Collège de France, on January 2015, and the title was

Mapping spacetime with extreme-mass ratio inspirals

With the Abstract

One of the most interesting sources of gravitational waves is the inspiral of compact objects on to a massive black hole (MBH), commonly referred to as an extreme-mass ratio inspiral. The small object, typically a stellar black hole, emits significant amounts of GW along each orbit in the detector bandwidth. In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA.

With my best regards,



Françoise Combes



Astronomía
FACULTAD DE CIENCIAS
FÍSICAS Y MATEMÁTICAS
UNIVERSIDAD DE CHILE

Correlativo N°235/19

Santiago, 30 de septiembre de 2019

CERTIFICADO

Por la presente certifico que el 23 de noviembre de 2015, don Pau Amaro Seoane realizó, como charlista, el coloquio titulado "Mapping spacetime with extreme-mass ratio inspirals", cuyo abstract fue "In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA. I will also describe the capture of stellar-mass compact objects by intermediate-mass black holes in globular clusters".

La charla se realizó en nuestras instalaciones del Departamento de Astronomía de la Universidad de Chile, Camino El Observatorio, 1515, Las Condes, Santiago de Chile.



Prof. Andrés Escala A.
Director

Departamento Astronomía
Facultad de Ciencias Físicas y Matemáticas
Universidad de Chile





Rome, October 1st, 2019

DECLARATION (to whom it may concern)

I hereby declare that dr. Pau Amaro Seoane has been a guest of our Department, in the frame of the Centro Amaldi, since April 2 to April 19 2019 for a scientific collaboration on topics of common interest. In particular, he gave a public talk on April 12, 2019, whose title and abstract are:

“Mapping spacetime with extreme-mass ratio inspirals”

Abstract

In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA. I will in particular address the role of the spin in the event rates calculation, and time allowing, I will also discuss the joint detection of intermediate-mass ratio inspirals from the space and the ground.

Faithfully,

A handwritten signature in black ink, reading 'P. Capuzzo Dolcetta'.

prof. Roberto Capuzzo Dolcetta
Dep. of Physics, Sapienza, universita' di Roma,
roberto.capuzzodolcetta@uniroma1.it



Kavli Institute for Astronomy and Astrophysics
Peking University
北京大学科维理天文与天体物理研究所



Dr Pau Amaro-Seoane
CSIC-IEEC
Email: pau@ice.cat

Xian Chen (陈弦)
Assistant Professor
Astronomy Department, Peking University

Aug 15, 2016

Tel: +86 010 6275 5391
Fax: +86 010 6276 7900
Email: xian.chen@pku.edu.cn

Dear Dr. Amaro-Seoane,

This letter is to confirm that you gave an invited seminar at KIAA-PKU on 5 August 2016 with the following title and abstract:

Title: The Gravitational Wave Astronomy Era: From the first detections on Earth to space observatories

Abstract: 2016 has been so far a revolutionary year in science. The direct detections of gravitational waves from the merger of black holes has put an end to the pre-Gravitational Wave Era. Thanks to the features of these waves, we can probe regimes where photons can barely escape, and achieve cosmological distances. In this talk I will discuss the potential of Gravitational Wave Astronomy thanks to detections from both the ground, and in particular from future space observatories, such as the planned LISA mission. I will focus on the capture of small compact objects by supermassive black holes. We these captures we will test gravity in the strong regime, because they allow us to do relativistic geodesy-They are unique event horizon probes.

Thank you for bring us this excellent and inspiring talk!

