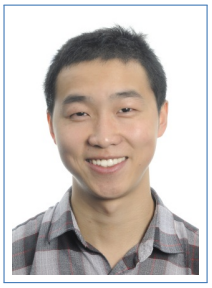

Yi-Ming Hu

Curriculum Vitae

Education

2011–2015 **Ph.D. in Physics and Astronomy**, *The University of Glasgow*, UK.

2007–2011 **Bachelor of Science in Astronomy**, *Nanjing University*, China.

Work experience

2017–Present **Associate Professor**, *School of Physics and Astronomy, Sun Yat-sen University*, China.

2015–2016 **Junior Scientist/Postdoc**, *The Max Planck Institute for Gravitational Physics (Albert Einstein Institute)*, Germany.

2015–2017 **Postdoc**, *Research Institute of Information Technology, Tsinghua University*, China.

Research interests

TianQin My primary research interest is to explore the astronomy and fundemental physics that could be achieved through the construction of TianQin, a proposed space-based gravitational wave detectior. My current affiliation is TianQin research center for gravitational physics.

GW astronomy As an astronomer deep down, I'm studying all possible gravitational wave sources for space-based GW missions, ranging from Galactic compact binaries, stellar mass compact binary inspirals, extreme mass-ratio inspirals, massive black hole binary mergers, as well as stochastic gravitational wave background.

Data Analysis I'm a Bayesinism, and my previous experience in LIGO equipped me with knowledge to perform GW data analysis related to space-based GW missions. I plan to construct data analysis pipelines for all sorts of potential sources to TianQin, to detect signals out of noise, and to measure parameters upon detected events.

TianQin Research Center for Gravitational Physics at Sun Yat-sen University
519082
+86 15876650785 • *huyiming@mail.sysu.edu.cn*

Selected Publication List ([†] means corresponding author)

2020 **Is GW190425 Consistent with Being a Neutron Star–Black Hole Merger?**, *Ming-Zhe Han, Shao-Peng Tang,* ***Yi-Ming Hu****, Yin-Jie Li, Jin-Liang Jiang, Zhi-Ping Jin, Yi-Zhong Fan*[†]*, Da-Ming Wei*, Astrophysical Journal Letters, vol. 891, L5.

we analyze the data associated with the GW190425 within the neutron star–black hole merger scenario, and concluded such possibility can not be dismissed with current data.

2019 **Constraining modified gravity with ringdown signals: an explicit example**, *Jiahui Bao, Changfu Shi, Haitian Wang, Jian-dong Zhang*[†]*,* ***Yiming Hu****, Jianwei Mei, Jun Luo*, Physical Review D, vol. 100, 084024.

We obtain the possible constraint that can be placed on the parameter describing the deviation of this particular alternative theory from general relativity by using the detection of the ringdown signals from binary black holes's merger with future space-based gravitational wave detectors.

2019 **TianQin project and international collaboration**, ***Yi-Ming Hu****, Jianwei Mei, Jun Luo*[†], Chinese Science Bulletin, vol. 64, no. 24, p. 2475-2483.

We introduce the TianQin project, including its technological requirement as well as its science cases. We explained the development plan and current progress, and we focus on the prospect for relavent international collaborations.

2019 **Results from an Einstein@Home search for continuous gravitational waves from Cassiopeia A, Vela Jr. and G347.3**, *Jing Ming*[†]*, Maria Alessandra Papa, Avneet Singh, Heinz-Bernd Eggenstein, Sylvia J. Zhu, Vladimir Dergachev,* ***Yi-Ming Hu****, Reinhard Prix, Bernd Machenschalk, Christian Beer, Oliver Behnke, Bruce Allen*, Physical Review D, vol. 100, 024063.

We report results of the most sensitive search to date for periodic gravitational waves from Cassiopeia A, Vela Jr. and G347.3 with frequency between 20 and 1500 Hz. The search was made possible by the computing power provided by the volunteers of the Einstein@Home project and improves on previous results by a factor of 2 across the entire frequency range for all targets.

