INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
PhD-17 SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The main focus of this thesis is the study of Strichartz estimates and their extensions to systems of orthonormal functions associated with certain self-adjoint operators. In addition, we investigate a sharp Heisenberg-Pauli-Weyl uncertainty principle for the fractional Dunkl transform. We begin with the Fourier analysis on the Euclidean space, discuss some well known results, basic definitions, and and recent developments that motivate the problems discussed in the thesis.

We establish anisotropic Strichartz estimates associated with the Grushin operator $G=-\Delta-|x|^2\partial_{t}^2$ on $\mathbb{R}^{n+1}$. It is well known that the Grushin-Schr\"odinger equation is totally non-dispersive and hence the classical approach to obtain Strichartz estimates fails. Instead, we employ restriction estimates associated with the scaled Hermite–Fourier transform on $\mathbb{R}^{n+2}$ for certain surfaces in $\mathbb{N}_0^n\times\mathbb{R^*}\times \mathbb{R}$.

Let $\mathcal{L}$ be the special Hermite operator on $\mathbb{C}^n$. We establish Strichartz estimates for system of orthonormal functions associated with general flows of the form $e^{-it\phi(\mathcal{L})}$, where $ \phi : \mathbb{R}^{+} \to \mathbb{R} $ is a smooth function. Our approach relies on restriction estimates for the Fourier-special Hermite transform on the class of surfaces $\{(\lambda, \mu, \nu)\in \mathbb{R}\times\mathbb{N}_0^n\times\mathbb{N}_0^n : \lambda=\phi(2|\nu|+n)\}$. We then address the optimality of the Schatten exponent and endpoint case of the orthonormal Strichartz estimate for the Schr\"{o}dinger propagator $e^{-it\mathcal{L}}$.
Furthermore, we investigate restriction estimates for the special Hermite spectral projections in the context of Schatten spaces.

Next, we derive a necessary condition on the Schatten exponent for the orthonormal Strichartz estimates for the Schr\"odinger equation associated to the Dunkl Laplacian and the Dunkl-Hermite operator, which turns out to be

optimal for the Schr\"odinger equations associated with Laplacian and Hermite operator proof uses coherent states in the Dunkl setting and semiclassical analysis.

Finally, we establish an L^p-type Heisenberg-Pauli-Weyl uncertainty principle for the fractiona with $1 \leq p \leq 2$. For the case $p = 2$, we further derive a sharper uncertainty principle for the fr transform. Furthermore, we derive conditions leading to equality in both the uncertainty principles obtained.