

Disks & Auroras

Miljenko Čemeljić

Institute of Physics, Silesian University in Opava,
Czech Republic

&

Nicolaus Copernicus Astronomical Center, PAN
Warsaw

&

ASIAA Visiting Scholar, Taipei, Taiwan

&

European Talent Centre Varaždin, Croatia



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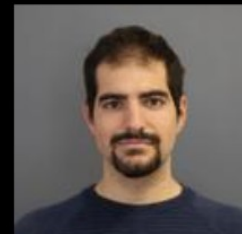
- Our work group
- Lecture booklets on Thin disks
- Work with CAMK PhD students & UW Master student
- Summer students 2022, PLUTO simulations of aurora on (exo)planets
- Mentoring in Talent center Croatia
- Publications, meetings, grants



Prof. Włodzimierz Kluźniak
CAMK, Warsaw

International Collaborators

PhD students at CAMK, Warsaw



Dr. Maciek Wielgus
Max Planck Institute for
Radio Astronomy

Dr. Miljenko Čemeljić
Silesian University
CAMK

Dr. Bhupendra Mishra
Los Alamos National Lab

Angelos
Karakonstantakis

Fatemeh
Kayanikhoo

Ruchi Mishra

Postdoc at CAMK, Warsaw



Dr. Deepika Bollimpalli
Max Planck Institute for

Debora Lančova
Silesian University

Dr. Tomasz Krajewski

I prepared two lecture scripts about the thin accretion disks for the Silesian University in Opava in Czech Republic, reviewing the theoretical material in the first part

Thin accretion disks Part I: Basic concepts and solutions,

where I presented in detail derivations of thin accretion disk by Shakura & Sunyaev (1973) and Kluźniak & Kita (2000) and Čemeljić, Parthasarathy & Kluźniak (2017, 2023), to continue in

Thin accretion disks Part II: Numerical simulations, with the PLUTO and KORAL codes details of numerical simulations of such disks. This two scripts (short, about 50 pages each, with many details usually not available in the literature) should be helpful as a fast introduction to the topic.



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Thin accretion disks Part I: Basic concepts and solutions

Dr. Miljenko Čemeljić

Opava, 2022

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Thin accretion disks Part II: Numerical simulations

Dr. Miljenko Čemeljić

Opava, 2022

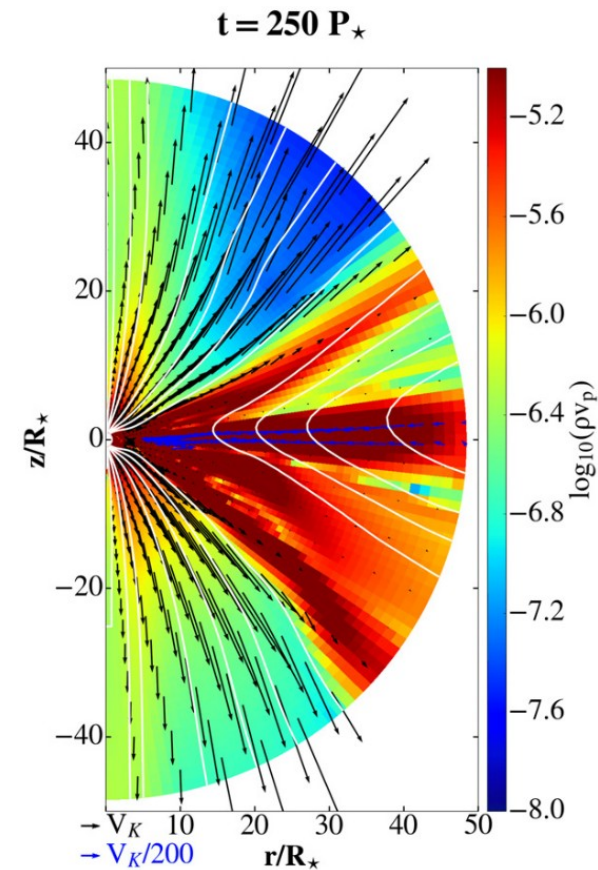
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- Ruchi Mishra submitted work on midplane backflow in accretion disk and is now preparing a publication on PLUTO simulations of aurora on planets around pulsars.
- With Fatima Kayanikhoo, publications are prepared on PLUTO and Koral simulations in Orszag-Tang problem in 2D and in 3D, and on the energy of strange quark stars
- In December, Aleksandra Kotek defended her Master thesis in Physics dpt.of the University of Warsaw, where, in an extension of her CAMK Summer program internship, she worked with me to perform a series of numerical simulations with PLUTO code. She investigated asymmetric axial outflows from young stellar objects-it is a rare work with parameter study on differences in magnetospheric outflows from the opposite stellar poles.



