Chi-kwan Chan

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Dr. Chi-kwan Chan (CK) is a tenure-track Associate Astronomer/Research Professor at the University of Arizona. He served as the Secretary of the Event Horizon Telescope (EHT) Collaboration Science Council from 2020 to 2022. He recently led the publication of the computational and theoretical modeling/interpretation of our black hole, Sgr A*. Dr. Chan created the collaboration's computational and data processing infrastructures and continues to manage them to this day, along with leading both the Software and Data Compatibility and the Gravitational Physics Working Groups in the collaboration. He is the current Principal Investigator of Black Hole PIRE, a leader of the Theoretical Astrophysics Program (TAP), a Data Science Fellow, and a faculty member of the Applied Mathematics Program. In addition to pioneering the use of Graphics Processing Units (GPUs) to accelerate the modeling of black holes, Dr. Chan also developed many new algorithms to improve and accelerate modern research, built cloud computing infrastructures for large observational data, and applied machine learning algorithms to speed up and automate data processing. Dr. Chan has taught and mentored in subjects of machine learning, numerical analysis, cloud computing, and quantum computing; has advocated for diversity, equity, and inclusion best practices in scientific publications; and is an avid hiker.

Research Interests

Computation- and data-intensive science, machine learning, visual computing, data visualization in VR/AR, interactive simulations, parallel and scalable algorithms, HPC-cloud convergence, computational astrophysics, black hole astrophysics, and VLBI.

Employment

2021 – current	Associate Research Professor, Steward Observatory
2018 – current	Data Science Fellow, University of Arizona
2018 – 2021	Assistant Astronomer, Steward Observatory
2017	Visiting Scientist, Harvard Black Hole Initiative
2013 – 2018	Research Associate, Steward Observatory
2010 – 2012	NORDITA Fellow, Nordic Institute for Theoretical Physics
2010	Teaching Fellow, Harvard University
2007 – 2010	ITC Fellow, Harvard-Smithsonian Center for Astrophysics
2005 – 2007	Summer Intern, Theory Division, Los Alamos National Laboratory

Education

May 2007	Ph.D. in Physics, University of Arizona
May 2002	B.S. in Physics and Mathematics (Cum Laude), University of Arizona

Leadership

2022 – current	*Leader*, Gravitational Physics Working Group, EHT Collaboration
2020 – 2022	*Secretary*, Science Council, EHT Collaboration
2021 – 2022	*Leader*, Sgr A* Theory Paper, EHT Collaboration
2021 – current	*Leader*, Computation and Data Initiative, University of Arizona
2021 – current	*Committee Member*, Research Computing Governance, University of Arizona
2020 – current	*Founding Advisor*, Hong Kong Student Association, University of Arizona
2018 – current	*Leader*, Software and Data Compatibility Working Group, EHT Collaboration

Professional Service

2022 – current	*Associate Member*, LSST AGN Science Collaboration
2020 – current	*Referee*, Internal Publication Committee, EHT Collaboration
2009 – current	*Referee*, astrophysics journals (ApJ, ApJL, MNRAS, PASJ, and A&A, etc.)
2021 – current	*Committee Member*, Computing and IT Committee, Steward Observatory
2021 – 2022	*Reviewer*, DOE INCITE Astrophysics Review Panel, U.S. Department of Energy
2022	*Committee Member*, Early Career Award Committee, EHT Collaboration
2022	*Reviewer*, RII Research Development Grants, University of Arizona
2022	*Committee Member*, Undergraduate Research Task Force, University of Arizona
2020 – 2021	*Committee Member*, Theory Prize, Steward Observatory
2021	*Reviewer*, NASA Open Source Tools, Frameworks, and Libraries 2020 Review Panel, National Aeronautics and Space Administration
2018	*Committee Member*, Campus Data Visualization Services, University of Arizona
2008 – 2009	*Member*, Postdoc Council, Harvard-Smithsonian Center for Astrophysics

