ON SPACES WITH $\sigma$-CLOSED-DISCRETE DISCRETE DENSE SETS

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Abstract. The main purpose of this paper is to study $e$-separable spaces, originally introduced by Georges Kurepa as $K'_0$ spaces; we call a space $X$ $e$-separable if and only if $X$ has a dense set which is the union of countably many closed discrete sets. We primarily focus on the behavior of $e$-separable spaces under products and the cardinal invariants that are naturally related to $e$-separable spaces. Our main results show that the statement “there is a product of at most $\mathfrak{c}$ many $e$-separable spaces that fails to be $e$-separable” is overinsistent with the existence of a weakly compact cardinal.

1. Introduction

The goal of this paper is to study a natural generalization of separability. Let us call a space $X$ $e$-separable if and only if $X$ has a dense set which is the union of countably many closed discrete sets. The definition is due to Georges Kurepa [18], who introduced this notion as property $K'_0$ in his study of Souslin’s problem. Later, $e$-separable spaces appear in multiple papers related to the study of linearly ordered and GO-spaces [11], [25], [26], [30]. In particular, M. J. Faber [11] showed that $e$-separable GO-spaces are perfect; however, whether the converse implication is true is famously open: is there, in $\text{ZFC}$, a perfect GO-space (or even just a perfect $T_3$ space) which is not $e$-separable? Let us refer the interested reader to a paper of Harold Bennett and David Lutzer [5] for more details and results on this topic.
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