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Single-bubble boiling under Earth's and low gravity.[1] BORIS KHUSID, EZINWA ELELE, QIAN LEI, JOHN TANG, YUEYANG SHEN, New Jersey Inst of Technology — Miniaturization of electronic systems in terrestrial and space applications is challenged by a dramatic increase in the power dissipation per unit volume with the occurrence of localized hot spots where the heat flux is much higher than the average. Cooling by forced gas or liquid flow appears insufficient to remove high local heat fluxes. Boiling that involves evaporation of liquid in a hot spot and condensation of vapor in a cold region can remove a significantly larger amount of heat through the latent heat of vaporization than force-flow cooling can carry out. Traditional methods for enhancing boiling heat transfer in terrestrial and space applications focus on removal of bubbles from the heating surface. In contrast, we unexpectedly observed a new boiling regime of water under Earth's gravity and low gravity in which a bubble was pinned on a small heater up to 270C and delivered a heat flux up to 1.2 MW/m^2 that was as high as the critical heat flux in the classical boiling regime on Earth.Low gravity measurements conducted in parabolic flights in NASA Boeing 727. The heat flux in flight and Earth's experiments was found to rise linearly with increasing the heater temperature. We will discuss physical mechanisms underlying heat transfer in single-bubble boiling.
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Boris Khusid
New Jersey Inst of Tech

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