Curvature inequalities and rigidity for constant mean curvature (CMC) and spacetime constant mean curvature (STCMC) surfaces

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I will discuss sharp curvature inequalities and rigidity results for constant mean curvature type surfaces in both Riemannian and Lorentzian geometry. In the Riemannian setting, I will describe an extension of the Christodoulou–Yau inequality $H^2 \leq 16\pi/|\Sigma|$ under a weaker stability condition, yielding rigidity in the equality case without symmetry assumptions. I will also briefly mention analogues in the hyperbolic and spherical settings. In the Lorentzian setting, I will introduce a notion of stability for spacetime constant mean curvature surfaces and present the corresponding sharp inequality and rigidity result under the dominant energy condition. This talk is based on the preprint [2].

References

[1] D. Christodoulou and S.-T. Yau, Some remarks on the quasi-local mass, Mathematics and general relativity (Santa Cruz, CA, 1986), Contemp. Math., **vol.** 71, Amer. Math. Soc., Providence, RI, 1988, pp. 9–14. MR 954405

[2] A. Penuela Diaz, Curvature inequalities and rigidity for constant mean curvature and spacetime constant mean curvature surfaces, arXiv preprint arXiv:2603.16707 (2026).

[3] J. Sun, Rigidity of hawking mass for surfaces in three manifolds, Pacific Journal of Mathematics **292** (2017), no. 1, 257–282.