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Habilitation Dr. Piotr Achinger

Piotr Achinger (35) is a distinguished algebraic geometer, mostly in positive and in mixed characteristic, who is a specialist of the theory of fundamental groups and of lifting problems.

His result [Hab4] published in *Invent. math* (2017) is of first importance and of great beauty. He proves that connected affine schemes are $K\pi_1$, that is étale cohomology with values in a torsion sheaf is computed by group cohomology. It is a deep result. It enables one to understand the very involved theory of étale cohomology in terms of group cohomology, which is way easier. The proof is elegant, contains nice constructions which can be applied in other circumstances, and uses as one tool the recent theory of Beilinson-T. Saito of singular support for constructible sheaves with wild ramification. In addition the article is beautifully written.

The articles [Hab1] [Hab2] [Hab3] (with coauthor Maciej Zdanowicz and in addition coauthor Jakub Witaszek for [Hab3]) constitute a coherent series of fine studies on the liftability and non-liftability of certain varieties from characteristic p to charactaeristic 0, with or without their Frobenius. In particular, he developed a Serre-Tate theory for 1-ordinary Calabi-Yau varieties and shows that among all lifts to W_2, the 'Serre-Tate' one is precisely the one so the middle de Rham cohomology over W_2 has the level Fil^1 of the Hodge filtration preserved by the action of Frobenius. It is very nice.

I read the 50 or so pages of his introduction to the articles like a book of an author one likes. The background and the motivation of the theorems are brilliantly presented, the main ideas are summarised in a convincing way. I think it should be made public, notably towards students, so they get some sense for Algebraic Geometry, and how one can present it under a

shining light.

Piotr Achinger is a wonderful Algebraic Geometer. The importance of his results is demonstrated in his Habilitation. **I recommend to the Scientific Council to award the title conferred by the Habilitation, and this with the highest honours.**