Professional Honours

2021	EHT Early Career Award
2021	Royal Astronomical Society Group Award
2020	Breakthrough Prize in Fundamental Physics
2020	Nelson P. Jackson Aerospace Award
2020	Bruno Rossi Prize
2020	Einstein Medal
2019	Special Congressional Recognition (U.S. Senate)
2019	Special Congressional Recognition (U.S. House)
2019	American Ingenuity Award in Physical Sciences
2019	NSF Diamond Achievement Award
2019	Breakthrough of the Year, Science Magazine
2019	#1 Science Image of the Year, Nature Magazine
2010 – 2012	NORDITA Fellowship
2007 – 2010	Harvard ITC Fellowship

Grants and Allocations

2022 – current	*PI*, "PIRE: Black Hole Astrophysics in the Era of Distributed Resources and Expertise", NSF #1743747, US$5,678,833
2022 – current	*PI*, "The Ultra Violet Output of Sgr A*", JWST Cycle 1 GO-02075, US$156,459
2020 – current	*PI*, "Event Horizon Telescope Allocation" and "Steward Observatory Allocation" OSG OSPool allocation for the EHT and Steward Observatory, 20M core-hr to date, US$380,000 equiv. to date
2020 – 2022	*PI*, "The Frontera-Event Horizon Telescope Partnership", TACC Frontera Large-Scale Community Partnerships AST20023, 1.2M SUs=80M core-hr, US$1,300,000 equiv. (*one of the largest awarded at the time*)
2020 – current	*Co-I*, "Advanced Debris Disk Modeling for the Next Decade", NASA 18-2XRP18_2-0063, US$328,565
2023	*Co-I*, "Black Hole Dynamics and Achromaticity in the Shadow of Sgr A*", ALMA Cycle 9 2022.1.01268.V
2023	*Co-I*, "A sample of SMBH shadows, rings, accretion flows and jet bases: exploratory EHT+ALMA flux measurements", ALMA Cycle 9 2022.1.01055.V
2023	*Co-I*, "NGC4261: the 2nd jet at < 50 gravitational radii (and the 3rd black hole shadow?)", ALMA Cycle 9 2022.1.00520.V
2023	*Co-I*, "A sample of SMBHs at <100 Rg scales: accretion flows, jets, shadows: GMVA+ALMA imaging", ALMA Cycle 9 2022.1.00366.V
2023	*Co-I*, "Kinematics of Jets in low luminosity AGNs", VLBA 22B-227, 40 hrs
2023	*Co-I*, "Constraining the accretion and jet properties of next generation EHT targets", NuSTAR 8229, 200 ksec
2023	*Co-I*, "X-ray reverberation in billion mass black holes", NICER 5176, 360 ksec
2023	*Co-I*, "Constraining the micro-variability time-scales to photon orbits in low luminosity AGNs", SMARTS-1m, 125 hrs
2023	*Co-I*, "EHT Sample: Jet profile of nearby AGNs", LBA V587, 70 hrs
2023	*Co-I*, "Pilot study to constrain the compactness of low luminosity AGN", ATCA C3404, 50 hrs
2023	*Co-I*, "A sample of black holes at ¡100 Rg scales: accretion flows, jets, shadows" GMVA 20B-343
2022	*Co-I*, "TESS Monitoring Of Low Luminosity AGNs", TESS G04232
2022	*Co-I*, "Towards a sample of SMBH shadows, rings, accretion flows and jet bases: exploratory EHT+ALMA flux measurements", ALMA Cycle 8 2021.1.01156.V
2022	*Co-I*, "Connecting the black hole shadow and jet base in M 87", ALMA Cycle 8 2021.1.00910.V
2022	*Co-I*, "Capturing Real-Time Black Hole Dynamics in Sgr A*", ALMA Cycle 8 2021.1.00906.V
2018	*Co-I*, "Imaging the Global Accretion and Outflow of Sgr A*: 3mm VLBI with GMVA+ALMA", ALMA Cycle 5 2017.1.00795.V

