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Physics as a Bridge: Biomimicry, Nanomaterials, and Innovation for Global Water Resilience

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Industrial physics is, at its core, physics for the people. It is the application of fundamental principles to real-world challenges, with the aim of improving lives and preserving ecosystems. Among the most pressing of these challenges is the global scarcity of clean water—a crisis that disproportionately affects Indigenous communities, Arctic populations, and displaced refugees.

Over two billion people worldwide lack regular access to safely managed drinking water, according to the WHO and UNICEF. In Canada, 27 Indigenous communities remain under long-term drinking water advisories, while melting permafrost, saltwater intrusion, and increased sediment loads in surface water threaten supply security across the North. Groundwater, once considered stable, is increasingly impacted by climate-driven recharge variability, contamination from thawing soil layers, and industrial pressures. These environmental disruptions render traditional water infrastructure insufficient, especially in isolated or underserved regions where logistical access is limited, and costs are high.

This presentation highlights the development of a biomimetic, carbon-based nanomaterial engineered to extract potable water from the atmosphere. Inspired by the Namib beetle's shell and xerophytic plant surfaces, this innovation enables water harvesting through capillary condensation and molecular selectivity, using nanoscale pores and minimal energy inputs. It is a tangible example of physics solving immediate human needs.

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