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Containment and Lower Bounds on Waldschmidt Constant

Nagata raised the following fundamental question:

"Given a finite set of points $X = \{P_1, \dots, P_s\} \subset \mathbf{P}_{\mathbb{C}}^2$ what is the minimal degree, $\alpha_x(t)$ of a hyper-surface that passes through the points with multiplicity at least t ?"

Chudnovsky provided a conjectural answer to the above question. Chudnovsky's conjecture has an equivalent statement involving a lower bound of the Waldschmidt constant of the ideal defining points. Demailly later on generalized Chudnovsky's conjecture. Harbourne and Huneke gave a containment conjecture involving the symbolic and the ordinary powers of the ideals, which implies gives the bounds on Waldschmidt constant of the ideals. We studied the stable-version of the containment conjecture and consequently, we proved Chudnovsky conjecture for a large number of general points. In this talk, I will introduce Chudnovsky's conjecture (similar bounds), the containment conjectures, and the tools that we used. I will be presenting the results from our joint work with Eloisa Grifo, Huy Tài Hà, and Thái Thành Nguyễn.