2019 **Science with TianQin: Preliminary Results on Testing the No-hair Theorem with Ringdown Signals**, *Changfu Shi, Jiahui Bao, Haitian Wang, Jian-dong Zhang*[†]*,* ***Yi-Ming Hu****, Alberto Sesana, Enrico Barausse, Jianwei Mei, Jun Luo*, Physical Review D, vol. 100, 044036.

We study the capability of the space-based gravitational wave observatory TianQin to test the no-hair theorem of General Relativity, using the ringdown signal from the coalescence of massive black hole binaries. TianQin will have constrained deviations of the frequency and decay time of the dominant 22 mode from the general relativistic predictions to within 0.2% and 1.5% respectively, the frequencies of the subleading modes can be also constrained within 0.3%

2019 **Science with TianQin: Preliminary Results on Massive Black Hole Binaries**, *Hai-Tian Wang, Zhen Jiang, Alberto Sesana, Enrico Barausse, Shun-Jia Huang, Yi-Fan Wang, Wen-Fan Feng, Yan Wang,* ***Yi-Ming Hu***[†]*, Jianwei Mei, Jun Luo*, Physical Review D, vol. 100, 043003.

We investigate the prospects of detecting gravitational waves from coalescing massive black hole binaries in the Universe with the TianQin observatory. In the most optimistic model, we conclude TianQin can detect as many as $\sim$ 60 mergers per year.

2019 **Preliminary study on parameter estimation accuracy of supermassive black hole binary inspirals for TianQin**, *Wen-Fan Feng, Hai-Tian Wang, Xin-Chun Hu,* ***Yi-Ming Hu***†*, Yan Wang*†, Physical Review D, vol. 99, 123002.

We use Fisher information matrix method to calculate the parameter estimation accuracy of inspiralling supermassive black holes binaries for TianQin, using the 'restricted' post-Newtonian waveform in which third order post-Newtonian (3PN) phase including spin effects (spin-orbit and spin-spin) and first-order eccentricity contribution. We show that adding spin parameters degrades measurement accuracy of the other parameters.

2018 **Gravitational waves induced by the asymmetric jets of gamma-ray bursts**, *Shuang Du, Xiao-Dong Li*†*,* ***Yi-Ming Hu****, Fang-Kun Peng, Miao Li*, Monthly Notices of the Royal Astronomical Society, vol. 480, no. 1, p. 402-406.

We sutdy a noval mechanism of gravitational emission through asymmetric jets from gamma-ray bursts.

2018 **Fundamentals of the orbit and response for TianQin**, *Xin-Chun Hu, Xiao-Hong Li, Yan Wang*†*,Wen-Fan Feng, Ming-Yue Zhou,* ***Yi-Ming Hu****, Shou-Cun Hu, Jian-Wei Mei, Cheng-Gang Shao*, Classical and Quantum Gravity, vol. 35, no. 9, 095008.

In this article, we present a simplification equation for the response and orbit of the TianQin mission.

2018 **Optimizing searches for electromagnetic counterparts of gravitational wave triggers**, *Michael W Coughlin*†*, Duo Tao, Man Leong Chan, Deep Chatterjee, Nelson Christensen, Shaon Ghosh, Giuseppe Greco,* ***Yiming Hu****, Shasvath Kapadia, Javed Rana, Om Sharan Salafia, Christopher Stubbs*, Monthly Notices of the Royal Astronomical Society, vol. 478, no.1 p. 692-702.

We make a systematic comparison of a variety of proposed tiling and time allocation schemes for followup study of gravitational wave events.

2017 **Science Prospects for Space-borne Gravitational Wave Missions**, ***Yi-Ming Hu***†*, Jianwei Mei, Jun Luo*, National Science Review, vol. 4, no. 5, p. 683-684.

In this perspective, we give a brief overview on science prospects for space-based gravitational wave missions, covering massive black hole merger, compact binary inspirals and multi-band gravitational wave astronomy

2017 **Excitation of high frequency voices from intermediate-mass-ratio inspirals with large eccentricity**, *Wen-Biao Han*†*, Zhoujian Cao,* ***Yi-Ming Hu***†, Classical and Quantum Gravity, vol. 34, no. 22, p. 225010.

We studied the intermediate-mass-ratio inspirals systems with the central object mass, which is undetectable for neither ground-based nor space-based detectors, can radiate higher frequency overtones through eccentricity, thus detectable for ground-based gravitational wave detectors.

