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Research field: Algebraic Geometry

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Present research:

My research lies in algebraic geometry and commutative algebra, with a particular focus on singularities of algebraic varieties. In particular, I investigate the relationship between F -singularities, which are singularities in positive characteristic defined using the Frobenius morphism, and singularities arising in birational geometry. In recent years, I have also been working on applying techniques involving big Cohen–Macaulay algebras and ultraproducts to the theory of F -singularities. Furthermore, through Frobenius splitting and global F -regularity, which are global counterparts of F -singularities, I also study the birational geometry of varieties of Fano type and Calabi–Yau type.

I am also interested in algebraic-geometric approaches to problems in commutative algebra, and have worked on topics such as the behavior of symbolic powers of ideals and vanishing theorems for local cohomology.

Notice for the students:

To complete a master’s thesis within two years, it is necessary to acquire the basics of commutative algebra and algebraic geometry before entering graduate school. More specifically, if you wish to pursue research in algebraic geometry, you are expected to master material roughly corresponding to Chapters 1 through 3 of Robin Hartshorne’s “Algebraic Geometry” (GTM 52, Springer-Verlag)*¹. If you wish to pursue research of a more commutative algebraic nature, it is desirable that you acquire material roughly corresponding to Chapters 1 through 9 of Hideyuki Matsumura’s “Commutative Ring Theory” (Cambridge University Press). Even in the latter case, I recommend that you acquire a basic knowledge of algebraic geometry.

Of course, there is much else to study as well. However, if your grasp of the fundamentals listed above is not sufficiently solid, it will be difficult to reach the frontiers of research within the master’s program. Please first build a firm foundation and then proceed steadily with your studies.

In addition, in carrying out research, it is important both to have the ability to find good problems and to have the patience and perseverance to keep thinking carefully about a single problem over an extended period of time. If you aspire to become a researcher, you should make every effort to find on your own a problem for your master’s thesis.

*¹ There is no need to adhere specifically to Hartshorne. Please use a textbook of your choice to acquire a basic understanding of scheme theory and sheaf cohomology.