

# Accepted Manuscript

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Neea Palojärvi

PII: S0022-314X(18)30225-7  
DOI: <https://doi.org/10.1016/j.jnt.2018.07.006>  
Reference: YJNTH 6090

To appear in: *Journal of Number Theory*

Received date: 21 September 2017  
Revised date: 3 July 2018  
Accepted date: 7 July 2018

Please cite this article in press as: N. Palojärvi, On the explicit upper and lower bounds for the number of zeros of the Selberg class, *J. Number Theory* (2018), <https://doi.org/10.1016/j.jnt.2018.07.006>

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# On the explicit upper and lower bounds for the number of zeros of the Selberg class

Neea Palojärvi

*Department of Mathematics and Statistics, Åbo Akademi University, Domkyrkotorget 1, 20500 Åbo, Finland*

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## Abstract

In this paper we prove explicit upper and lower bounds for the error term in the Riemann-von Mangoldt type formula for the number of zeros inside the critical strip. Furthermore, we also give examples of the bounds.

*Keywords:* Selberg class, Riemann-von Mangoldt type formula, Explicit upper and lower bounds

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## 1. Introduction

The Selberg class  $S$ , defined by A. Selberg [17], consists of functions  $\mathcal{L}(s) = \sum_{n=1}^{\infty} \frac{a(n)}{n^s}$  which satisfy the following conditions:

1. Ramanujan hypothesis: For any  $\epsilon > 0$  we have  $|a(n)| \ll_{\epsilon} n^{\epsilon}$ .
2. Analytic continuation: There is an integer  $k \geq 0$  such that  $(s-1)^k \mathcal{L}(s)$  is an entire function of finite order.
3. Functional equation: There exists a positive integer  $f$  and a real number  $Q$  and for integer  $j \in [1, f]$  there are positive real numbers  $\lambda_j$  and complex numbers  $\omega, \mu_j, d_{\mathcal{L}} = 2 \sum_{j=1}^f \lambda_j, \lambda = \prod_{j=1}^f \lambda_j^{2\lambda_j}$  where  $|\omega| = 1$  and  $\Re(\mu_j) \geq 0$  which satisfy

$$\Lambda_{\mathcal{L}}(s) = \overline{\omega \Lambda_{\mathcal{L}}(1 - \bar{s})}$$

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*Email address:* [neea.palojarvi@abo.fi](mailto:neea.palojarvi@abo.fi) (Neea Palojärvi)

This work was supported by the Vilho, Yrjö and Kalle Väisälä Foundation of the Finnish Academy of Science and Letters.

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