Best,

Xian Chen



Kavli Institute for Astronomy and Astrophysics
Peking University
北京大学科维理天文与天体物理研究所



Dr Pau Amaro-Seoane
CSIC-IEEC
Email: pau@ice.cat

Xian Chen (陈弦)
Assistant Professor
Astronomy Department, Peking University

Dec 20, 2017

Tel: +86 010 6275 5391
Fax: +86 010 6276 7900
Email: xian.chen@pku.edu.cn

Dear Dr. Amaro-Seoane,

On behalf of the organizing committee of the Gravitational Wave Seminar, I'd like to thank you for giving an invited talk at KIAA-PKU on 19 December 2017 with the following title and abstract:

Title: The gravitational capture of stellar mass compact objects by supermassive and intermediate-massive black holes

Abstract: One of the most interesting sources of gravitational waves is the inspiral of compact objects on to a massive black hole (MBH), commonly referred to as an extreme-mass ratio inspiral. The small object, typically a stellar black hole, emits significant amounts of GW along each orbit in the detector bandwidth. In this talk I will summarize the science that we can do with these gravitational waves. In particular, I will review the gravitational capture of compact objects by supermassive black holes, and by intermediate-mass black holes, in globular clusters. The velocity dispersion of these clusters is low enough to allow the merged system to escape the host cluster. I will present numerical simulations of this situation.

Best,

Xian



Department of Physics and Astronomy, Seoul National University
Seoul 151-747, Korea
Phone: +82-2-880-6625

Fax: +82-2-887-1435

October 1, 2019

To Whom It May Concern,

I would like to confirm that I have organized a scientific workshop together with Rainer Spurzem (Astronomisches-Rechen Institut in Germany and National Astronomical Observatory of China) entitled "The 9th Korea-China-Kazakhstan workshop on Stellar Dynamics" during December 19 to 22, 2017 at Hoam Faculty House of Seoul National University in Seoul, Korea. Dr. Pau Amaro-Seoane was one of the participants and he gave the following two invited talks on December 22 (Thursday):

- (1) Mapping spacetime with extreme-mass ratio inspirals
(Abstract) In this talk I will show how to map spacetime around Supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA.
- (2) Intermediate-mass ratio inspirals
(Abstract) I will give a description of the capture of stellar-mass compact objects by intermediate-mass black holes in globular clusters. These sources are potentially detectable from the ground and space.

Please let me know if you need any further details.

Sincerely,

A handwritten signature in blue ink that reads "Hyung Mok Lee".

Hyung Mok Lee
Professor
hmlee@snu.ac.kr
02-880-6625

President
Korea Astronomy and Space Science
hmlee@kasi.re.kr
042-865-3300



Sun Yat-sen University,
Zhuhai Campus

Prof. Yi-Ming Hu, PhD

October 3, 2019

Prof. Yi-Ming Hu
TianQin Research Center for Gravitational Physics,
School of Physics and Astronomy
Office Building
Zhuhai, Guangdong, 519082
Email: huyiming@mail.sysu.edu.cn
Phone: +86 0756-3668980

To whom it may concern,

I'm writing this document to prove that on the Dr. Pau Amaro Seoane was invited to gave a talk a while ago to our institute (TianQin Research Center for Gravitational Physics) in the city of Zhuhai, Guangdong province, China. The exact date for the previous visit happened on the date of 21st of April, 2017, when Dr. Amaro Seoane gave a talk concentrating on his recent research activity, afterwards we also hold a short discussion.

Dr. Amaro Seoane gave the talk with the title **Mapping spacetime with extreme-mass ratio inspirals**.

The abstract of the talk details as follows:

"In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA. I will also describe the capture of stellar-mass compact objects by intermediate-mass black holes in globular clusters. "

If you have any question upon the described visit, please don't hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read 'Yi-Ming Hu'.