Media and Public Engagement

2019 – 2022	*Interviewee*, national and international TV channels and newspapers (various)
2022	*Interviewee*, NSF Press Release of the first Sgr A* results
2022	*Invited Speaker*, Tucson Amateur Astronomers Club
2022	*Outreach Member*, South by Southwest™
2019	*Organizer and Host*, Penguin AI Club Visit, University High School
2019	*Outreach Speaker*, Faculty Presentations, Korean Student Visit, University of Arizona
2019	*Organizer and Host*, Hong Kong Student Visit, partnering with the Chinese University of Hong Kong
2019	*Organizer and Artist*, "Einstein Chalk Art", University of Arizona
2019	*Interviewee*, NSF Press Release of the first M87* results
2018	*Outreach Member*, UArizona Home Coming
2015	*Co-founder and advisor*, `AstroCardboard` app
2015	*Developer and advisor*, `RosettaTour` app

Teaching

2021 – current	*Instructor*, ASTR/PHYS 105A "Introduction to Scientific Computing", Astronomy and Physics Departments, University of Arizona
	Instructor, "Performing Large Scale Parameter Surveys with OSG Services", Black Hole PIRE Webinar, Sep 2022
2019	*Organizer and Instructor*, "Container Camp", CyVerse, University of Arizona
2019	*Organizer and Instructor*, "PIRE Cloud Computing Busyweek", Black Hole PIRE, University of Arizona
2018	*Organizer and Instructor*, "Black Hole PIRE Winter School on High-Performance Computing and Coordinating Global Observations", Black Hole PIRE, University of Arizona
2018	*Organizer and Instructor*, "Learning Docker and Singularity", CyVerse AstroContainers Workshop, University of Arizona
2018	*Organizer and Instructor*, "Docker and Jupyter for Reproducible Astronomy", PIRE Mini-Hackathon, Tucson
2010	*Guest Lecturer*, numerical analysis class on topics of GPU computation, KTH, Stockholm

Mentorship

2018 – current	"Numerical Methods for Simulating Plasma Around Black Holes", *Tyler Trent*, mentoring the development of a feature extraction algorithm for the M87* and Sgr A* black holes and numerical integrators in curved spacetime
2021 – current	"General Relativistic Ray Tracing in Dynamic Spacetime", *Gabriele Bozzola*, mentoring the image simulations of merging black holes

2015 – 2020	"Plasma Physics and General Relativistic Radiative Transfer", *David Ball*, mentoring the study of electron number distributions and their effect in black hole images
2015 – 2019	"Time Variability and Interferometric Images in GRMHD Simulations", *Lia Medeiros*, mentoring the study of VLBI signatures of black hole with general relativistic radiative transfer
2022 – current	"Particle Orbits around Kerr Naked Singularity", *Elyas Loutfi Farah, Lebanese American University, Lebanon*, mentoring the use of `fadge` to solve time-like geodesics around naked singularity
2021 – current	"Observation Signature of Kerr Naked Singularity", *Bao Nguyen*, mentoring the use of `fadge` to solve null geodesics around naked singularity
2021 – current	"General Relativistic Ray Tracing", *Aniket Sharma*, mentoring the use of Google `JAX` for general relativistic ray tracing
2021 – current	"Signature of Magnetorotational Instability in GRMHD Simulations", *Tin-Lok Chan, The Chinese University of Hong Kong, Hong Kong*, mentoring the simulation of black holes with `Athena++` and `BHAC`; results published in EHTC Sgr A* Papers I and V
2021 – current	"Application of Machine Learning in Astrophysics", *Anthony Hsu*, mentoring the development of machine learning methods and topological data analysis software
2020 – current	"Weather Nowcasting at Telescope Sites", *Phani Datta Velicheti*, mentoring the development software package μcast
2022	"Comparison of clustering algorithms for VLBI imaging", *Edward Chang*, mentoring the study of different clustering algorithms for VLBI imaging work
2021	"Honor Project to Develop EHT Outreach Materials", *Rachel Wells*, mentoring the development of education materials for elementary school students
2020	"Data Process and Security with Kubernetes", *Jarod Bristol, Ethan Glasberg, & Ryan Luu*, mentoring the improvement of security for cloud computing infrastructure
2020	"PCA-based Clustering Algorithm for EHT Imaging Results", *Yuan Jea Hew*, mentoring the development of algorithms for Sgr A* imaging work
2020	"Create virtual reality app to visualize black hole simulations", *Jose Perez, Jimena Stephenson, Hafizudin Hashim, & JianDa Zhau*, mentoring the development of educational AR apps
2019	"Developing Augmented Reality App for Stellar Evolution", *Muaz Burhanudin*, mentoring the development of educational AR app "ARStellarEvolution"
2019	"Time Variability of Closure Phase", *Ryan Gatski*, mentoring the development of model-free algorithm to calibration polarimetry visibility data
2019	"Improving General Relativistic Ray Tracing", *Will Price & Devin Shawn Cameron*, mentoring the development of algorithms to visualize black hole simulations
2019	"Developing Augmented Reality App for the Event Horizon Telescope", *Jose Perez, Elizabeth Champagne, & Yuan Jea Hew*, mentoring the development of educational AR app "EHTGo"
2018	"Cloud Computing for Astronomy", *Alexis Tinoco Cazarez*, mentoring the applica-

