**The hypoelliptic Laplacian and propagation speed**

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In the talk, I will review some aspects of the geometric hypoelliptic Laplacian in connection with propagation speed.

We will consider in detail the flat hypoelliptic Laplacian, and the associated Hamilton-Jacobi equation. The proper uniform control of the flat action functional as $b \to 0$ gives a corresponding uniform control of the geometric hypoelliptic heat kernel on compact manifolds, and on noncompact manifolds of negative curvature at large distances .

While the standard heat equation has infinite propagation speed, the geodesic flow propagates at finite speed. The question will be to know at what speed does the geometric hypoelliptic Laplacian propagate. Connections with the wave equation will be discussed.

The proofs of these results are contained in the references [1, 2].

# Bibliography

[1] J.-M. Bismut. *Hypoelliptic Laplacian and orbital integrals*, volume 177 of *Annals of Mathematics Studies*. Princeton University Press, Princeton, NJ, 2011.

[2] J.-M. Bismut. Hypoelliptic Laplacian and probability. *J. Math. Soc. Japan*, 67(4):1317–1357, 2015.