Prof. Yi-Ming Hu, PhD

5th Valencia Winter Workshop on Theoretical Physics

December 13-15, 2021



CERTIFICATE

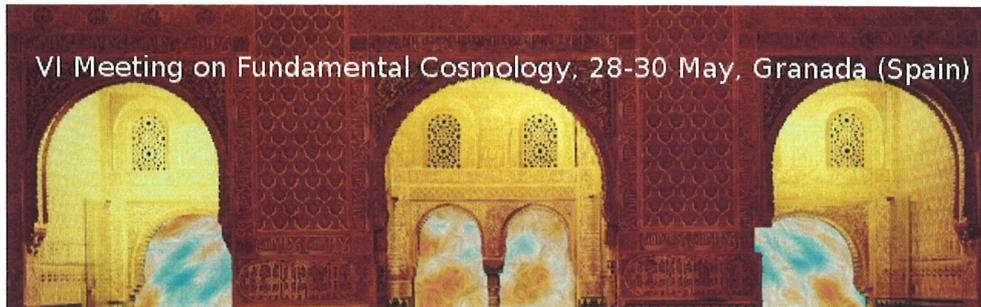
The undersigner certifies that

Pau Amaro Seoane

Fully participated in the 5th Valencia Winter Workshop on Theoretical Physics held in hybrid form, online and onsite at the Departamento de Física Teórica & IFIC, a joint research center of the University of Valencia and CSIC at Valencia (Spain). He also presented an **invited talk** entitled

Capture of substellar objects by supermassive black holes: Extremely-large mass ratio inspirals

Gonzalo J. Olmo
LOC Chair



UNIVERSIDAD
DE GRANADA

May 30, 2018

To whom it may concern,

We hereby certify that

Pau Amaro Seoane

has participated in the *VI Meeting on Fundamental Cosmology* held in Granada (Spain) during May 28-30, 2018, and presented and invited talk entitled

Gravitational Waves from inspiraling compact objects on to supermassive black holes

Sincerely,

Mar Bastero Gil
On behalf of the Organizing Committee



Prof. Vitor Cardoso
Chair of GWverse COST Action
Head of the Gravity Group

GWverse COST Action CA16104

To the Selection Committee

I am Vitor Cardoso, Professor of Physics and Head of the Gravity group at IST Lisbon, and Van der Waals professor at the University of Amsterdam. I Chair the GWverse COST Action CA16104 “Gravitational waves, black holes and fundamental physics”.

Dr. Amaro-Seoane is a very active member of our Consortium. As organizer of the COST global meeting in Athens, Greece, 21-23 Jan 2019, it is my pleasure to declare that Dr. Pau Amaro-Seoane was present and delivered a talk on *Extremely loud Extreme Mass Ratio Inspirals*, with the following abstract “Mapping spacetime with extreme-mass ratio inspirals: In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA.”

I am at your disposal for any further clarifications that you may deem necessary.

Lisbon, September 29 2019

Yours sincerely,

Vitor Cardoso

Vitor Manuel dos Santos Cardoso



Prof. Vitor Cardoso
Chair of GWverse COST Action
Head of the Gravity Group

LISA in Lisbon meeting

To the Selection Committee

I am Vitor Cardoso, Professor of Physics and Head of the Gravity group at IST Lisbon, and Van der Waals professor at the University of Amsterdam. I co-Chair the LISA Science Interpretation package for the LISA Consortium.

Within the context of the LISA observatory and science, I organized the *LISA in Lisbon* workshop in August 16-17, Lisbon 2019. It is my pleasure to declare that Dr. Pau Amaro-Seoane delivered an overview of sub-package that he is in charge of, on Extreme Mass Ratio inspirals. The following is the abstract of Dr. Amaro-Seoane's contribution: "Report on EMRIs: I will report on the progress we have made in the last months in the organisation of the EMRI working Group for the LISA mission."

I am at your disposal for any further clarifications that you may deem necessary.

Lisbon, September 29 2019

Yours sincerely,

Vitor Cardoso

Vitor Manuel dos Santos Cardoso



L-Università
ta' Malta

**Institute of
Space Sciences &
Astronomy**

University of Malta
Msida MSD 2080, Malta

Tel: +356 2340 2524/3035
issa@um.edu.mt

www.um.edu.mt/issa

1st September 2019

To whom it may concern,

This is to certify that Pau Amaro Seoane attended Gravity@Malta 2018 which took place on the dates 22-25 January 2018. This was a workshop organised by CA16104 - Gravitational waves, black holes and fundamental physics (GWverse). During this event, Dr Pau Amaro Seoane gave a talk as described below

Title: Relativistic mergers of black hole binaries have large, similar masses, low spins and are circular

Abstract: In this talk I will show that detections of black hole mergers with ground-based observatories will statistically have a bias towards detecting systems of zero eccentricity, large, similar masses and low spins.