tion of Docker technology for astronomy data processing

2011 – 2012   "Growth of Massive Black Holes by Super-Eddington Accretion" *Phillip Jenks*, mentoring the development of radiation hydrodynamic algorithm for master thesis

2005 – 2006   "Numerical Method of Radiactive Diffusion" *Robert Marcus*, mentoring the development of radiative transfer algorithm for senior thesis

Selected Software

Sole Developer:

- `lux`, a high performance scientific computation framework that can measure the run time performance of algorithms and optimize it on-the-fly: `https://github.com/luxsrc/lux`; related projects: `https://github.com/luxsrc`

- `gray`, a massive parallel ODE integrator for performing general relativistic radiative transfer using ray tracing: `https://github.com/luxsrc/gray`

- `XAJ`, an ordinary differential equation (ODE) integrator compatible with Google's GPU-accelerated autodiff package `JAX`: `https://github.com/adxsrc/xaj`; related projects: `https://github.com/adxsrc`

- `foci`, a python package for processing and imaging VLBI data: `https://github.com/focisrc/foci`; related projects: `https://github.com/focisrc`

- μ`cast`, a weather forecast data processing package with micro-weather forecasting for radio astronomy: `https://github.com/focisrc/ucast`

- `insight`, an open of the first interactive data visualization tools in virtual reality: `https://github.com/luxsrc/insight`, `https://youtu.be/tfDO88R1jTw`

- `orbits`, a collection of symplectic integrators that are ideal for solving celestial mechanic problems: `https://github.com/rndsrc/orbits`; related projects: `https://github.com/rndsrc`

- `sg2`, a 2D spectral Galerkin code written in CUDA C and runs on nVidia GPUs: `https://github.com/rndsrc/sg2`, `https://youtu.be/4ORDgzIwK00`

- EHT docker stack, Dockerfile recipes and tools to set up EHT's data analysis containers for reproducibility: `https://github.com/eventhorizontelescope/docker-recipes`

- OSG tools for `igrmonty` and `ipole`, tools for running large GRRT and GR Monte Carlo simulations: `https://github.com/bhpire/igrmonty-osg`, `https://github.com/bhpire/ipole-osg`

Lead Developer:

- EHT 2017 HOPS pipeline, a HOPS pipeline used to process EHT's 2017 observation data: `https://github.com/eventhorizontelescope/2017-april`

- Sgr A* theory paper data analysis tools, Jupyter notebooks for managing and analyzing large number of GRRT images and GR Monte Carlo SEDs of black holes, used for EHT Sgr A* paper V: `https://github.com/eventhorizontelescope/2017_sgra_paper5`

- `ehtplot`, a plotting utility including the perceptually uniform `afmhot_10us` colormap, `https://github.com/AFD-Illinois/igrmonty`

Key Contributor:

- OSG SYMBA pipeline, a Pegasus pipeline for running very large scale synthetic data generation jobs for VLBI: `https://github.com/bhpire/symba-osg`
- OSG calsz tools, tools for estimating second moments in visibility domain of very large number of images: `https://github.com/bhpire/calsz-osg`
- `igrmonty`, a well tested GR Monte Carlo code for computing SEDs of black holes, `https://github.com/AFD-Illinois/igrmonty`
- `eht-imaging`, one of EHT's main image reconstruction and data processing packages, `https://github.com/achael/eht-imaging`

