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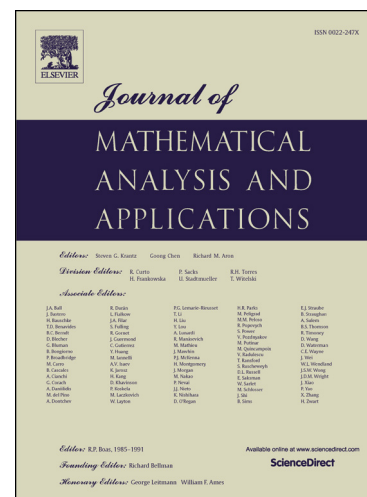
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HARDY-TYPE THEOREMS ON FOURIER TRANSFORMS REVISED

M. DYACHENKO, E. NURSULTANOV, AND S. TIKHONOV

ABSTRACT. We obtain new conditions on periodic integrable functions so that their transformed Fourier series belong to L_p . This improves the classical Hardy and Bellman results. A counterpart for the Fourier transforms is also established. Our main tool is a new extension of the Hausdorff–Young–Paley inequality for Fourier transforms.

1. INTRODUCTION

1.1. **Transformed Fourier series.** The famous Hardy’s result [12] on the transformed Fourier series reads as follows.

Theorem A. *Let the series*

$$(1) \quad \frac{a_0(f)}{2} + \sum_{k=1}^{\infty} (a_k(f) \cos kx + b_k(f) \sin kx)$$

be the Fourier series of a function $f \in L_p(\mathbb{T})$, $1 < p < \infty$. Then the series

$$(2) \quad \frac{a_0^H(f)}{2} + \sum_{k=1}^{\infty} (a_k^H(f) \cos kx + b_k^H(f) \sin kx),$$

where

$$a_k^H(f) = \frac{1}{k+1} \sum_{l=0}^k a_l(f), \quad b_k^H = \frac{1}{k+1} \sum_{l=1}^k b_l(f), \quad k = 1, 2, \dots$$

is the Fourier series of a function $F \in L_p(\mathbb{T})$.

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