Kind Regards,

A blue handwritten signature, likely of Dr Jackson Levi Said, consisting of a stylized 'J' followed by a long horizontal stroke.

Dr Jackson Levi Said
Local Organising Committee Chair
Department of Physics and Institute of Space Sciences and Astronomy
Faculty of Science
University of Malta
Msida MSD2080, Malta

E-mail: jsaid01@um.edu.mt

Tel: +356 2340 3035
Fax: +356 21 332728



NATIONAL RESEARCH CENTRE
"KURCHATOV INSTITUTE"

To whom it concerns



A.I. Alikhanov Institute
for Theoretical and Experimental Physics
of National Research Centre
"Kurchatov Institute"
(NRC "Kurchatov Institute" - ITEP)
B. Cheremushkinskaya 25,
Moscow, 117218, Russia

29 September 2019

As the chair of the Parallel Session: BH2 at the Fifteenth Marcel Grossmann Meeting on Recent Developments in Theoretical and Experimental General Relativity, Astrophysics and Relativistic Field Theories (MG15) which was taken place at "La Sapienza" University in Rome, Italy from July 1 to 7, 2018 (http://www.icra.it/mg/mg15/par_sessions_chairs_details.htm#zakharov) I confirm that Pau Amaro Seoane presented an invited talk with the title "Gravitational Wave Astrophysics (with LISA)" at the Session: BH2 - "Theoretical and observational studies of astrophysical black holes".

Abstract of the invited talk.

Relativistic mergers of black hole binaries have large, similar masses, low spins and they are circular. In this talk it is shown that detections of black hole mergers with ground-based observatories will statistically have a bias towards detecting systems of zero eccentricity, large, similar masses and low spins.

Alexander F. Zakharov

Leading Researcher of NRC "Kurchatov Institute" - ITEP

Tel.: +7-965-3226854

E-mail: alex_f_zakharov5@mail.ru



UNIVERSITÄT
HEIDELBERG
ZUKUNFT
SEIT 1386



Manuel Arca Sedda

Alexander von Humboldt fellow
Astronomisches Rechen Institut
Zentrum für Astronomie
Universität Heidelberg
Mönchhofstraße 12, Heidelberg
m.arcasedda@ari.uni-heidelberg.de

Heidelberg, 29th December 2018

to whom it may concern.

I hereby declare that Dr Pau Amaro-Seoane participated in the Conference “*15th Marcel Grossmann meeting*”, held at the University of Rome “La Sapienza” (Rome, Italy) from July 1st to 7th, 2018, as an Invited Speaker of the session “*GW8 - Dense stellar environments as sites of gravitational wave emission*”. The title and abstract of the invited talk delivered by Dr Amaro Seoane is displayed below.

Talk title: Detecting IMRIs from the ground and space

Abstract: I will give a description for the joint detection of intermediate-mass ratio inspirals with ground- and space-borne gravitational-wave detectors.

A combined detection would help to break down the parameter degeneracies.

Best regards,

Manuel Arca Sedda



Dear Dr. Pau Amaro Seoane,

We are pleased to confirm that we invited you to the “Ge Zhi Innovation Forum”, scheduled from 27-30 August 2018 in Lanzhou. This Forum is a joint effort of the School of Physical Science and Technology Lanzhou University and the Lanzhou University Cuiying Honors College. We were very happy that you gave two invited talks with the titles and abstracts as follows in the forum.