Selected Presentations and Conferences

54. *Chair, Scientific Organizing Committee*, 2022 EHT Winter Collaboration Meeting, Virtual, Dec 2022

53. *Speaker*, "Sparking Imaginations with Black Hole Images", 4th Shaw-IAU workshop, Nov 2022

52. *Speaker*, "Resolving the Galactic Center Black Hole with the Event Horizon Telescope", Astrophysics Colloquium, UBC, Oct 2022

51. *Speaker*, "Resolving the Galactic Center Black Hole with the Event Horizon Telescope", Cosmology Seminar, SFU, Oct 2022

50. *Speaker*, "Resolving the Galactic Center Black Hole with the Event Horizon Telescope", Astronomy Seminar, UW, Oct 2022

49. *Instructor*, "Performing Large Scale Parameter Surveys with OSG Services", Black Hole PIRE Webinar, Sep 2022

48. *Speaker*, "Resolving the Galactic Center Black Hole with the Event Horizon Telescope", Steward Observatory/NSF's NOIRLab Joint Colloquium, Tucson, Sep 2022

47. *Invited Speaker*, "First Sagittarius A* Event Horizon Telescope Results: Testing Astrophysical Models of the Galactic Center Black Hole", AAS Meeting, Pasadena, Jun 2022

46. *Invited Speaker*, "Sagittarius A*: the Supermassive Black Hole at our Galactic Centre", Hong Kong Space Museum, May 2022 (*Cantonese*)

45. *Invited Speaker*, "Resolving Black Holes with the Event Horizon Telescope", Tucson Amateur Astronomers Club, Apr 2022

44. *Organizer*, "A Deep Look Into the Black Hole in the Center of the Milky Way", Black Hole PIRE Webinar Series, Jan–May 2022

43. *Member, Scientific Organizing Committee*, EHT 2021 Winter Collaboration Meeting, Virtual, Dec 2021

42. *Organizer*, EHT 2021 U.S. Meeting, Tucson, Nov 2021

41. *Organizer*, EHT Sgr A* Theory Busyweek II, Sep 2021

40. *Organizer*, "Advanced EHT Data Analysis", Black Hole PIRE Webinar Series, Jan–Apr 2021

39. *Organizer*, EHT 2020 Winter Collaboration Meeting, Virtual, Dec 2020

38. *Organizer*, EHT Sgr A* Theory Busyweek I, Dec 2020

37. *Speaker*, "Astrophysics Empowered by the EHT: Ray Tracing", Black Hole PIRE Webinar Series Session 3, Oct 2020

36. *Organizer*, "Astrophysics Empowered by the EHT", Black Hole PIRE Webinar Series, Sep–Nov 2020

35. *Organizer*, "VLBI Data Series", Black Hole PIRE Webinar Series, Mar–May 2020

34. *Public Speaker*, "Imaging the Supermassive Black Hole at the Center of the M87 Galaxy", Public talk to visiting highschool students, Tucson, Dec 2019

33. *Public Speaker*, "Imaging the Supermassive Black Hole at the Center of the M87 Galaxy", Public talk to visiting students from Korea, Tucson, Nov 2019

32. *Speaker*, "Imaging the Supermassive Black Hole at the Center of the M87 Galaxy: A Data Analysis Perspective", UA-TRIPODS Seminar, Tucson, Oct 2019

31. *Invited Speaker*, "Capturing Black Holes in the Era of Distributed Resources and Expertise", Zoomtopia, San Jose, Oct 2019

30. *Organizer*, "Cloud Computing", Black Hole PIRE Webinar Series, Sep–Dec 2019

29. *Organizer and Instructor*, "Container Camp", CyVerse, Tucson, Jul 2019

28. *Keynote Speaker*, "Imaging the Supermassive Black Hole at the Center of the M87 Galaxy: A Computation Perspective", IUPAP Conference on Computational Physics, Hong Kong, Jul 2019

