Closure spaces, countable conditions and the axiom of choice

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A closure space or a Čech closure space is a pair (X, c) where X is a set and $c : 2^X \to 2^X$ is a closure operator such that:

(i) $c(\emptyset) = \emptyset$;

(ii) $A \subseteq c(A)$;

(iii) $c(A \cup B) = c(A) \cup c(B)$.

In other words, a Čech closure is a topological (or Kuratowski) closure where the idempotency of the closure is not imposed.

In this talk we will discuss how to transpose to closure spaces some countable notions usual in topological spaces such as: separability, Lindelöfness, first and second countability, . . . and study how they compare to each other using the axiom of choice, some weak forms of choice or in a choice-free context.

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