1. Detecting Intermediate-Mass Ratio Inspirals From The Ground And Space

Abstract: The detection of a gravitational capture of a stellar-mass compact object by a massive black hole (MBH) will allow us to test gravity in the strong regime. These sources form via two-body relaxation, by exchanging energy and angular momentum, and inspiral in a slow, progressive way down to the final merger. I will show that, depending on their orbital parameters, in globular clusters intermediate-mass ratios (IMRIs) of MBH of masses between a hundred and a few thousand have frequencies that make them detectable (i) with ground-based observatories, or (ii) with both LISA and ground-based ones such as advanced LIGO/Virgo and third generation ones, with ET as an example. The binaries have a signal-to-noise ratio large enough to ensure detection. More extreme values in their orbital parameters correspond to systems detectable only with ground-based detectors and enter the LIGO/Virgo band in particular in many different harmonics for masses up to some 2000 Msun. I show that environmental effects are negligible, so that the source should not have this kind of complication. The accumulated phase-shift is measurable with LISA and ET, and for some cases also with LIGO, so that it is possible to recover information about the eccentricity and formation scenario. For IMRIs with a total mass $< \sim 2000$ Msun and initial eccentricities up to 0.999, LISA can give a warning to ground-based detectors with enough time in advance and



seconds of precision. The possibility of detecting IMRIs from the ground alone or combined with space-borne observatories opens new possibilities for gravitational wave astronomy.

2. Relativistic mergers of black hole binaries have (1) large, similar masses, (2) low spins and (3) are circular

Abstract: Binaries of stellar-mass black holes are among the most interesting sources for ground-based detectors, and have constituted the first detections. In this talk I will show that there is a selection effect for ground-based detectors, which should predominantly observe binaries of black holes with (1) large, similar masses, (2) low spins and (3) low eccentricities. "Hyperstellar" black holes (HSBs) (i.e. black holes with masses larger than the nominal $10 M_{\text{sun}}$) are predicted to be principally observed with an associated low value for the spin, typically of $a < 0.5$, regardless of the formation channel. Also, when two HSBs build a binary, each of the spin magnitudes is also low, and the detection is mostly of binary members with similar masses. To address the distribution of the eccentricities of HSB binaries in dense stellar systems, I have used a large suite of dedicated three-body scattering experiments that include binary-single interactions and long-lived hierarchical systems with a highly accurate integrator, including relativistic corrections up to $O(1/c^5)$. The results show that most sources in the detector band mainly have nearly zero eccentricities.

It was an honor and privilege to have invited you to participate in this forum as speaker. We believe that your contribution to this field is unparalleled and your talks were of great benefits for our students.

Your Faithfully,
Honggang Luo

A handwritten signature in black ink, appearing to read 'Luo Honggang'.

Dean of the School of Physical Science and
Technology Lanzhou University

222 South Tianshui Road, Lanzhou 730000, P.R.China
Tel: +86-931-8912753 Fax: +86-931-8913554
Email: phys@lzu.edu.cn
Web: <http://phy.lzu.edu.cn>



To Whom It May Concern:

I am writing this letter to certify that Dr. Pau Amaro-Seoane was invited to visit and give a seminar at our department on the 11th of June, 2019.

Talk title: Mapping spacetime with extreme-mass ratio inspirals

Abstract: In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA.

Yours sincerely,

Lap-Ming Lin

Lecturer

Department of Physics

The Chinese University of Hong Kong

<http://www.phy.cuhk.edu.hk/people/lin-lm.html>



DESY | Platanenallee 6, 15738 Zeuthen, Germany

Dr. Rolf Bühler
Fermi-LAT group leader
rolf.buehler@desy.de

Astroparticle division
Platanenallee 6
15738 Zeuthen
Germany
Phone. +49 33 7627 7249

2nd October 2019

To whom it may concern,

I hereby confirm that I invited Pau Amaro Seoane for DESY to give a seminar at our campus in Zeuthen. He gave the seminar on the 13th of September of 2019 and it was very well received. The title and abstract are listed below.

Mapping spacetime with extreme-mass ratio inspirals:
In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA.

