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An Application of Van der Corput's Inequality

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Abstract: In this note we give a short and elegant proof of the result $\sum_{t=1}^{n} e^{i(\omega t+\alpha t^2)} = o(n)$ for α not a rational multiple of π, uniformly in ω. This was first proved by Hardy and Littlewood, in 1938. The main ingredient of our proof is Van der Corput's inequality. We then generalize this to obtain $\sum_{t=1}^{n} t^{\beta} e^{i(\omega t+\alpha t^2)} = o(n^{\beta+1})$, where β is a nonnegative constant.