2017 **Neutron Star−Black Hole Coalescence Rate Inferred from Macronova Observations**, *Xiang Li,* ***Yi-Ming Hu***†*, Zhi-Ping Jin, Yi-Zhong Fan*†*, Da-Ming Wei*, Astrophysical Journal Letters, vol. 844, no. 2, p. L22.

We studied the neutron star-black hole coalescence rate from the observed kilonovae observations, and by comparing the different model predictions with LIGO detection results, we put constraints on the system properties, like equation of state of neutron star and the spin distribution.

2017 **Systematic errors in estimation of gravitational-wave candidate significance**, *Collin Capano, Thomas Dent, Chad Hanna, Martin Hendry,* ***Yi-Ming Hu***†*, Chris Messenger, John Veitch*, Physical Review D, vol. 96, p. 082002.

To safely report the detection of the gravitational events, one need to estimate the significance, or how unlikely the signal comes from noise. There're two categories of methods and we set up a mock data challenge to distinguish which category of method is better.

2017 **Maximising the detection probability of kilonovae associated with gravitational wave observations**, *Man Leong Chan,* ***Yi-Ming Hu***†*, Chris Messenger, Martin Hendry, Ik Siong Heng*, Astrophysical Journal, vol. 834, no. 1, p. 84.

We designed a Bayesian algorithm to include all systematic uncertainty of the possible electro-magnetic counterparts of gravitational wave events, so that telescopes adopting our strategy can maximise their chance of observin the counterparts.

2016 **Long-short GRBs within the horizon of the advanced LIGO/VIRGO network and Time lag between compact object coalescence and GRB onset**, *Xiang Li,* ***Yi-Ming Hu****, Yi-Zhong Fan*†*, Da-Ming Wei*, Astrophysical Journal, vol. 827, no. 1, p. 75.

The observation from multiple channels of the GW sources could be used the constraint the speed of GW and Einstein's equivalence principle. We discussed how well can such constraint reach in the Advanced detector era and how likely such constraint could be made.

2015 **Global Optimisation for Future Gravitational Wave Detectors' Sites**, ***Yi-Ming Hu***†*, Peter Raffai, Laszlo Gondan, Ik Siong Heng, Nandor Kelecsenyi, Martin Hendry, Zsuzsa Marka, Szabolcs Marka*, Classical and Quantum Gravity, vol. 32, no. 10, p. 105010.

We used the efficient MCMC sampling method to perform a global optimisation for future generation gravitational wave detectors' sites, we conclude Australia hosts the most flexible site, either for a 3-detector-network or for a 5-detector-network

2014 **Glitch or anti-glitch: a Bayesian view**, ***Yi-Ming Hu***†*, Matthew Pitkin, Ik Siong Heng, and Martin A. Hendry*, Astrophysical Journal Letters, vol. 784, no. 2, p. L41.

We applied the Bayesian Model Selection method to distinguish which of the following two models support the observed data better: either two successive anti-glitch or one anti-glitch followed by a normal one.

Conference and invited talks

December 2019 **Invited talk at Guangzhou University, Guangzhou**, *Science with the TianQin Observatory*.

We investigate the prospects of detecting gravitational waves from coalescing massive black hole binaries in the Universe with the TianQin observatory, and discuss the implication for testing the theory of gravity, we also report the progress of the TianQin project.

December 2019 **The Sixth Workshop of TianQin Space Science Mission, Zhuhai**, *Progress on Studies of TianQin Scientific Objectives*.

We give a keynote talk to present a brief overview of all astronomical science cases for TianQin.

November 2019 **KIAA Forum 2019: The Future of Gravitational Wave Astrophysics, Beijing**, *Science with TianQin: Prospects and applications of massive black hole binaries detections*.

We investigate the prospects of detecting gravitational waves from coalescing massive black hole binaries in the Universe with the TianQin observatory, and discuss the implication for testing the theory of gravity.

November 2019 **3rd Seminar on TianQin science case, Zhuhai**, *1. Prospect of TianQin on Massive Black Hole Binaries and EMRI; 2. Prospect of TianQin on Stellar-mass Black Hole Binary*.