27. *Public Speaker*, "Imaging the Supermassive Black Hole at the Center of the M87 Galaxy", Public talk to visiting students from Hong Kong, Tucson, Jul 2019

26. *Keynote Speaker*, "In the Shadow of the Black Hole", GitHub Satellite, Berlin, May 2019

25. *Keynote Speaker*, "Bringing Black Holes into Focus: The Event Horizon Telescope's First Image", Tucson, Apr 2019

24. *Organizer and Instructor*, "PIRE Cloud Computing Busyweek", Black Hole PIRE, Tucson, Feb 2019

23. *Organizer and Instructor*, "Black Hole PIRE Winter School on High-Performance Computing and Coordinating Global Observations", Tucson, Dec 2018

22. *Invited Speaker*, "Imaging Event Horizons—A Journey Walked Together by Observers and Theorists", Shanghai Astronomical Observatory, Sep 2018

21. *Organizer and Instructor*, "Learning Docker and Singularity", CyVerse AstroContainers Workshop, Tucson, May 2018

20. *Organizer and Instructor*, "Docker and Jupyter for Reproducible Astronomy", PIRE Mini-Hackathon, Tucson, Apr 2018

19. *Keynote Speaker*, "GPU Computing: from PC & HPC to the Cloud & the Edge", Black Hole PIRE Launch, Tucson, Feb 2018

18. *Speaker*, "Recent Progress in General Relativistic Ray Tracing", Black Hole Initiative, Cambridge, Sep 2017

17. *Organizer*, "Multi-Scale Plasma Flows Around Black Holes", TCAN Collaboration Meeting, Tucson, Oct 2016

16. *Speaker*, "`GRay2`: Improving General Relativistic Ray Tracing and Beyond", TCAN Collaboration Meeting, Tucson, Oct 2016

15. *Speaker*, "Fast Variabilites in GRMHD Models of Sgr A* and Their Implications for EHT Observations", International Astronomical Union Symposium 322, Australia, Jul 2016

14. *Speaker*, "On MHD Turbulence and Angular Momentum Transport in Accretion Disk Boundary Layers", International Astronomical Union Symposium 294, Beijing, Aug 2012

13. *Organizer*, "Astrophysics Code Comparison Workshop", NORDITA, Stockholm, Aug 2012

12. *Speaker*, "Condensates in Two Dimensional Turbulence", FrischFest: the Solar Course, the Chemic Force, and the Speeding Change of Water, Stockholm, Oct 2011

11. *Speaker*, "The Pseudospectral Method: Recent Advances and Prospects, Part II", The Nature of Turbulence Workshop at KITP, Santa Barbara, Mar 2011

10. *Speaker*, "Local Anisotropy in MHD Turbulence", RädlerFest: α Effect and Beyond, Stockholm, Feb 2011

9. *Speaker*, "High Order Numerical Methods on GPUs", Computational Physics with GPUs Conference, Lund, Nov 2010

8. *Speaker*, "Lessons from Radiative and MHD Simulations for Supermassive Black Hole Growth", Aspen Winter Conference on Formation and Evolution of Black Holes, Aspen, Feb 2010

7. *Speaker*, "What do Spectra Mean in MHD Turbulence?", Institute for Advanced Study Thursday Seminar, Princeton, May 2009

6. *Organizer*, "Plasma Astrophysics Meetings", Institute for Theory and Computation, Cambridge, 2009

5. *Speaker*, "Generalized Shearing Boxes for Multi-Scale Studies of MHD Turbulence", Saturation and Transport Properties of MRI-driven Turbulence Conference at IAS, Princeton, Jun 2008

4. *Organizer*, "Saturation and Transport Properties of MRI-driven Turbulence", IAS, Princeton, Jun 2008

3. *Speaker*, "Turbulence Generation in Magnetized Accretion Disks", Harvard-Smithsonian Center for Astrophysics PEOPLE Lecture, Cambridge, Dec 2007

2. *Organizer*, "Astrophysical Turbulence Meetings", Institute for Theory and Computation, Cambridge, 2007 – 2008

