# UNIVERSITÀ DI TRENTO
## Dipartimento di Matematica

# DOTTORATO

CYCLE 34th
ORAL DEFENCE OF THE PHD THESIS

## Wednesday 8 June 2022 – at 9:30 am
## Seminar Room "-1"

The event will take place online through the ZOOM platform.
To get the access codes please contact the secretary office

## Francesco Romeo

**PhD Student in Mathematics**

# Algebraic Properties and Invariants of Polyominoes

**Abstract** Polyominoes are two-dimensional objects obtained by joining edge by edge squares of same size. Originally, polyominoes appeared in mathematical recreations, but it turned out that they have applications in various fields, for example, theoretical physics and bio-informatics. Among the most popular topics in combinatorics related to polyominoes one finds enumerating polyominoes of given size, including the asymptotic growth of the numbers of polyominoes, tiling problems, and reconstruction of polyominoes. Recently Qureshi introduced a binomial ideal induced by the geometry of a given polyomino, called polyomino ideal, and its related algebra. From that moment different authors studied algebraic properties and invariants related to this ideal, such as primality, Gröbner bases, Gorensteinnes and Castelnuovo-Mumford regularity.

In this final talk, we provide an overview on the results that we obtained about polyomino ideals and its related algebra. In the first part of the talk, we discuss questions about the primality and the Gröbner bases of the polyomino ideal. In the second part of the talk, we talk over the Castelnuovo-Mumford regularity, Hilbert series, and Gorensteinnes of the polyomino ideal and its coordinate ring. In particular, we give a formula for the Hilbert series and a geometrical condition for the Gorenstein property of a nice class of polyominoes, parallelogram polyominoes.

**Supervisor:**
Giancarlo Rinaldo (University of Messina, Italy)