With kind regards,

Dr. Rolf Bühler

Deutsches Elektronen-
Synchrotron DESY

Notkestraße 85
22607 Hamburg
Germany
www.desy.de

Location Zeuthen

Platanenallee 6
15738 Zeuthen
Germany

Directorate

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Prof. Dr. C. Stegmann
Prof. Dr. E. Weckert

Dr. A. Willner, CTO
(Delegate of the
Directorate for Innovation)



2019-09-30

To whom it may concern:

This is to confirm that Pau Amaro Seoane gave an invited talk at the Department of Physics at Fudan University (Shanghai, China) on March 16, 2019, during my group meeting. The title of the talk was “X-MRIs” and the abstract was the following: “I will present results about a new source of gravitational waves for LISA, the capture of sub-stellar objects by supermassive black holes. Depending on their evolutionary stage, they could potentially bury the signal of binaries of supermassive black holes”.

Sincerely,

A handwritten signature in black ink, appearing to be 'Cosimo Bambi', written in a cursive style.

Cosimo Bambi

Xie Xide Junior Chair Professor

Department of Physics, Fudan University

2005 Songhu Road, Shanghai 200438, China

Tel: +86-187-21711498 Fax: +86-21-65642363

Email: bambi@fudan.edu.cn

国台学术报告 NAOC COLLOQUIUM

2019 年 第 3 次 / No. 3 2019

Time: Wednesday 2:30 PM, Mar.6th Location: A601, NAOC

Gravitational Wave Astrophysics with the gravitational capture of compact objects by massive black holes

Dr. Pau Amaro Seoane

Institute of Space Studies at the Universitat Autònoma de Barcelona

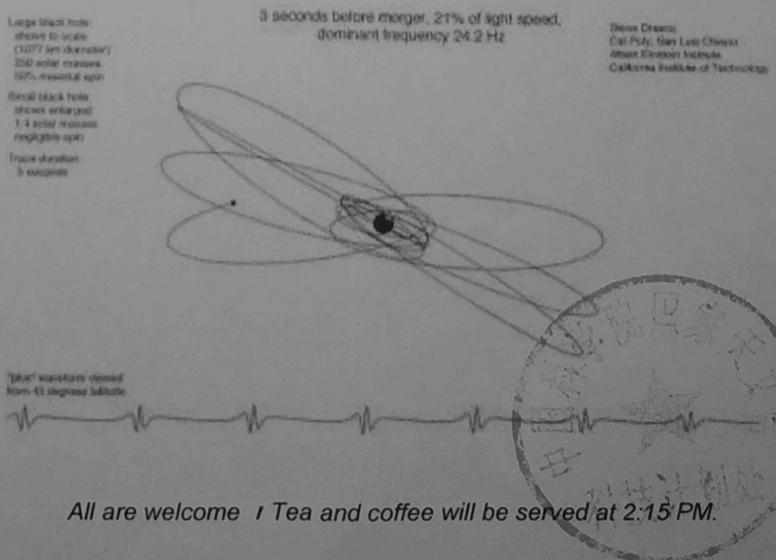


After completion of his Bachelor's in Theoretical Physics (Particle Physics) in Spain, Pau Amaro Seoane moved to Heidelberg to do a PhD in Theoretical Astrophysics, more precisely on dense stellar systems and the cosmic growth of supermassive black holes. Later, he moved to the the Max Planck Institute of Gravitational Physics in Potsdam (also called the "Albert Einstein Institute", AEI) to work with the director, Dr. Bernard Schutz and Dr. Curt Cutler on General Relativity, in particular on Gravitational Wave Astronomy. During his time in Barcelona, with Ignasi Ribas and Jordi Miralda-Escudé, he worked on the formation and evolution of protoplanetary disks, which later led to the development of a hybrid algorithm to study the formation and evolution of protoplanetary disks. He then received an offer from the AEI in Potsdam to be a Senior Scientist in 2008 and after successfully