We took **five** summer students in our group in 2021. This year, thanks to online mode of work, we had **six**:

- **two** worked with Fatima on the further improvements of her investigations of strange stars.
- I worked with **four** students: three from Warsaw University, and one from Teheran University, on PLUTO simulations of star-planet magnetospheric interaction. This work is in collaboration with **Jacobo Varela** from Carlos III University in Madrid, who shortly visited us in CAMK in June. Students learned to use PLUTO code and performed simulations of aurora on exoplanets of their choice-this varied from rocky planet to Neptune-like one, to a brown dwarf-there was a case of observation of aurora on such star.

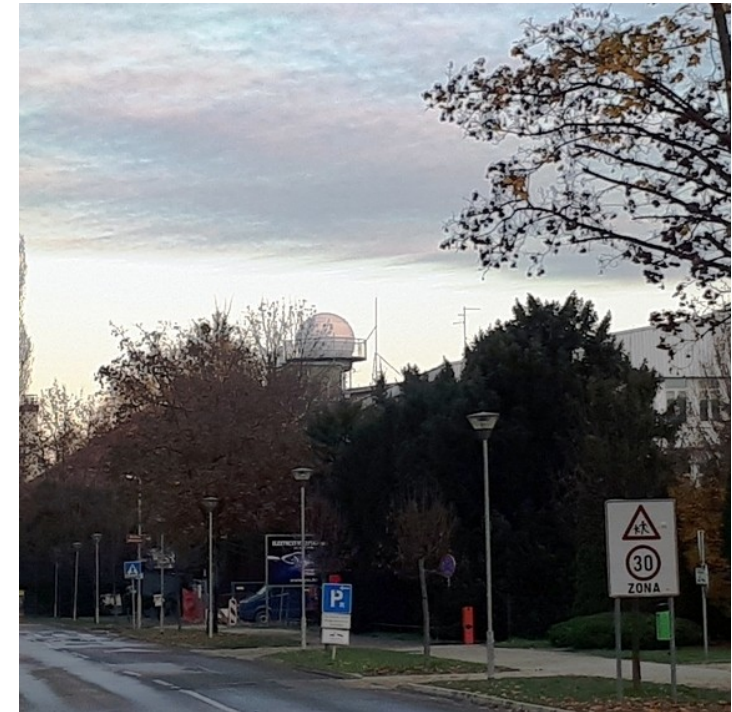
For the School year 2022/2023 I obtained the mentor status in European Talent Centre Croatia and lecture in Astro Center Varaždin in north of Croatia. I devised a program on Computational astrophysics for advanced students at secondary school level. It is an interesting experiment where I try to teach modern astrophysics-development is so fast that school teachers are usually not in capacity to follow, so active researchers should step in and help. They equipped the astronomical lab, with dome and telescope connected to computers, and a modern lecture room.

Računalna astrofizika



Miljenko Čemeljić

Centar izvrsnosti za astronomiju, Varaždin



- **Published:**

- ApJ 933, 55**: Čemeljić, M., Yuan, F., Yang, H., Shang, H., “*Flares and associated episodic jets from black hole and protostellar accretion*”

- ApJ 939, 12**: Mossalanezhad, Bu, Čemeljić, Zahra Zeraatgari, Yang, Mei, “*Numerical Simulation of Hot Accretion Flow around Bondi Radius*”

- PTA Proceedings: Ciecuch, F., Čemeljić, M., “*Star-disk magnetospheric interaction with non-dipolar stellar field*”

- **Submitted:**

- to **A&A** with revision after second review comments sent: Čemeljić & Brun, “*Trends in torques acting on a star in star-disk magnetospheric interaction*”

- revision to be sent to **A&A**: Čemeljić, M., Kluźniak, W., Parthasarathy, V., “*Magnetically threaded accretion discs around millisecond X-ray pulsars in resistive MHD simulations and asymptotic expansion*”

- Presentation at 5th Meeting of Young Astronomers, March 3, 2022, CAMK (online because of COVID)
- Participation at one week Workshop organized by Opava group in August in Pavlov, South Moravia, Czech Republic, on Koral code simulations of disk around black holes
- Presentation at 31st Texas Symposium in September, Prague, Czech Republic
- Presentation at RAGtime 24 in October in Opava, Czech Republic
- Grant **not** obtained: With members of our group, in December 2021 I applied for OPUS 22 grant by NCN on the topic of “Accretion simulations for the Event Horizon Telescope: inferring the space-time metric from black hole shadows”.

After all the sitting...some walks: Slovenian Alps and Croatian hills.

Thank you!

