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Planar Jumping-Drop Thermal Diodes JONATHAN BOREYKO, YUEJUN ZHAO, CHUAN-HUA CHEN, Duke University — Phase-change thermal diodes transport heat asymmetrically with a large rectification coefficient unmatched by their solid-state counterparts, but are limited by either the gravitational orientation or one-dimensional configuration. We report a planar phase-change diode scalable to large areas with an orientation-independent diodicity of up to 100, in which water/vapor is enclosed by parallel superhydrophobic and superhydrophilic plates. The thermal rectification is enabled by spontaneously jumping dropwise condensate which only occurs when the superhydrophobic surface is colder than the superhydrophilic surface. Our jumping-drop thermal diode is expected to be particularly useful for the thermal protection of planar electronic components and the thermal regulation of large-area energy harvesting systems.

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