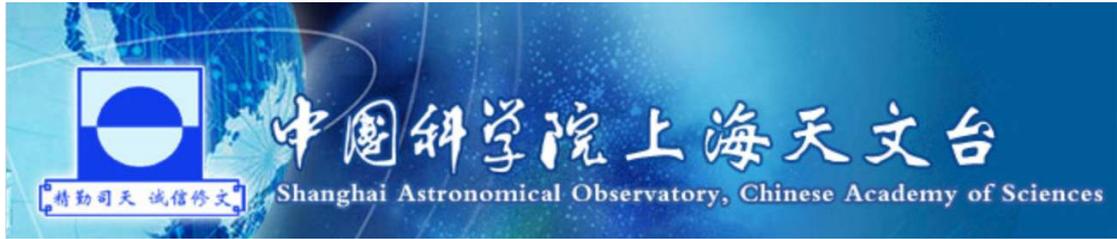
raising a significant amount of third-party funding (i.e. not from the Max Planck Society), he created his own Gravitational Wave Astronomy group at the AEI to host his 4 postdocs and 3 PhD students. He obtained his habilitation at the University of Potsdam in 2016, and a docent title at the Technical University of Berlin, which means that he is entitled to teach there and officially supervise PhD astronomy students at the Zentrum für Astronomie und Astrophysik. In 2016 he got an offer to join the Institute of Space Studies located at the Campus of Universitat Autònoma de Barcelona thanks to a Ramóny Cajal fellowship. Their Gravitational Wave Astronomy Research and Technology group there has led the Spanish effort in the LISA Pathfinder mission and in the future LISA one. He also visits regularly the Kavli Institute for Astronomy and Astrophysics and the Academy of Mathematics and System Science in Beijing, where he is leading a group on Gravitational Wave Astronomy. His main research focus has been Gravitational Wave Astronomy since 2004.

Abstract

In this talk I will give a general, broad description of the extreme-mass ratio inspiral problem, i.e. the gravitational capture of a stellar-mass compact object via loss of energy due to the emission of gravitational waves. This is one of the most interesting sources of gravitational waves to be detected in the future by a space-borne observatory such as LISA. My talk will mostly be focused on astrophysics but will include bits of general relativity as well. Time allowing, I will present a new source of gravitational waves, the so-called extremely-large mass ratio inspirals.



All are welcome / Tea and coffee will be served at 2:15 PM.



Proof

To whom it may concern,

This is to confirm that Prof. Pau Amaro Seoane gave an invited talk at Shanghai Astronomical Observatory of CAS on the 15th of March 2019. The title of talk is *intermediate-mass ratio inspirals*, and the abstract is attached following: *In this talk I will present results about the joint detection of gravitational waves from IMRIs with both space-borne and ground-based detectors.*

If you have any questions, please contact me.

Cheers,

Dr. Wenbiao Han

HAN Wenbiao

2019 Sep. 30th

Shanghai Astronomical Observatory



中国科学院国家天文台

NATIONAL ASTRONOMICAL OBSERVATORIES, CHINESE ACADEMY OF SCIENCES

Prof. Dr. R. Spurzem, NAOC/CAS, Beijing 100012, China

Prof. Dr. Rainer Spurzem
National Astronomical Observatories
Chinese Academy of Sciences
20A Datun Lu, Chaoyang District
Beijing 100012, China
spurzem@nao.cas.cn

To
Prof. Dr. Pau Amaro-Seoane
Institute for Space Science
08193 Barcelona

Beijing/Heidelberg, October 28, 2019

Certificate for Dr. Pau Amaro-Seoane

To whom it may concern:

This letter is to prove that Dr Amaro Seoane gave an invited talk at the NAOC colloquium on 16 February 2010 with the title

“The connection between missing stellar cusps in galactic nuclei and general relativity”

and the abstract:

“One of the most interesting sources of gravitational waves is the inspiral of compact objects on to a massive black hole (MBH), commonly referred to as an extreme-mass ratio inspiral. The small object, typically a stellar black hole, emits significant amounts of GW along each orbit in the detector bandwidth. On the other hand, recent observations of the Galactic center revealed a dearth of giant stars inside the inner parsec relative to the numbers theoretically expected for a fully relaxed stellar cusp. The possibility of unrelaxed nuclei (or, equivalently, with no or only a very shallow cusp) adds substantial uncertainty to the estimates. I show that under quite generic initial conditions, the time required for the growth of a relaxed, mass segregated stellar cusp is shorter than a Hubble time for MBHs with masses $\lesssim 5 \cdot 10^6 M_{\odot}$.”

