Self-powered nano-scintillators for energy

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The monitoring of technological relevant infrastructures, located in remote or hostile environments, requires electronics that must be powered for decades without the possibility of replacing or recharging energy sources; this highlights the need and urgency of supplying long-term stable power sources that can be integrated into complex and dense devices such as submarine cables or space-grade equipments. Nuclear batteries are the only sources capable of supplying stable power over decades, safely converting the decay of a radionuclide into electrical energy. To date, the nuclear battery market is expanding, worth about one billion USD, and is driven by bulky "beta voltaic cells" which, however, suffer from intrinsic low efficiency and do not satisfy the real needs of miniaturization.

Our recent advances in colloidal scintillating nanomaterials offer a platform for a paradigm shift, opening to thin and flexible batteries while outpacing existing energy conversion efficiency by a factor of ten. Our idea has gathered the interest of the U4I-Innovation Project Fund 2021 and Prysmian Group, the world leader in submarine cables for telecom and energy transport. Over the next 12 months, we aim to realize a lab-scale prototype embedding optimized scintillating nanocrystals and validate it in an industrially relevant context. Our projections show that the prototype will match the power efficiency of currently marketed devices while featuring a thinner, flexible, and customizable layout that allows its integration into submarine cables or other strategic applications, which are currently precluded to beta voltaic cells.