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Dark Kinetic Heating of Exoplanets and Brown Dwarfs

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Dark kinetic heating of neutron stars has been extensively studied as a promising dark matter detection avenue. This occurs when dark matter is accelerated to relativistic speeds in the gravitational well of high-escape velocity objects, and deposits its kinetic energy after becoming captured by the object, thereby increasing its temperature. I will show how this effect can also arise in low-escape velocity objects like exoplanets and brown dwarfs if a long-range self-interaction is present. Such dark forces can lead to enhanced heating even for extremely weak couplings, opening new detection opportunities. I will discuss how different objects yield complementary heating signals across parameter space, map out future cross-section sensitivity, and show how observations of a single exoplanet already set new constraints on dark sector parameters.

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