

## Optics development for X-ray astronomy – a review on four joint Bavarian-Czech projects

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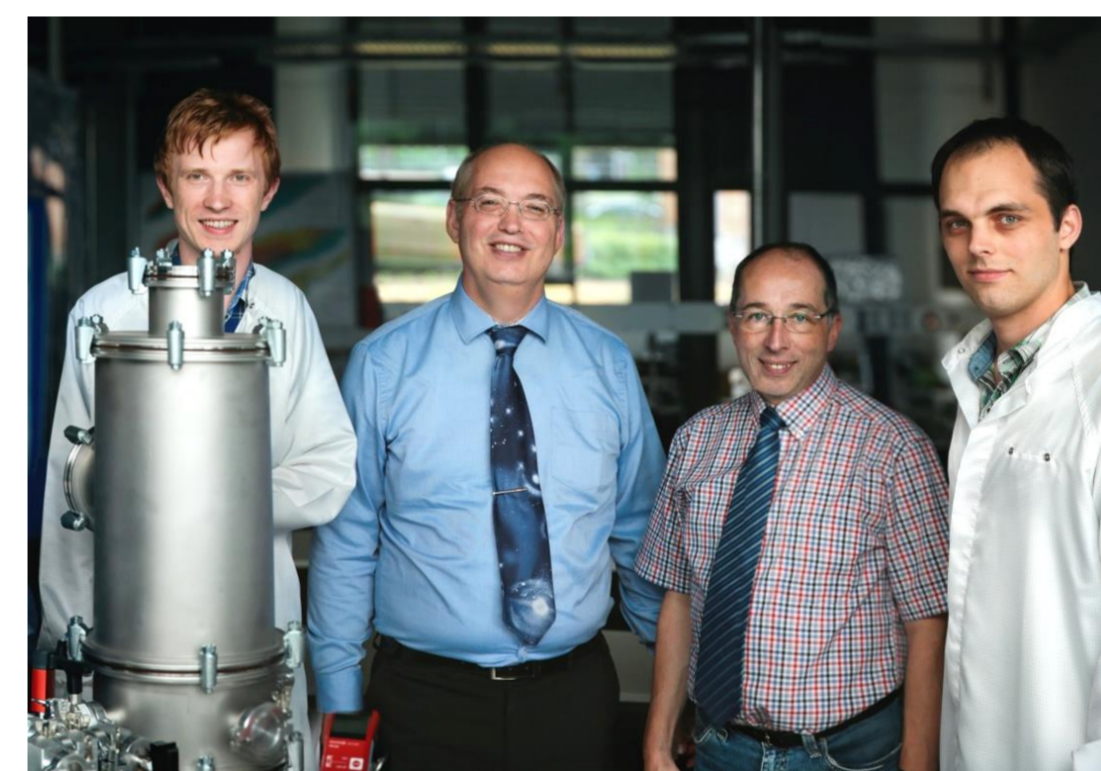
### Summary

In the years 2016 to 2018 the Bavarian-Czech Academic Agency (BTHA) funded in summary four bilateral projects between Aschaffenburg University and CVUT Prague: JEUMICO, TRILAMICO, JODEXRA, and AXROCO. The effective combination of equipment, manpower, and know-how of both partners resulted in the development of stress-compensated iridium coatings for astronomical X-ray mirrors. The findings have been published at scientific conferences and in joint papers. This poster gives a review on the social, political and educational aspects of the collaborations in form of a photo documentation.



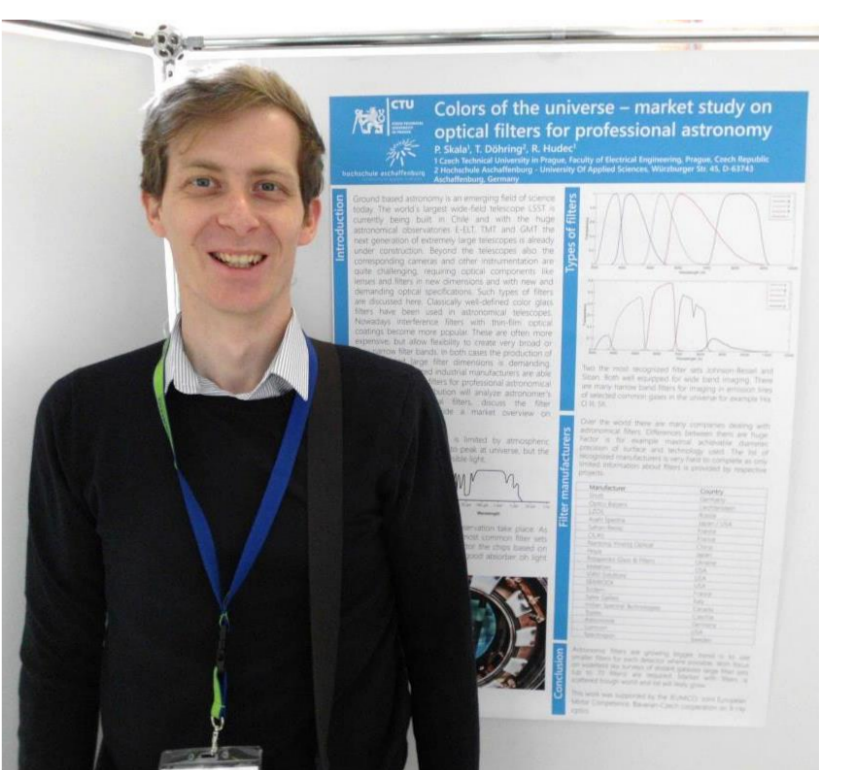
JEUMICO: Joint European mirror competence (2016 – 2017)  
TRILAMICO: Trilateral Mirror Collaboration (2017)

