

PUBLIC LECTURE EVALUATION

Masaryk University	
Faculty	Faculty of Science
Procedure field	Theoretical physics and astrophysics
Applicant	doc. Mgr. Norbert Werner, Ph.D.
Lecture date	14.10.2021
Lecture topic	X-raying the Cosmic Web
Persons present (number)	50
Designated evaluators (board members)	prof. RNDr. Vladimír Karas, DrSc. (on-site) prof. Rikard von Unge, Ph.D. (on-site) Prof. Dr. Marcus Brüggen (online)

In his lecture, Norbert Werner explained how even most of the ordinary matter, made from Standard Model particles, remains unseen and unexplored. Only a small fraction has turned into stars; most remains in the form of a hot, strongly ionised, low-density, X-ray emitting plasma that permeates the gravitational halos from the scale of galaxies, through groups, to massive clusters of galaxies. These systems are stabilized by the activity of their supermassive central black hole which heat the gas, preventing its runaway cooling. He presented recent results based on radio and X-ray observations, which provide new insights into the physics of black hole activity, as well as future prospects with instruments coming online in the next decade. He also showed that the hot plasma has been uniformly enriched in heavy elements by supernovae more than 10 billion years ago, during the period of maximum star formation and black hole activity. Finally, he looked at the outskirts of galaxy clusters, which show signs of gas inhomogeneity and into the filaments of the cosmic web permeated by warm-hot intergalactic medium and presented prospects for its survey by future instruments. For instance, the Xrism reflight of the Hitomi satellite, the CAMELOT cubesat project, the Athena mission. These projects show a high ambition for the future which should be commended.

The lecture showed that the applicant has a firm grasp of the topic.

The following questions were asked:

- 1) The role of magnetic fields and evidence from multi wavelength observations.
- 2) The relation between the maximum mass of the central black hole and the mass the dark matter halo.
- 3) Are there some observations that could discriminate between the two ways of creation of X-ray lobes.
- 4) The importance of cosmic rays for heating the intergalactic medium.
- 5) If the other apparent filament in the dark matter distribution between two clusters of galaxies is an artefact or not.



The applicant answered all these questions in a persuasive way, showing his complete overview of the topic.

Conclusion

The lecture delivered by Norbert Werner, entitled “X-raying the Cosmic Web” and delivered as part of the professor appointment procedure, **demonstrated** sufficient scholarly qualifications and pedagogical capabilities expected of applicants participating in a professor appointment procedure in the field of Theoretical physics and astrophysics.

The lecture took place in a hybrid form at 3 pm on October 14, 2021. The above-mentioned members of the board attended the lecture and provided its evaluation. All designated evaluators are familiar with the text of the evaluation and agree with it.

Date: 14.10.2021

Vladimír Karas

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Rikard von Unge

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