The ability to reliably transmit information over unreliable channels continues to grow in importance as digital communication becomes increasingly embedded into the fabric of the modern world. The ever-expanding list of applications of error-correcting codes includes—but is certainly not limited to—satellite and fiber-optic communication, local and distributed storage systems, network coding as well as post-quantum cryptography. In 1981, V. D. Goppa introduced the astronomically diverse class of algebraic geometry (AG) codes, which have since generated a considerable amount of theoretical interest as they lend themselves to deep mathematical analysis and include some of the most error-resilient codes currently known. The benefits of these codes, however, do not come without a price: the computational problems associated with using them in practice are notoriously difficult to solve efficiently, and as a consequence of this, it would be an understatement to say that their current real-world utility is rather limited.

The primary goal of this project has been to address some of the main computational problems associated with AG codes, aiming to bring their theoretical potential closer to being realized as practical value. Our contributions include efficient algorithms for encoding certain well-behaved AG codes as well as decoding all AG codes.
Please email the summary to the PhD secretary at the department