Hot bodies no drag

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(PhysOrg.com) -- A Swinburne University professor was part of a team that showed that drag on hot bodies moving through liquid can be radically reduced by up to 85 per cent, potentially doubling their speed.

In an experiment highlighted by the world's top physics journal, Physical Review Letters, researchers Ivan Vakarelski and Derek Chan observed that a heated ball can fall through liquid more than twice as fast as a colder, 'control' ball.

The discovery exploits the drag-reducing properties of a vapour layer formed between a hot body and surrounding liquid, known as the Leidenfrost effect.

"A very hot body - hot enough to vaporise the thin layer of liquid in contact with it - can drastically reduce energy-sapping drag forces when such bodies travel at high speed through the liquid", said Swinburne physicist Professor Derek Chan.

This is a novel application of the familiar phenomenon where water drops are observed to dance or 'levitate' around when splashed onto a very hot plate; known for over 200 years as the Leidenfrost effect.

Partly funded by the Australian Research Council, the research was purely fundamental in nature, but may have potential military applications.

Chan - an already distinguished ARC principal investigator working in

the area of surface science at the nano-scale - stressed the genesis of the discovery was motivated by novel science.

"This is a novel use of an idea that has been around for over 200 years. We did not set out to do the research with any particular application in mind. We were just curious about a new possibility. But we welcome technologists taking it on and developing it further."

However he conceded it could have military applications, such as helping to make submarines, torpedoes and even sea-launched missiles drastically swifter for short periods.

"But this is really very fundamental research and I see the possibility of broader applications in efficient energy usage. For example allowing marine vehicles to travel faster and further for the same amount of energy or power, and ultimately contribute to reducing greenhouse gas emissions," he said.

More information: Drag Reduction by Leidenfrost Vapor Layers, Phys. Rev. Lett. 106, 214501 (2011)
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Abstract
We demonstrate and quantify a highly effective drag reduction technique that exploits the Leidenfrost effect to create a continuous and robust lubricating vapor layer on the surface of a heated solid sphere moving in a liquid. Using high-speed video, we show that such vapor layers can reduce the hydrodynamic drag by over 85%. These results appear to approach the ultimate limit of drag reduction possible by different methods based on gas-layer lubrication and can stimulate the development of related energy saving technologies.

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