1. *Speaker*, "Toward Realistic Accretion Disk Simulations", Los Alamos National Laboratory Theory Seminar, Los Alamos, Jul 2007

White Papers

4. "The Growing Importance of a Tech Savvy Astronomy and Astrophysics Workforce", Norman, D ... **Chan, C.-k.**, et al. 2019, arXiv:1910.08376

3. "Sustaining Community-Driven Software for Astronomy in the 2020s", Tollerud, E ... **Chan, C.-k.**, et al. 2019, BAAS 51 (7), 180

2. "Training the Future Generation of Computational Researchers", Besla, G ... **Chan, C.-k.**, et al. 2019, Bulletin of the American Astronomical Society 51 (7) and arXiv:1907.04460

1. "Astro2020 APC White Paper: Elevating the Role of Software as a Product of the Research Enterprise", Smith, A.M. ... **Chan, C.-k.**, et al. 2019, arXiv:1907.06981

Selected Publications

73. "Resolving the Inner Parsec of the Blazar J1924-2914 with the Event Horizon Telescope", Issaoun, S. ... **Chan, C.-k.**, et al. 2022, ApJ, 934, 145

72. "Topological Data Analysis of Black Hole Images", Christian, P., **Chan, C.-k.**, et al. 2022, PhRvD, 106, 023017

71. "Characterizing and Mitigating Intraday Variability: Reconstructing Source Structure in Accreting Black Holes with mm-VLBI", Broderick, A.E. ... **Chan, C.-k.**, et al. 2022, ApJL, 930, 18

70. "A Universal Power-law Prescription for Variability from Synthetic Images of Black Hole Accretion Flows", Boris, G. ... **Chan, C.-k.**, et al. 2022, ApJL, 930, 18

69. "Millimeter Light Curves of Sagittarius A* Observed during the 2017 Event Horizon Telescope Campaign", Wielgus, M. ... **Chan, C.-k.**, et al. 2022, ApJL, 930, 18

68. "Selective Dynamical Imaging of Interferometric Data", Farah, J. ... **Chan, C.-k.**, et al. 2022, ApJL, 930, 18

67. "First Sagittarius A* Event Horizon Telescope Results. VI. Testing the Black Hole Metric", EHT Collaboration ... **Chan, C.-k.**, et al. 2022f, ApJL, 930, 17

66. "First Sagittarius A* Event Horizon Telescope Results. V. Testing Astrophysical Models of the Galactic Center Black Hole", EHT Collaboration ... **Chan, C.-k.**, et al. 2022e, ApJL, 930, 16

65. "First Sagittarius A* Event Horizon Telescope Results. IV. Variability, Morphology, and Black Hole Mass", EHT Collaboration ... **Chan, C.-k.**, et al. 2022d, ApJL, 930, 15

64. "First Sagittarius A* Event Horizon Telescope Results. III. Imaging of the Galactic Center Supermassive Black Hole", EHT Collaboration ... **Chan, C.-k.**, et al. 2022c, ApJL, 930, 14

63. "First Sagittarius A* Event Horizon Telescope Results. II. EHT and Multiwavelength Observations, Data Processing, and Calibration", EHT Collaboration ... **Chan, C.-k.**, et al. 2022b, ApJL, 930, 13

62. "First Sagittarius A* Event Horizon Telescope Results. I. The Shadow of the Supermassive Black Hole in the Center of the Milky Way", EHT Collaboration ... **Chan, C.-k.**, et al. 2022a, ApJL, 930, 12

61. "PATOKA: Simulating Electromagnetic Observables of Black Hole Accretion", Wong, G.N. ... **Chan, C.-k.**, et al. 2022, ApJS, 259, 64

60. "Black Hole Physics and Computer Graphics", Bozzola, G., **Chan, C.-k.**, Paschalidis, V. 2022, Computing in Science and Engineering, 24, 19

59. "Markov Chains for Horizons MARCH. I. Identifying Biases in Fitting Theoretical Models to Event Horizon Telescope Observations", Psaltis, D. ... **Chan, C.-k.**, et al. 2022, ApJ, 928, 55