We update our preliminary results on TianQin's detection ability for massive black hole binaries, extreme mass-ratio binaries and stellar-mass black hole binaries.

July 2019 **GR22 – Amaldi13 conference, Valencia**, *Science with TianQin: Preliminary Results on Massive Black Hole Binaries*.

We investigate the prospects of detecting gravitational waves from coalescing massive black hole binaries in the Universe with the TianQin observatory.

May 2019 **2nd Seminar on TianQin science case, Wuhan**, *Science with TianQin: Preliminary Results on Massive Black Hole Binaries*.

We give a presentation on TianQin's detection and measurement prospect of massive black hole binaries.

May 2019 **2nd GrEAT meeting, Glasgow**, *Science with TianQin: Preliminary Results on Massive Black Hole Binaries*.

We give a presentation on TianQin's detection and measurement prospect of massive black hole binaries.

April 2019 **2019 CCNU-USTC Junior Cosmology Symposium, Wuhan**, *Science with TianQin: Preliminary Results on Massive Black Hole Binaries*.

We give a presentation on TianQin's detection and measurement prospect of massive black hole binaries.

April 2019 **Invited talk at SYSU, Guangzhou**, *Science with TianQin: Preliminary Results on Massive Black Hole Binaries*.

We give a presentation on TianQin's detection and measurement prospect of massive black hole binaries.

March 2019 **RESCEU Workshop on Space Gravitational-Wave Detection, Tokyo**, *Analysis of TianQin Scientific Objectives*.

We give a presentation on all astronomical science cases for TianQin.

Janunary 2019 **Seminar on Simulation Technology of Space-based Gravitational Wave Detection, Zhuhai**, *Data analysis pipeline for space-based gravitational wave detections*.

We present an preview on the necessary components of data analysis pipelines related to gravitational wave sources of space-based gravitational wave detections.

Janunary 2019 **Invited talk at KIAA, Beijing**, *Analysis of TianQin Scientific Objectives*.

We give a presentation on all astronomical science cases for TianQin.

December 2018 **The Fifth Workshop of TianQin Space Science Mission, Zhuhai**, *Analysis of TianQin Scientific Objectives*.

We give a keynote talk to present a brief overview of all astronomical science cases for TianQin.

September 2018 **Advanced seminar of gravitational wave physics, Changsha**, *Analysis of TianQin scientific targets*.

We give a brief overview of all astronomical science cases for TianQin science.

July 2018 **12th International LISA Symposium, Chicago**, *The Effect of the Earth Gravity Field Measurement Uncertainty on Gravitational Waves Detection with TianQin*, poster.

TianQin is a space-based gravitational wave mission using a set of geocentric orbits with radii in the order of 105km. Because the TianQin satellites are relatively close to the Earth, there is concern that the orbits might be so strongly affected by the multipole moments of the gravity field of the Earth as to impair the detection of gravitational waves. We investigate such effect through both analytic and numerical methods.

May 2018 **2nd workshop on GW astrophysics, Xiamen**, *Introduction of TianQin mission*.

In this talk, I briefly discussed the implication of gravitational wave detection, the science case of TianQin mission, as well as the current progress of TianQin mission.

April 2018 **Zhuhai Workshop on GW detection and Nucleosynthesis, Zhuhai**, *Introduction of TianQin mission*.

In this talk, I briefly discussed the implication of gravitational wave detection, the science case of TianQin mission, as well as the current progress of TianQin mission.

March 2018 **Junior Cosmology Symposium: Gravitational Waves and Early Universe, Hefei**, *Impact of Earth Multiple Moments on TianQin Gravitational Wave Detection*.

We report the progress on this topic.

March 2018 **1st Seminar on TianQin science case, Zhuhai**, *Analysis of TianQin Science Cases*.

We report the progress for the study of science cases for the TianQin mission.

December 2017 **Invited talk at USTC, Hefei**, *Maximising the detection probability of kilonovae associated with gravitational wave observations*.

We discussed the potential influence of Earth Gravity field uncertainty on the Geocentric gravitational wave mission, TianQin. Through both Monte Carlo and error propagation, we conclude that with the more updated Earth gravity model, the uncertainty raised from Earth gravity field would not prevent TianQin from a successful GW detection.