With kind regards

(Rainer Spurzem)



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NATIONAL ASTRONOMICAL OBSERVATORIES, CHINESE ACADEMY OF SCIENCES

Prof. Dr. R. Spurzem, NAOC/CAS, Beijing 100012, China

Prof. Dr. Rainer Spurzem
National Astronomical Observatories
Chinese Academy of Sciences
20A Datun Lu, Chaoyang District
Beijing 100012, China
spurzem@nao.cas.cn

To
Prof. Dr. Pau Amaro-Seoane
Institute for Space Science
08193 Barcelona

Beijing/Heidelberg, October 28, 2019

Certificate for Dr. Pau Amaro-Seoane

To whom it may concern:

This letter is to prove that Dr Amaro Seoane gave an invited talk at the NAOC colloquium on 20 March 2013 with the title

“Intermediate-mass ratio inspirals”

and the abstract

“In this talk I will present results from numerical simulations which show the formation of an IMRI in a globular cluster. I will discuss the prospects for the detection of IMRIs with space-borne detectors, and their features.”

With kind regards

(Rainer Spurzem)



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NATIONAL ASTRONOMICAL OBSERVATORIES, CHINESE ACADEMY OF SCIENCES

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To
Prof. Dr. Pau Amaro-Seoane
Institute for Space Science
08193 Barcelona

Beijing/Heidelberg, October 28, 2019

Certificate for Dr. Pau Amaro-Seoane

To whom it may concern:

This letter is to prove that Dr Amaro Seoane gave an invited talk at the NAOC colloquium on 11 November 2014 with the title

“Mapping spacetime with extreme-mass ratio inspirals:”

and the abstract

“In this talk I will show how to map spacetime around supermassive black holes with the gravitational capture of stellar-mass compact objects. This is one of the fundamental sources of the space-borne detector LISA.”

With kind regards

(Rainer Spurzem)

Ciudad Universitaria, Septiembre de 2019.

A quien concierne

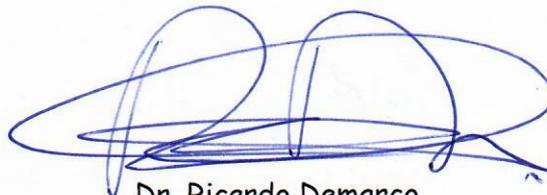
El suscrito, Director del Departamento de Astronomía de la Facultad de Ciencias Físicas y Matemáticas, de la Universidad de Concepción, deja constancia que el Dr. Pau Amaro Seoane, realizó un Seminario el día 20 de noviembre del año 2015 titulado

"The connection between missing stellar cusps in galactic nuclei and general relativity"

Abstract:

One of the most interesting sources of gravitational waves is the inspiral of compact objects on to a massive black hole (MBH), commonly referred to as an extreme-mass ratio inspiral. The small object, typically a stellar black hole, emits significant amounts of GW along each orbit in the detector bandwidth. On the other hand, recent observations of the Galactic center revealed a dearth of giant stars inside the inner parsec relative to the numbers theoretically expected for a fully relaxed stellar cusp. The possibility of unrelaxed nuclei (or, equivalently, with no or only a very shallow cusp) adds substantial uncertainty to the estimates. I show that under quite generic initial conditions, the time required for the growth of a relaxed, mass segregated stellar cusp is shorter than a Hubble time for MBHs with masses $\sim 5 \times 10^6 M_{\text{sun}}$.

Atentamente,



Dr. Ricardo Demarco

Director

DIRECTOR
DEPARTAMENTO DE ASTRONOMIA
FACULTAD DE CIENCIAS FISICAS Y MATEMATICAS
UNIVERSIDAD DE CONCEPCION

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