JODEXRA: Joint optics development for X-ray astronomy (2018)  
AXROCO: Astronomical X-ray optics conference (2018)



### Internationalization of education

One important aim of the joint funding programs was to enhance the binational cross-border cooperation between Bavaria and the Czech Republic by an exchange of scientific staff between the involved partner organizations. In this context research stays of four young Czech Ph.D. students at Aschaffenburg University of Applied Sciences have been organized in the framework of the projects.



### Scientific output

The joint effort within the projects resulted in 14 papers and several contributions to scientific conference like talks and posters. This important output is especially valuable for young scientists in an early stage of their scientific career.

1. R. Hudec, L. Pina, V. Maršíková, A. Inneman, T. Döhning: "KB X-ray Optics for Astrophysics: Recent Status", DGaO-Proceedings 2018, ISSN: 1614-8436
2. R. Hudec, L. Pina, V. Maršíková, A. Inneman, T. Döhning: "LE X-ray Optics for Astrophysics: Recent Status", DGaO-Proceedings 2018, ISSN: 1614-8436
3. V. Stehlíková, et al.: "Study of multiple layers coatings for X-ray mirrors", Contrib. Astron. Obs. Skalnaté Pleso 48, 488 – 497 (2018)
4. T. Döhning and R. Hudec: "JEUMICO and TRILAMICO: Dimensions of successful Bavarian-Czech cooperation", Contrib. Astron. Obs. Skalnaté Pleso 48, 430 – 436 (2018)
5. A.-C. Probst et al.: "Influence of sputtering pressure on the nanostructure and the X-ray reflectivity of iridium coatings", Surface & Coatings Technology 343, 101–107 (2018)
6. V. Stehlíková et al.: "Indirect Glass Slumping of Grazing Incidence Mirror Segments for Lightweight X-Ray Telescopes", Proc. SPIE 10399, 103990Z (2017)
7. T. Döhning et al.: "Development of iridium coated X-ray mirrors for astronomical applications", Proc. SPIE 10399, 103991C (2017)
8. V. Stehlíková et al.: "Development of iridium coated silicon X-ray mirrors for Lobster Eye astronomical telescopes", Proceedings of EOSMOS 2017 (2017)
9. P. Skala, T. Döhning, R. Hudec: "Colors of the universe – market study on optical filters for professional astronomy", DGaO-Proceedings 2017, ISSN: 1614-8436,
10. R. Hudec and T. Döhning: "JEUMICO: Czech-Bavarian Astronomical X-Ray Optics Project", Contrib. Astron. Obs. Skalnaté Pleso 47, 170 - 177 (2017)
11. R. Hudec, T. Döhning, K. Remišová: "Lobster Eye Optics & Biomimetics", DGaO-Proceedings 2017, ISSN: 1614-8436
12. T. Döhning et al.: "JEUMICO – Bayerisch-tschechische Kooperation zur Entwicklung von Röntgenteleskopen", DGaO-Proceedings 2017, ISSN: 1614-8436
13. T. Döhning et al.: "Prototyping iridium coated mirrors for X-ray astronomy", Proceedings of SPIE 10235, 10235-04 (2017)
14. V. Stehlíková et al.: "Study of lobster eye optics with iridium coated X-ray mirrors for a rocket experiment", Proceedings of SPIE 10235, 10235-05 (2017)

### Summary and outlook

Scientific cooperation in an international context (here between Bavaria and the Czech Republic) and also corresponding private contacts are important contributions for political stability and for joint economical development. Both partners are interested to continue the cooperation. However, at present the required funding is not available. Proposals on future joint projects are under consideration.

### Acknowledgement

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