58. "The Variability of the Black Hole Image in M87 at the Dynamical Timescale", Satapathy, K. ... **Chan, C.-k.**, et al. 2022, ApJ, 925, 13

57. "Brightness Asymmetry of Black Hole Images as a Probe of Observer Inclination", Medeiros, L., **Chan, C.-k.**, et al. 2022, ApJ, 924, 46

56. "Accretion properties of low-luminosity active galactic nuclei", Ramakrishnan, V., **Chan, C.-k.**, & Nagar, N. 2021, Astron. Nachr., 342:1180–1184

55. "A Plasmoid model for the Sgr A* Flares Observed With Gravity and CHANDRA", Ball, D. ... **Chan, C.-k.**, et al. 2021, ApJ, 917, 8

54. "Event Horizon Telescope observations of the jet launching and collimation in Centaurus A",

Janssen, M. ... **Chan, C.-k.**, et al. 2021, Nature Astronomy, 5, 1017

53. "Constraints on black-hole charges with the 2017 EHT observations of M87*", Kocherlakota, P. ... **Chan, C.-k.**, et al. 2021, PhRvD, 103, 104047

52. "Ten simple rules to cultivate transdisciplinary collaboration in data science", Sahneh, F., Balk, M.A., Kisley, M., **Chan, C.-k.**, et al. 2021, PLOS Computational Biology, vol 17, issue 5, p. e1008879

51. "The Polarized Image of a Synchrotron-emitting Ring of Gas Orbiting a Black Hole", Narayan, R. ... **Chan, C.-k.**, et al. 2021, ApJ, 912, 35

50. "Broadband Multi-wavelength Properties of M87 during the 2017 Event Horizon Telescope Campaign", EHT MWL Science Working Group ... **Chan, C.-k.**, et al. 2021, ApJL, 911, 11

49. "Polarimetric Properties of Event Horizon Telescope Targets from ALMA", Goddi, C. ... **Chan, C.-k.**, et al. 2021, ApJL, 910, 14

48. "First M87 Event Horizon Telescope Results. VIII. Magnetic Field Structure near The Event Horizon", EHT Collaboration ... **Chan, C.-k.**, et al. 2021, ApJL, 910, 13

47. "First M87 Event Horizon Telescope Results. VII. Polarization of the Ring", EHT Collaboration ... **Chan, C.-k.**, et al. 2021, ApJL, 910, 12

46. "FANTASY: User-friendly Symplectic Geodesic Integrator for Arbitrary Metrics with Automatic Differentiation", Christian, P. and **Chan, C.-k.** 2021, ApJ, 909, 67

45. "Gravitational Test beyond the First Post-Newtonian Order with the Shadow of the M87 Black Hole", Psaltis, D. ... **Chan, C.-k.**, et al. 2020, PRL, 125, 14

44. "Monitoring the Morphology of M87* in 2009-2017 with the Event Horizon Telescope", Wielgus, M. ... **Chan, C.-k.**, et al. 2020, ApJ, 901, 67

43. "Event Horizon Telescope Imaging of the Archetypal Blazar 3C 279 at an Extreme 20 microarcsecond Resolution", Kim, J.Y., Krichbaum, T.P., Broderick, A.E., Wielgus, M, Blackburn, L, Gomez, J.L., Johnson, M.D., Bouman, K.L., Chael, A., Akiyama, K., Jorstad, S., Marscher, A.P., Issaoun, S., Janssen, M., **Chan, C.-k.**, et al. 2020, Astronomy & Astrophysics, 640, 69

42. "Verification of Radiative Transfer Schemes for the EHT", Gold, R. ... **Chan, C.-k.**, et al. 2020, ApJ, 897, 148

41. "A Plasmoid Model for the Sgr A* Flares Observed with GRAVITY and Chandra", Ball, D. ... **Chan, C.-k.**, et al. 2020, arXiv:2005.14251

40. "Markov Chains for Horizons (MARCH). I. Identifying Biases in Fitting Theoretical Models to Event Horizon Telescope Observations", Psaltis, D. ... **Chan, C.-k.**, et al. 2020, arXiv:2005.09632

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