December 2017 **Workshop on GW detection and Nucleosynthesis, Xinglong**, *Earth Gravity field effect on TianQin*.

We report the similar result on this topic.

November 2017 **ACGRG9, Perth**, *Earth Gravity field effect on TianQin*.

We discussed the potential influence of Earth Gravity field uncertainty on the Geocentric gravitational wave mission, TianQin. Through both Monte Carlo and error propagation, we conclude that with the more updated Earth gravity model, the uncertainty raised from Earth gravity field would not prevent TianQin from a successful GW detection.

October 2017 **The 6th Beijing GW workshop, Beijing**, *Multiband Gravitational Wave astronomy*.

In this talk, inline with the discovery of the binary neutron star merger signal, I discussed the prospect of detecting gravitational waves using space-borne missions, especially the TianQin mission. An early warning via TianQin is possible to issue alert far before the actual merger, assuring a much more solid prepration for multi-messenger observation.

August 2017 **The 1st Youth GW workshop, Anji**, *NS-BH rate from macronovae observation*.
We report the update on the project, including the constrain on equation of state as well as possible conenction with binary neutron star merger rate.

June 2017 **Invited talk at Guangzhou University, Guangzhou**, *Progress of the TianQin project*.
We introduce the TianQin project, its development plan and progress.

May 2017 **Invited talk at Yunnan Observatory, Kunming**, *Maximising the detection probability of kilonovae associated with gravitational wave observations*.
We designed a Bayesian algorithm to include all systematic uncertainty of the possible electro-magnetic counterparts of gravitational wave events, so that telescopes adopting our strategy can maximise their chance of observin the counterparts.

April 2017 **The 5th Beijing GW workshop, Beijing**, *NS-BH rate from macronovae observation*.
We studied the neutron star-black hole coalescence rate from the observed kilonovae observations, and by comparing the different model predictions with LIGO detection results, we put constraints on the system properties, like equation of state of neutron star and the spin distribution.

August 2016, Glasgow **LVC meeting**, *Improvements of the line-robust statistic*.
Update on the line-robust statistic is given.

June 2016 **GWPAW, Boston**, *Constructing a more physical Line-Robust Statistic*, poster.
The Bayesian statistic B_{SGL} is designed to distinguish Signal of continuous wave from either Gaussian noise or Line feature. Currently, the implementation of such statistics requires elaborate and numerically expensive tuning of an ad-hoc control parameter. Here we propose a new statistic to remove the arbitrariness of such ad-hoc tuning parameter by adopting a more physical prior instead, which could allow a more natural and less ad-hoc choice of the input parameters.

March 2016 **LVC meeting, Pasadena**, *Tuning of Bayesian statistics in Einstein@Home for O1*.
The Bayesian statistic B_{SGL} is designed to distinguish Signal of continuous wave from either Gaussian noise or Line feature. Other statistics like B_{SGLtL}, B_{tSGLtL} can deal with transient lines or transient signal. The format of the statistic requires an ad-hoc tuning of a parameter so that it can perform in the best form. We here present a detailed study about the tuning of such parameter specifically for Einstein@Home over O1 data.

April 2015 **BritGrav meeting, Birmingham**, *Estimation of gravitational wave event statistical significance*.
Some further updates of the mock data challenge was reported.

September 2014 **Invited talk at Caltech, Pasadena**, *Determine the optimal sites for Gravitational Wave Detectors*.
We consider the optimal site selection of future generations of gravitational wave detectors. Given the locations of the component detectors in the network, we compute a measure of the network's ability to distinguish the polarization, constrain the sky localization and reconstruct the parameters of a gravitational wave source. We further define the 'flexibility index' for a possible site location, by counting the number of multi-detector networks with a sufficiently high FoM that include that site location.

August 2014 **LVC meeting, Stanford**, *Significance MDC progress and discussion – the Hamlet test*.

I presented the result of the significance mock data challenge. There exist two modes of analysing signals' significances, either including or not including the actual signal for background estimation, which will generally disagree for a very loud signals. Participants are required to estimate the significance of the loudest signal with both modes, these estimations are compared with theoretical calculation. Conclusions are draw based on a variety of background distributions and foreground rates.